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The analysis of consecutive cycles in sports performance. A new perspective in sports biomechanics research

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In daily activities, the vast majority of natural events, the actions we perform or the events that occur around us are cyclical in nature. Many of these events occur consecutively, are repeated with greater or lesser frequency and, consequently, have shorter or longer periods. These cyclical events are determined by a process in which the final and initial states coincide and are repeated successively in a defined or indefinite temporal space.

As for the cyclic events present in the human being and which have been the subject of study in the field of physical exercise, we can find in the physiology field some well-known ones such as breathing, heartbeat or hormone regulation. In the field of sports performance at a physiological level, we are used to terms such as heart rate or respiratory rate, in both cases we are referring to the number of times that the beginning of a cycle that is repeated consecutively occurs. If we examine in depth what we are quantifying in this type of variable, we might realize that we are interpreting consecutive cycles with the use of mean values, that is, we use the mean to give a value to an indefinite number of cycles that could be different from each other. Should we consider whether quantifying a succession of so many cycles with the mean value is correct to represent the behavior of this type of events?

In the 1960s, a concept emerged that is now very popular in the world of sports performance, among others, heart rate variability. Those who are familiar with this concept will know that consecutive heartbeats do not exhibit equal periods, but that each heartbeat has a different duration than the others. Furthermore, we know that the more these heartbeats differ from each other in a given time interval, the better the condition of the athlete generally is, the better the health or the better the recovery after a training stimulus. So, if we know that each cycle is different from the rest, why do we still quantify with average values and not analyze the relationship of variability between consecutive cycles in events that are repeated successively?

The heartbeat is not the only one in which this lack of regularity and balance has been observed, but many other biological systems show this lack of stability in their consecutive cycles, indicating a better performance of them. If we leave the analysis of biological systems, it has also been observed that some kinematic factors such as gait show balance in their cycles as a factor of aging or impaired health. Therefore, in biomechanical aspects we could think that those events that are repeated consecutively in the form of cycles may be interesting to cease to quantify with mean values and begin to quantify the relationship between consecutive periods.

In the last year the first pilot studies have begun to emerge in sports with a very marked cyclical character such as canoeing or swimming. For the moment, there are no conclusive data, since this is a research line that is just beginning to emerge. However, the first results show something very different from what happened with biological cycles: sports performance seems to be marked by greater stability between cycles, i.e., less variability. In these sports we have mentioned, it seems logical to think that the more constant the stroke is, the more efficient the maintenance of a higher speed will be, avoiding a longer duration of negative accelerations caused by the environment on which it travels. Therefore, the questions that arise are: will the analysis of cyclic events finally be determinant in the performance of these sports? will the same happen in other cyclic sports in other environments such as running or cycling? in which other cyclic sports does it make sense to analyze the presence or absence of stability between cycles?

We could say that there is a wide research direction that opens its doors and that could be determinant in the understanding of which factors can be influencing in the sports performance of those naturally cyclic sports.

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El análisis de ciclos consecutivos en el rendimiento deportivo. Una nueva perspectiva en la investigación en biomecánica deportiva

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En el día a día, la gran mayoría de eventos naturales, las acciones que realizamos o los sucesos que acontecen a nuestro alrededor presentan un carácter cíclico. Muchos de dichos eventos se suceden de manera consecutiva, se repiten con mayor o menor frecuencia y, consecuentemente, presentan ciclos más cortos o más largos. Estos eventos cíclicos están determinados por un proceso en el que el estado final e inicial coinciden para repetirse sucesivamente en un espacio temporal definido o indefinido.

En cuanto a los eventos cíclicos presentes en el ser humano y que han sido objeto de estudio en el campo del ejercicio físico, podemos encontrar en el mundo de la fisiología algunos muy conocidos como la respiración, el latido cardiaco o la regulación hormonal. En el mundo del rendimiento deportivo a nivel fisiológico, estamos habituados a términos como la frecuencia cardiaca o frecuencia respiratoria, en ambos casos nos estamos refiriendo a las veces que tiene lugar el inicio de un ciclo que se repite consecutivamente. Si profundizamos en aquello que estamos cuantificando en este tipo de variables, podemos darnos cuenta de que estamos interpretando ciclos consecutivos con el uso de valores medios, es decir, usamos la media para darle un valor a un número indefinido de ciclos que podrían ser distintos entre sí. ¿Deberíamos pararnos a pensar si cuantificar una sucesión de tantos ciclos con el valor medio es correcto para representar el comportamiento de este tipo de eventos?

En la década de los 60 surgió un concepto que actualmente goza de mucha fama en el mundo del rendimiento deportivo entre otros, la variabilidad de la frecuencia cardiaca. Los que estén familiarizados con este concepto sabrán que los latidos cardiacos consecutivos no presentan periodos iguales, sino que cada latido cardiaco tiene una duración diferente al resto. Además, sabemos que cuanto más difieren entre sí estos latidos en un rango de tiempo determinado, el estado del deportista es generalmente mejor, de mejor salud o de mejor recuperación tras un estímulo de entrenamiento. Entonces, si sabemos que cada ciclo es distinto al resto ¿por qué seguimos cuantificando con valores medios y no analizamos la relación de variabilidad entre ciclos consecutivos en los eventos que se repiten sucesivamente?

El latido cardiaco no es el único en el que se ha observado esta falta de regularidad y equilibrio, sino que muchos otros sistemas biológicos muestras esta falta de estabilidad en sus ciclos consecutivos, indicando un mejor rendimiento del mismo. Si salimos del análisis de los sistemas biológicos, también se ha podido observar que algunos factores cinemáticos como la marcha presentan equilibrio en sus ciclos como factor de envejecimiento o salud negativamente afectada. Por lo tanto, en aspectos biomecánicos podríamos pensar que aquellos sucesos que se repiten de forma consecutiva en forma de ciclos puede ser interesante dejar de cuantificar con valores medios y comenzar a cuantificar la relación entre los periodos consecutivos.

En el último año han comenzado a surgir los primeros estudios piloto en deportes con un carácter cíclico muy marcado como pueden ser el piragüismo o la natación. De momento, no existen datos concluyentes puesto que es una línea de investigación que está poco más que viendo la luz. Sin embargo, los primeros resultados arrojan algo muy distinto a lo que sucedía con los ciclos biológicos, el rendimiento deportivo parece estar marcado por una mayor estabilidad entre ciclos, es decir, menor variabilidad. En estos deportes que hemos mencionado, parece lógico pensar que cuanto más constante sea la palada o la brazada, el mantenimiento de una mayor velocidad será más eficiente, evitando una mayor duración de aceleraciones negativas ocasionadas por el medio sobre el que se desplaza. Por lo tanto, las preguntas que surgen son ¿será finalmente determinante el análisis de eventos cíclicos en el rendimiento de estos deportes? ¿sucederá lo mismo en otros deportes cíclicos en otros medios como la carrera o el ciclismo? ¿en qué otros deportes cíclicos tienen sentido analizar la presencia o ausencia de estabilidad entre ciclos?

Podríamos decir que existe una amplia línea de investigación que abre sus puertas y que podría ser determinante en la comprensión de qué factores pueden ser influyentes en el rendimiento deportivo de aquellos deportes naturalmente cíclicos.

Which periodization is better (traditional vs undulating) to induce changes in body composition and strength of healthy young adults?

¿Qué periodización es mejor (tradicional versus ondulada) para inducir cambios en la composición corporal y la fuerza de adultos jóvenes sanos?

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Abstract

The present study intends to investigate which type of programming is most effective for improving strength and body composition in untrained young men. A total of 41 men participated (22.5 ± 2.8 years old, 75.6 ± 5.5 kg, 175.3 ± 8.4 cm, 24.6 ± 1.8 kg · m-2) which were divided into two groups; Traditional periodization and Undulating periodization. A program of eight weeks of training including back and chest exercises were applied twice a week for the two groups. Both fat mass and fat-free mass were measured by Dual-energy X-ray absorptiometry, as well as the maximum repetition (RM) of the bench press and row by measuring the speed of execution with a linear encoder and the resting heart rate before and after the program. Data were analyzed using magnitude-based inference. Changes in athletes' scores were assessed by using effect sizes and 90% confidence intervals. The differences within the group in pre-training and post-training were evaluated using the standardized effect size. Improvements in 1RM row, resting heart rate and fat-free mass were observed not possible to determine which training periodization produces greater adaptations in both groups with a possible and probable inference.

Keywords: Dual-energy X-ray absorptiometry, lean body mass, bench press, rowing, health.

Resumen

El presente estudio pretende investigar qué tipo de programación es más efectiva para mejorar la fuerza y la composición corporal en hombres jóvenes. Participaron 41 hombres (22.5 ± 2.8 años, 7.,6 ± 5.5 kg, 175.3 ± 8.4 cm, 24.6 ± 1.8 kg · m-2) divididos en dos grupos; Periodización tradicional y Periodización ondulatoria. Se aplicó para los dos grupos un programa de ocho semanas de entrenamiento que incluía ejercicios de espalda y pecho, dos veces por semana. Se midió la masa grasa y la masa libre de grasa mediante el DEXA, el RM del press de banca y remo a través de la velocidad de ejecución, y la frecuencia cardiaca en reposo antes y después del programa. Los datos se analizaron mediante inferencia basada en la magnitud. Los cambios en las puntuaciones de los atletas se evaluaron utilizando tamaños del efecto e intervalos de confianza del 90%. Las diferencias dentro del grupo en pre-entrenamiento y post-entrenamiento se evaluaron utilizando el tamaño del efecto estandarizado. Se observaron mejoras en 1RM en remo, frecuencia cardiaca en reposo y masa libre de grasa. Los resultados muestran una posible y probable inferencia, no siendo posible determinar qué periodización del entrenamiento produce mayores adaptaciones.

Palabras clave: Absorciometría de rayos X de energía dual, masa corporal magra, prensa de banco, remo, salud.

Introduction

Muscle hypertrophy and strength enhancement are the main goals of strength training practiced by those within the fitness world (Schoenfeld, 2010, 2013). It is known that the physiological mechanisms for these adaptations to occur are different but at the same time complementary, therefore, the programming of strength training is an important factor for obtaining these results in the long term.

Programming consists in altering one or more elements during training over a period of time, in order to allow the program to remain challenging and effective (Baker, Wilson, & Carlyon, 1994). Simple manipulation of training variables such as volume and intensity can offer benefits like reducing overtraining and stimulating gains in performance (Schoenfel, Ogborn, & Krieger, 2017). However, there is a debate currently open about which periodization model gains better adaptations. At the moment, the two most used periodization models are: linear (LP) and undulating (UP) (Poliquin, 1988). Linear periodization is traditionally used in many sports. It is characterized by starting the cycle with a high volume of training and moderate intensity, which change their roles as the sessions develop, where at the end of the training cycle the intensity becomes high unlike the volume, which descends (Baker, Wilson, & Carlyon, 1994). Nonlinear or undulating periodization is based on the alternation of short periods of high training volume with other high-intensity periods (Izquierdo, et al., 2006). Undulating periodization is characterized by spending less time working on each aspect (hypertrophy, strength, and power), one or two weeks, but working on each one more frequently. Kraemer (1997) proved the possibility of undulating within a microcycle, thus being able to work all three aspects within the same week and even within the same session known as daily undulating periodization.

Attending the neuromuscular adaptation and the greater capacity to recruit fast contraction motor units, the undulating periodization generated better responses Monteiro, et al. (2009). This may be because of the constant change in the recruitment of motor units due to the different types of training over a short time frame. In the same line, Prestes et al. (2009) found that in trained individuals (minimum 1 year of experience) strength increases using a nonlinear periodization were between 30% and 40% higher compared to those who used conventional planning.

The daily undulating periodization showed better results in terms of muscle cross-sectional area over nine weeks of training Kok, Hamer, y Bishop (2009). However, undulating periodization could generate too much fatigue and can even reduce force Hartmann et al. (2009). Painter et al. (2012) found that daily undulating periodization trained every day to a maximum effort and even reached muscle failure during hypertrophy training. Therefore, it seems logical that there are unfavorable results in these conditions. In this sense, Simão et al. (2012) found higher enlarge increases for nonlinear periodization training. Zourdos et al. (2016) compared the two different programming models under different orders: phase of hypertrophy, strength, and power of the maximum strength concluding to reaching a greater total volume in a 6-month mesocycle, along with a greater magnitude of force gain in both squat and bench press. Finally, it is believed that undulating periodization is superior to traditional training Poliquin (1988) because linear periodization leads to stagnation and overtraining of the athlete which does not improve either their muscular structure or strength. Thereby, the aim of the present study was to analyze two types of training periodization programming (traditional vs. undulating periodization) to know which is the most effective for the improvement of strength and body composition in untrained young men.

Materials and Methods

Experimental Approach to the Problem

A quasi-experimental pre-and post-test group design using two training groups to examine the short-term (eight weeks) effects of two sessions per week when using traditional (TP) or undulating (UP) periodization. Before data collection, the subjects took part in a familiarization session for each test. One week after the familiarization, the dependent variables were tested, as described below. The subjects were tested by the same investigator, using the same protocol, at the same time of day at weeks 0 and 9, and at a similar ambient temperature (19 - 22 C°). In session 1, body composition (dual x-ray absorptiometry; DEXA; XR-46, Norland Corp., Fort Atkinson, WI) was measured. In session 2, completed 48 h after session 1, the individual 1RM strength was determined by means of a progressive loading during bench press (BP) and prone bench pull (PBP). For the completion of all experimental protocols, the subjects were instructed to remain fast for three hours and not to consume alcohol or caffeine within 12 h. They were also asked to avoid strenuous physical activities the day before each session. During the eight weeks training period, both training groups (UP and TP) performed training using a Technogym equipment (Technogym SpA, Cesena, Italy) twice a week. All subjects were asked to maintain their normal daily routines and eating habits, not to take nutritional supplements that might affect lean tissue mass, and to refrain from commencing new exercise programs during the study.

Sample

Forty-one males (22.5±2.8 years old, 75.6±5.5 kg, 175.3±8.4 cm, 24.6±1.8 kg·m-2) responded to an invitation to participate in the study. Inclusion criteria for participation included: a) All participants must not have participated in any strength training for at least three months; b) Must not perform any type of regular physical activity during the program; c) Not have any medical condition that could influence the training protocol; d) Do not use any anabolic androgenic steroid and/or other ergogenic substances. Prior to testing, subjects were informed about the design of the study and possible risks and discomforts related to the testing and training, after which they read and signed an informed consent document. Subjects were told that they were free to withdraw from the study at any time, without penalty. Each participant provided written informed consent before any testing began, based on the last version of the Helsinki Declaration. This study was approved by the Ethical Committee of the European University of Madrid (CIPI17/2019). To ensure the confidentiality of the players, all performance data were anonymized before analysis.

Procedures

Subjects performed two similar test sessions before and after the eight weeks training period. The first test session was conducted on two non-consecutive days during the week prior to the beginning of the training program. The second test session was conducted under the same conditions during the week after completion of the training program. Both test sessions were performed using the same procedures, and with the same technician, who was blind to the training-group affiliation following previous

research protocol Heilbronn et al. (2020). All subjects were familiarized with the testing procedures one week before. Before each test session, the subjects performed a standard warm-up that included eight minutes of stationary cycling, followed by 10 min of dynamic stretching exercises. All tests were performed at the same location and under similar environmental conditions as in the training sessions.

Dual-energy X-ray absorptiometry

Total and regional fat and lean (body mass – [fat mass + bone mass]) masses were calculated by means of dual-energy X-ray absorptiometry (DXA) (Hologic Series Discovery QDR, Software Physician's Viewer, APEX System Software Version 3.1.2. Bedford, MA, USA). DXA equipment was calibrated using a lumbar spine phantom and following the Hologic guidelines. To ensure the reliability of the DEXA measurements, all pre- and post-training scans were conducted and analyzed by the same operator. Participants were scanned in supine position, with their body and limbs fully extended and inside the limits set by the scan lines. The x-ray scanner performed a series of transverse scans moving at 1-cm intervals from top to bottom of the whole body. Lean mass (g) and fat mass (g) were calculated from total and regional analysis of the whole-body scan. The lean mass of the limbs was assumed to be equivalent to the muscle mass. The test-retest reliability coefficient (*ICC*) for this device was very high ($R2$ = 0.99; p = 0.001) in both cases. DEXA measures were performed before any strength measures to minimize any effects of fluid shifts.

Dynamic measurement system

A dynamic measurement system (T-Force System, Ergotech, Murcia, Spain) automatically calculated the relevant kinematic parameters of every repetition, provided auditory velocity feedback and stored data on disk for analysis. This system consists of a linear velocity transducer interfaced to a personal computer by means of a 14-bit resolution analog-to-digital data acquisition board and custom software. Instantaneous velocity was sampled at a frequency of 1000 Hz and subsequently smoothed with a 4th order low-pass Butterworth filter with a cut-off frequency of 10 Hz. A digital filter with no phase shift was then applied to the data. Reliability (*ICC* = 1.00, *CV* = 0.57%) of this system has been recently reported elsewhere (Lorenzetti, Lamparter, y Lüthy, 2017; Garnacho-Castaño, López-Lastra, y Maté-Muñoz, 2015). Mean propulsive velocity (MPV) was calculated as the average velocity measured only through the propulsive phase, defined as that portion of the concentric action during which the measured acceleration (a) is greater than acceleration due to gravity (g), i.e., a ≥ -9.81 m·s −2. The final braking phase, on the other hand, corresponds to the remaining part of the concentric action, during which a < g. Since the effect of friction force was negligible in pilot testing, it was not taken into account in the calculations. The constant downward force exerted by the cable (~5 N) was not taken into consideration since it was minimal compared to the weights being lifted.

In each testing session, the individual 1 RM strength was determined by means of progressive loading. The warm-up consisted of five minutes of stationary cycling at a self-selected easy pace and upper-body joint mobilization exercises, followed by two sets of five repetitions for each exercise with fixed loads of 20 and 40 kg. A description of the BP testing protocol starts and finishes positions in the PBP, subjects were instructed to lie prone and place their chin on the padded edge of a high bench. The pulling phase began with both elbows in full extension, while the barbell was grasped with hands shoulder-width apart or slightly wider (4–5 cm). Participants were instructed to pull with maximum effort until the barbell struck the underside of the bench, after which it was again lowered to the starting position, they were not allowed to use their legs to hold onto the bench. There was a distance of 8 cm between the underside of the bench and the subjects' chest. Subjects were required to always perform the concentric action of both exercises in an explosive manner, at maximal voluntary velocity. A momentary pause, which lasted approximately 1.5 s, was interposed between the eccentric and concentric phases of each exercise to minimize the contribution of the rebound effect, and allow for more reproducible, consistent measurements. Only the concentric actions (pushing for BP and pulling for PBP) were analyzed in the present study. Both exercises were performed on the same Smith machine (Multipower Fitness Line, Peroga, Murcia, Spain)

For both exercises, the initial load was set at 20 kg for all subjects and was progressively increased in increments of 10 kg until the attained mean propulsive velocity (MPV) was lower than 0.5 $m \cdot s^{-1}$ and 0.7 $m \cdot s^{-1}$ for BP and PBP respectively. Thereafter, the load was individually adjusted using smaller increments (i.e., 5 to 2.5 kg). The heaviest load that each subject could properly lift while completing the full range of motion and without any external help was considered to be his 1RM. In the PBP, the barbell was required to touch the underside of the bench at the end of the concentric pulling phase. Trained spotters were present when high loads were lifted to ensure safety. Three attempts were executed for light (< 50% RM), two for medium (50–80% RM), and only one for the heaviest (> 80 % RM) loads. Inter-set rest intervals were three minutes for the light and medium loads and five minutes for the heaviest loads. Only the best repetition at each load was considered for subsequent analysis. The 1RM was calculated from the MPV attained against the heaviest load (kg) lifted in the progressive loading test using the following equations (Sánchez-Medina et. al., 2014): BP load = $11.2988 \times MPV^2 - 78.05 \times MPV + 113.04$; PBP load = $13.2596 \times MPV^2 - 93.867 \times MPV + 144.38$.

Table 1. Traditional Periodization. Sessions 1 and 2

	Sets × repetitions (cadences)	Rest between sets (min)	Intensity
Bench press	3×10 (1, 1, 3)	1-2	70% of RM
Press down	3×10 (1, 1, 3)	1-2	70% of RM
Bench press with dumbbells	3×10 (1, 1, 3)	1-2	70% of RM
Bench press declined	3×10 (1, 1, 3)	1-2	70% of RM
Row	3×10 (1, 1, 3)	1-2	70% of RM
Pull-up	3×10 (1, 1, 3)	1-2	70% of RM
Chest pulley	3×10 (1, 1, 3)	1-2	70% of RM
Row with dumbbells	3×10 (1, 1, 3)	1-2	70% of RM

Table 2. Undulating Periodization. Session 1 and 2

Exercise	Sets × repetitions (cadences)		Rest between sets (min)		Intensity	
	Session 1	*Session 2*	*Session 1*	*Session 2*	*Session 1*	*Session 2*
Bench press	3×8 (2, 1, 2)	3×10 + fail (1, 1, 3)	1-4	1-2	90% of RM	70% + 50% of RM
Press down	3×10 (0, 0, 1)	3×10+ fail (1, 1, 3)	1-2	1-2	50% of RM	70% + 50% of RM
Bench press with dumbbells	3×12 (1, 1, 3)	3×10 + fail (1, 1, 3)	1-2	1-2	70% of RM	70% + 50% of RM
Bench press declined	3×12 (1, 1, 3)	3×10 + fail (1, 1, 3)	1-2	1-2	70% of RM	70% + 50% of RM
Row	3×8 (2, 1, 2)	3×10 + fail (1, 1, 3)	1-4	1-2	90% of RM	70% + 50% of RM
Pull-up	3×10 (1, 0, 1)	3×10 + fail (1, 1, 3)	1-2	1-2	50% of RM	70% + 50% of RM
Chest pulley	3×12 (1, 1, 3)	3×10 + fail (1, 1, 3)	1-2	1-2	70% of RM	70% + 50% of RM
Row with dumbbells	3×12 (1, 1, 3)	3×10 + fail (1, 1, 3)	1-2	1-2	70% of RM	70% + 50% of RM

Diet logs

Subjects were instructed to maintain their accustomed dietary habits throughout the course of the study. To verify compliance with this instruction, dietary habits were assessed on two occasions (2 and 8 weeks). An experienced instructor obtained dietary records from the subjects without warning. On all occasions, dietary logs were recorded for three consecutive days, including one weekend day. The three days dietary records were analyzed for total caloric intake and for carbohydrate, fat, and protein composition using commercially available computer software (DietSource 3.0; Novartis, Barcelona, Spain), following previous research with similar protocols (Gallon et al., 2017). The two groups demonstrated a substantial similarity in diet habits: ≈ 61% carbohydrates, ≈ 20% proteins, ≈ 19% lipids.

Training Procedure Protocol

The subjects had to perform two workouts per week, and in each session, they performed four chest and four back exercises. The subjects that belonged to the TP group completed a total volume of 48 sets per week, 24 for each muscle group, at 70% of the RM at a cadence (1, 1, 3) with a rest between sets from one to two minutes. The individual load-velocity and load-power output relationships as well as 1 RM strength were determined by means of a progressive loading during bench press and seated pulley (Table 1). Undulating Periodization group, the volume of sets was matched to

the traditional periodization, but the two weekly sessions followed a different methodology (undulating per session), working at different power levels, maximum strength and hypertrophy with different intensities, cadences and rests within the same session (Table 2).

Statistical Analysis

Statistical analysis of data was performed with SPSS 25.0 for iOX (IBM, Chicago, IL). Subjects' physical characteristics are reported as means ± standard deviation. The normal distribution and homogeneity parameters were checked with Shapiro-Wilk and Levene tests, respectively. A two-way repeated measures ANOVAs with GROUP (UP vs TP) and TIME (pre- to post-test) as factors was performed to analyze the training related effects. When significant interactions of both factors (GROUP × TIME) were found, independent t tests were computed on the pre- to post-trial change scores *(Δ%).* The calculation of Δ % used the pre- to post-test differences divided by the pre-test values and then multiplied by 100 and was carried out for each subject. Significance was accepted when $p < 0.05$. Effect sizes and confidence limits were reported to observe changes in scores athlete. The magnitude of the within-group changes was interpreted by using values of trivial (< 0.20), small (0.20 – < 0.60) and moderate (0.60 – < 1.20). The probability that these differences actually exist was then assessed via magnitude-based qualitative inferences (Batterham, & Hopkins, 2006; Hopkins et al., 2009). Qualitative inferences were based on quantitative chances of benefit (Baker, Wilson, & Carlyon, 1994). Probabilities that differences were higher than, lower than, or similar to the smallest worthwhile difference were evaluated qualitatively as possibly, 25% to 75%; likely, 75% to 95%, very likely, 95% to 99.5%; and most (extremely) likely, >99.5 %.

Results

Mean ± *SD* values for al l RM and body composition parameters pre- and post-training intervention are shown in Table 3, 4 and 5. No significant differences in any of these characteristics were found between UP and TP at the beginning of exercise training. No significant differences were observed in training compliance between UP and TP (95.6 ± 2.3 vs. 94.6 ± 2.9%, respectively).

Both press and row repetition maximum were statistically higher in the post-test than in the pre-test for the UP and TP group. However, the ANOVA did not display a GROUP × TIME interaction. For fat body mass and lean body mass, the ANOVA did not display either a TIME effect or a GROUP × TIME interaction; instead, upper lean body mass was statistically higher in the post-test than in the pre-test for the UP group. There was no difference in the change in upper lean body mass between UP and TP.

Table 3. Traditional Periodization (n = 21): mean ± SD values for all 1RM parameters pre- and post-training intervention

	Pre	Post	Post – Pre			
	M	***M***	***p***	***%Δ***	***ES***	***Inference***
	(SD)	***(SD)***		***(SD)***	***(90% CL)***	
RM Bench Press (kg)	63.8	68.4	0.005	8.53	*0.26*	***Small****
	(16.8)	(15.3)		(12.48)	*(0.16)*	
RM Prone Bench Pull (kg)	74.6	92.6	<0.0001	25.32	*0.81*	***Moderate****
	(21.4)	(27.8)		(20.98)	*(0.26)*	
Fat body mass (g)	14024.7	14800.6	0.419	6.49	*0.09*	***Trivial****
	(7934.3)	(8037.7)		(11.85)	*(0.07)*	
Lean body mass (g)	60748.4	61071.9	0.896	0.54	*0.04*	***Trivial****
	(7133.2)	(7542.4)		(4.33)	*(0.14)*	
Upper lean body mass (g)	24046.8	24491.6	0.104	1.80	*0.14*	***Trivial****
	(3151.0)	(3423.4)		(3.82)	*(0.27)*	

Values are mean ± standard deviation, percent change ± standard deviation and standardized effect size; ±90% confidence limits. Abbreviations: *n*, sample size; *M*, mean; *SD*, standard deviation, %Δ, percent change; *ES*, effect size; 90% *CL*, 90% confidence limits; RM, repetition maximum. Qualitative inferences are *trivial* (< 0.20), *small* (0.20 – < 0.60) and *moderate* (0.60 – < 1.20): * possibly, 25 – < 75; ** likely, 75 – < 95%; *** very likely, 95 – < 99.5; **** most likely, > 99.5. Positive, neutral and negative descriptors qualitatively describe the change between post and pre values and its importance relative to the specific variable.

Table 4. Undulating Periodization (n = 20): mean ± SD values for all 1RM parameters pre- and post-training intervention

	Pre	Post	Post – Pre			
	M	***M***	***p***	***%Δ***	***ES***	***Inference***
	(SD)	***(SD)***		***(SD)***	***(90% CL)***	
RM Bench Press (kg)	62.1	67.8	0.001	10.23	*0.27*	***Small*****
	(20.1)	(21.8)		(11.34)	*(0.11)*	
RM Prone Bench Pull (kg)	71.6	86.9	<0.0001	21.22	*0.68*	***Moderate*******
	(21.8)	(29.8)		(18.17)	*(0.23)*	
Fat body mass (g)	13883.2	13728.3	0.357	-2.12	*0.02*	***Trivial*******
	(8111.5)	(8373.4)		(9.86)	*(0.06)*	
Lean body mass (g)	57069.2	57392.4	0.130	0.53	*0.04;*	***Trivial*******
	(8397.9)	(8293.1)		(2.29)	*(0.06)*	
Upper lean body mass (g)	22069.0	22718.5	0.017	3.14	*0.16*	***Trivial******
	(3423.4)	(3933.6)		(5.85)	*(0.32)*	

Values are mean ± standard deviation, percent change ± standard deviation and standardized effect size; ±90% confidence limits. Abbreviations: *n*, sample size; *M*, mean; *SD*, standard deviation, %Δ, percent change; *ES*, effect size; 90% *CL*, 90% confidence limits; RM, repetition maximum. Qualitative inferences are *trivial* (< 0.20), *small* (0.20 – < 0.60) and *moderate* (0.60 – < 1.20): * possibly, 25 – < 75; ** likely, 75 – < 95%; *** very likely, 95 – < 99.5; **** most likely, > 99.5. Positive, neutral and negative descriptors qualitatively describe the change between post and pre values and its importance relative to the specific variable.

Table 5. Post#Pre change. Traditional and Undulating Periodization

	ES (90% CL)	Inference
RM Bench Press (kg)	0.04 (0.65)	Trivial*
RM Prone Bench Pull (kg)	0.20 (0.57)	Small*
Fat body mass (g)	0.14 (0.65)	Trivial*
Lean body mass (g)	0.56 (0.61)	Small**
Upper lean body mass (g)	0.35 (0.53)	Small**

Values are mean ± standard deviation, percent change ± standard deviation and standardized effect size; ±90% confidence limits. Abbreviations: *ES*, effect size; 90% CL, 90% confidence limits; RM, repetition maximum. Qualitative inferences are *trivial* (< 0.20), *small* (0.20 – < 0.60) and *moderate* (0.60 – < 1.20): * possibly, 25 – < 75; ** likely, 75 – < 95%; *** very likely, 95 – < 99.5; **** most likely, > 99.5. Positive, neutral and negative descriptors qualitatively describe the change between post and pre values and its importance relative to the specific variable.

Discussion

The aim of the present study was to analyse two type of training periodization programming (traditional vs. undulating periodization) to know which is the most effective for the improvement of strength and body composition in untrained young men. The findings indicated that eight-weeks of TP or UP improve upper body strength, and upper lean body mass only with TP. However, in the absence of statistically significant differences between groups, it is not possible to determine which training periodization produces greater adaptations.

Nevertheless, Baker et al. (1994), unlike what is shown in the present study were the first to compare strength between a linear and a nonlinear periodization model and concluded that an undulating model was more effective. Along the same line Rhea et al. (2002) compared a twelve-week

protocol the greatest increases in strength levels were achieved with the nonlinear protocol. Another similar study was conducted by Simao et al. (2012), concluded that in both programs there were gains in the two parameters evaluated, although better results were obtained in nonlinear programming. The variety of stimuli performed in the undulation may also favor physiological adaptations, through supercompensation. Another priority would be flexibility when applying the training load, as the stimulus varies at each moment.

Thereby, previous studies (Painter et al., 2012; Solberg et al., 2015) affirmed that there were no significant differences between the two models of periodization. Within the nonlinear models, no differences in force between a daily undulating model and a weekly one has been observed. The studies that evaluated hypertrophy using corporal values did not show any significant difference to be able to affirm that one type of periodization is more efficient than another. This corroborates with our results found in which the two types of periodization are effective. However, the studies analyzed had measured strength using the traditional RM method and for body composition anthropometry techniques were used. In the present study body composition was measured with DEXA and strength was obtained measuring the speed of execution.

In this sense, within the parameters of strength and body composition in advanced practitioners, found no significant differences in body composition or strength increases across neither of the three protocols (daily undulating, weekly undulating or a linear method) Buford et

al. (2007). Although more studies would be needed to verify which type of periodization is more effective for advanced participants. On the other hand, Hoffman et al. (2003) showed better results in the traditional model compared with the undulating model. However, they compared the same group over two periods of time, meaning that improvements in the classical model could be attributed to an adaptation during the first period (first year, first season) which followed a linear model, and the second year the same group followed an undulating model. In our study there is a slight inclination towards the traditional periodization, but unlike the work of Hoffman et al. (2003), the comparison was made with two different groups which both trained and were measured in the same conditions.

Equalizing the volume for both linear periodization training and nonlinear training is very relevant, since this has not been done with all the studies found, meaning that some of the non-significant differences could be related to the amount of volume in one model or another. Another characteristic of the studies found is that those who correlate a linear model with greater effectiveness in training have the peculiarity that their participants are physically active, and the vast majority follow a specific strength training plan.

It should also be noted that not all studies used the same evaluation technique to measure body values, some were measured by skin folds, others by circumference, others by bioelectrical impedance and some even by ultrasound. Body values depend on more factors besides training, as in the case of hypertrophy, which also depends on other variables such as eating habits or sleep. In the present study, dietary indications were given so that the sample was the most homogenous as possible in that aspect.

As demonstrated, both periodization methods are able to obtain significant gains in strength and improvement of body composition. Obviously, the two compared models obtain greater effectiveness than a non-periodized model (Fleck, 2011). However, it can be said that both periodization models increased equally in the different variables such as strength and body composition. In general terms, there are no significant differences between using a linear or a nonlinear periodization. For practical purposes, it would be interesting to analyses which of the two causes less injury or greater motivation, since these two factors can influence the adherence to strength programs.

Conclusions

An important finding in this study was that for untrained subjects, the benefits will always be positive regardless of the type of periodization used, which is important for this population so that training organization does not cause physical problems or demotivation. In trained subjects, where adherence is already established, the most frequent problem is the stagnation of adaptations or an increase in injuries, for which, planning considering either models makes training more efficient. The undulating model may have an advantage over the linear model regarding the upper lean body mass, although there were no statistically significant differences between groups. This kind of periodization works with different load and volume ranges making the training less boring which may influence on the results of the training.

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Acute effects of different facemasks during High Intensity Interval Training in trained women. A randomized crossover pilot study

Efectos agudos del uso de mascarillas durante el ejercicio interválico de alta intensidad en mujeres entrenadas. Un estudio piloto cruzado y aleatorizado

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Abstract

The aim of the present investigation was to analyze the acute effect of different facemasks on physiological, perceptual and performance parameters in trained young women during a High Intensity Interval Training (HIIT) on cycle ergometer. Fifteen subjects participated in the study. Heart rate variability, muscle oxygen saturation, lactate concentration and comfort parameters were measured under 3 conditions: no facemask, surgical and FFP2 facemask. The use of facemasks had no effect on any variable related to oxygen saturation, heart rate variability and cycling power during the HIIT protocol. Only lactate concentration revealed significantly lower values in the No mask condition compared to FFP2 3 min after HIIT (p = .038). Regarding the overall perception and comfort, participants reported greater discomfort when wearing the FFP2 mask compared to the No mask condition (p<.05). On the contrary, the analysis of heart rate variability, revealed significant differences (p<.001) in the Pre compared to the Post exercise for all conditions. The use of surgical or FFP2 facemask during HIIT training does not affect performance during strenuous exercise while perceived comfort appears to be lower with FFP2 masks in physically trained women.

Keywords: facemask, interval training, exercise, Covid-19, women.

Resumen

El objetivo de esta investigación fue analizar los efectos agudos de diferentes tipos de mascarillas sobre los parámetros fisiológicos y comodidad en mujeres entrenadas durante un entrenamiento interválico de alta intensidad (HIIT) en cicloergómetro. Quince sujetos fueron examinados, obteniendo la variabilidad de la frecuencia cardíaca, la saturación de oxígeno muscular, la concentración de lactato y los parámetros de confort bajo 3 condiciones: sin mascarilla, mascarilla quirúrgica y mascarilla FFP2. El uso de mascarillas no tuvo efecto sobre la saturación de oxígeno, la variabilidad de la frecuencia cardíaca y la potencia de pedalada durante el ejercicio. Sólo la concentración de lactato reveló valores significativamente más bajos Sin mascarilla que con FFP2 3 min después del HIIT (p = .038). En cuanto a la percepción y comodidad, los participantes identificaron una mayor incomodidad con el uso de FFP2 en comparación con la ausencia de ésta (p<.05). Por el contrario, el análisis de la variabilidad de la frecuencia cardíaca, reveló diferencias significativas (p<.001) en el ejercicio Pre- comparado con el Post- en todas las condiciones. El uso de mascarilla quirúrgica o FFP2 durante el entrenamiento HIIT no afecta al rendimiento, mientras que la comodidad percibida parece ser menor con las mascarillas FFP2 en mujeres entrenadas.

Palabras clave: mascarilla, entrenamiento interválico, ejercicio, Covid-19, mujer.

Introduction

One of the most common ways of SARS-CoV-2 spreading, cause of Covid-19, is by close contact through respiratory droplets. There is growing evidence that the use of facemasks prevents its contagion and transmission (Chu et al., 2020; Leung et al., 2020; Wang et al., 2020), since they are considered a worldwide useful mitigation strategy during the pandemic (Esposito et al., 2020). Typically, Surgical and Filtering Face Piece (FFP2) are recommended facemasks, but they meet different filtration requirements. The FFP2 facemask filters small airborne particles and offers fewer facial seal leaks, making it more effective in reducing viral infections than surgical facemasks (Smith et al., 2016).

High Interval Intensity Training (HIIT) method has become popular not only for athletes to improve performance in endurance (Billat, 2001; Laursen & Jenkins, 2002) but also for sedentary and active individuals (Gibala et al., 2012; Kemi & Wisløff, 2010). HIIT can be defined as repeated bouts of high intensity exercise, from a maximal lactate steady state (MLSS) or point of respiratory compensation (CPR) to a total supramaximal exercise intensity, interspersed with recovery periods (Koichiro Azuma & Matsumoto, 2016). With exercises at these intensities oxygen systems are exposed to maximum stress, which provides the most effective stimulus to increase maximum oxygen consumption (VO_2max) (Buchheit & Laursen, 2013; Seiler & Sjursen, 2004). Therefore, the ability to perform that type of vigorous physical activity with some type of facemask could be a problem (Chandrasekaran & Fernandes, 2020) as physiological impact during vigorous physical activity is unknown (Bailey et al., 2015). Moreover, some physiological effects associated with the use of facemasks such as decreasing muscle metabolism or increasing cardiorespiratory and mental stress have been recently reported and might have and influence on discomfort during exercise (Chandrasekaran & Fernandes, 2020).

Recent studies have successfully used infrared spectroscopy to monitor muscle oxygen saturation (SmO_2) during intense activities such as HIIT (Olcina et al., 2019; Paquette et al., 2020). The predominant metabolism during intense and strenuous exercise is the anaerobic, which needs a large amount of oxygen (O_2) for an efficient lactic acid conversion (Jacobson et al., 2019). An increase in arterial carbon dioxide (CO_2) may occur due to the constant breathing of previously exhaled air (closed cycle), resulting in an acidic environment, increasing lactate levels, and consequently a rapid onset of fatigue in the athlete. All this will result in a worse hemoglobin saturation and the appearance of a hypoxic environment of all vital organs (Chandrasekaran & Fernandes, 2020; Jacobson et al., 2019). In addition, to quantify autonomic cardiac activity (Thayer et al., 2010) or exercise-induced adaptations (Barbosa et al., 2014) some methods such as heart rate variability (HRV) have been widely used.

Currently, results on whether the use of facial facemask impairs the performance of the exercise has been analyzed by incremental cycling test (Epstein et al., 2021; Fikenzer et al., 2020; Shaw et al., 2020) and on a treadmill (Wong et al., 2020) but the results with strenuous physical activity tests such as the HIIT method are unknown. Moreover, physiological differences between males and females may be a factor to consider because females have smaller lungs and rib cages (Dominelli et al., 2019) and consequently smaller conducting airways while males have a higher minute ventilation who may have a greater increase in work of breathing while wearing a facemask during intense efforts (Hopkins et al., 2021).

The effect of HIIT exercise using different facemasks has never been investigated taking into consideration gender differences. Thus, the main aim of the current study was to analyze the effect of not wearing a facemask, wearing a surgical facemask or wearing a FFP2 facemask on different physiological, perceptual and performance responses in trained young women during a HIIT protocol on a cycle ergometer.

Methods

Participants

Sixteen physically-trained females with a regular participation (3 times a week) in high intensity endurance activities voluntarily participated in this investigation. During the study one "experimental death" occurred resulting in a final sample of 15 participants (23.67 ± 3.04 years of age, 58.33 ± 6.93 kg of body mass and 164.97 ± 8.98 cm of height).

Facemasks

In the protocol study two types of facemasks were used: FFP2 (Qh Medicine, Jiangsu, China) and surgical (Cmc Medical Device, Málaga, Spain) with bacterial filtration capacity >99%. Both facemasks are commercially available to hospitals and pharmacies complying with all the sanitary guarantees.

Experimental design

A randomized crossover design was performed to analyze the possible different effects of diverse facial facemask types during a high intensity protocol. The facemask-type based groups were stablished as: a) No mask, b) Surgical: and c) FFP2. Each participant was randomly assigned a facemask-type group order by using a computerized randomization scheme. The inclusion criteria were: a) being female; b) being physically active in endurance activities (at least 6 hours per week); and c) between 18 and 30 years of age. The exclusion criteria included: a) presenting any injury or cardiorespiratory disease; and/or b) taking medication that could interfere with the results of the study. All subjects participated in the experiment only when they were during follicular phase.

All participants were informed about the study and were asked to provide written informed consent before participating in the study, which had been previously approved by the Ethics Committee of the Catholic University of Murcia (Spain) following current legislation (CE012103).

The participants were asked to come to the laboratory rested and having performed no vigorous exercise in the preceding 48 h. The anthropometric parameters analyzed included height (cm), measured by a stadiometer (Seca 222, Hamburg, Germany) and weight (kg), which was recorded with a Seca 634 scale (Hamburg, Germany).

Every participant attended the laboratory four times, at the same time of the day on four different days using the same procedures and materials. The first session consisted in a familiarization with the protocol whereas the other three were counterbalanced HIIT (High Intensity Interval Training) sessions, one with surgical facemask, (SM), one with FFP2 facemask (FM) and one with no facemask (NM). Figure 1 shows a schematic diagram during a session of the study protocol.

Outcomes

Experimental protocol

Each session lasted about 30 min. The temperature (22º) and relative humidity (53%) of the laboratory remained constant during all the trials. The same warm-up was performed in all sessions, consisting of 5 min of continuous pedaling on the cycle ergometer, at 100 W, with 1 min rest before starting the protocol. An electronically controlled cycle ergometer (Technogym Bike, Med Technogym SpA, Cesena, Italy) with a workload mode independent of pedaling frequency was used. In the first session the participants self-selected their exercise intensity in response to a prescription of "effort maximum interval and session" and was maintained along the other sessions. Participants were instructed to remain seated on the cycle ergometer during the test. In total, 8 high intensity intervals of 30 s were performed, respectively, analyzing the maximum power (Pmax) and average power (Pmean) in watts (W) every 5 s during the HIIT intervals.

Heart rate variability

The HRV measurements were carried out at resting in a supine position for 10 minutes, being analyzed only the last 5 min to ensure that a resting heart rate was achieved. The analysis of only 5 min was performed in accordance with the HRV task force (Camm et al., 1996).

HRV estimations were performed with a pulse sensor Polar H7 (Kempele, Finland) to assess beat-to-beat data during the evaluations. The examination of HRV variables was done through the product Kubios HRV 3.0. This product was additionally used to apply filters for artifact correction if necessary. The time- and frequency-domain as well as Poincare plot variables were obtained. The time-domain factors investigated were the mean heart rate (HR), mean R-R interval time in ms (RR), the standard deviation of consecutive R-R intervals (SDNN), the root mean square of successive differences of consecutive R-R intervals in ms (RMSSD) and the relative value of consecutive intervals that differ by more than 50 ms (pNN50). At last, Poincare plot factors such as the standard deviation of instantaneous beat-to-beat interval variability (SD1) and the continuous long-term R-R interval variability (SD2) were determined. Stress score (SS) was calculated by 1000 x 1/SD2, and the sympathetic/parasympathetic ratio (S/PS) was determined through SS/SD1.

Blood Lactate

To obtain the blood lactate concentration, a portable lactate analyzer (Lactate Scout system, RedMed, Warsaw, Poland) was used. Lactate concentration was measured according to the principle of enzymatic determination by photometric reflection. For that purpose, a capillary blood drop sample was taken under safety standards from the index finger of the subject's right hand. In order to obtain a correct and hygienic collection, nursing material such as latex gloves, sterile gauze, lancets and 98º alcohol were used.

To observe lactate levels as a function of the test, a total of three measurements were performed: 1) baseline level (previous to the protocol and warm-up); 2) post-test after 1 min; and 3) post-test after 3 min.

Muscle Oxygen Saturation

Muscle oxygen saturation was measured by a MOXY monitor (Fortiori Design LLC). The device uses four wavelengths of Near-Infrared Spectroscopy (NIR) light at 680, 720, 760, and 800 nm (Schmitz, 2015) to identify changes in total tissue hemo- (+myo-) globin (tHb). Before testing, a moxy device was placed only on the anterolateral part of the right thigh (right vastus lateralis of the quadriceps femoris), at 1/3 distance between the patella and greater trochanter, parallel to the longitudinal femur axis and above the upper patella border. Data acquisition was obtained from the sensors internal memory from the Moxy PC software.

Perceived effort and comfort of physical activity

To measure perceived exertion and comfort levels during physical activity two measurements were used, the rating of perceived exertion (RPE) (Borg, 1998) and one scale for subjective comfort with the use of different facemasks (Li et al., 2005).

Rating of perceived exertion (RPE): during the 30-second rest period of each protocol interval participants were required to assign a value (1 to 10) according to their levels of perceived exertion, with a value of 10 being the maximum perceived effort.

Rating of perceived discomfort: at the end of the cycloergometer protocol of each session, participants were asked about some markers of discomfort with the use of the face facemask (humidity, heat, breathing resistance, itchiness, tightness, saltiness, feeling unfit, odor, fatigue, and overall discomfort), ranging from 0 (not at all, comfortable) to 10 (strongly discomfort).

The Physical Activity Enjoyment Scale (PACES) adapted to Spanish (Moreno et al., 2008) was used at the end of each session of the study protocol. Responses were collected on a Likert-type scale whose score ranges ranged from 1 (strongly disagree) to 5 (strongly agree). The final PACES score was obtained according to the procedures from Motl et al., (2001).

Statistical analysis

Data collection, treatment, and analysis were performed using the SPSS for Windows statistical package (version 20.0; SPSS, Inc., Chicago, IL, USA). Measures of homogeneity and spread were reported as mean and standard deviation (s). The hypotheses of homogeneity of variance and normality of the distribution were analyzed using the Levene's test and Kolmogorov–Smirnov test, respectively. The comparisons of facemask groups means were performed using repeated measures analysis of variance (ANOVA) test with three levels (no facemask, Surgical and FFP2) when statistical tests revealed no violations of the assumptions of normality and homogeneity. To identify the significance between groups when ANOVA revealed significant differences, post hoc Bonferroni tests with corrections were conducted. Friedsman test was used when normality supposition of data was rejected, whereas if any significant difference between groups were identified, post hoc Wilcoxon signed-rank tests with Bonferroni corrections were performed. The level of significance was set as . < .05 and partial eta squared (η^2_p) was calculated as a measure of effect size, considering small size when between .01 and .06, moderate when between .06 and .13, and large when the effect was > .13.

Results

The results of the oxygen saturation and HRV parameters before and after a HIIT protocol depending on the type of facemask are presented in Table 1. No significant differences were observed in any oxygen-related variable. Conversely, the analysis of heart rate variability revealed significant differences (p < .001) in all facemask conditions as a consequence of HIIT effect in all variables investigated, observing large effect sizes higher than .74 in all cases.

Table 1. Oxygen saturation and heart rate variability parameters before and after a HIIT protocol wearing different face masks (No, Surgical and FFP2 mask)

		PRE	POST		ANOVA								
					HIIT effect			Mask effect			HIIT*Mask effect		
Outcome	Mask	Mean ± s	Mean ± s	*p*	F	*p*	η^2_p	F	*p*	η^2_p	F	*p*	η^2_p
Oxygen saturation parameters													
Rest SmO_2 (%)	No mask	77.37 ± 12.78	78.79 ± 8.54	.695	.705	.406	.019	.217	.806	.012	.005	.995	<.001
	Surgical	76.91 ± 11.61	78.69 ± 7.68	.664									
	FFP2	78.66 ± 8.41	80.58 ± 9.62	.525									
Rest THb (g · kg^{-1})	No mask	11.93 ± 0.36	11.92 ± 0.34	.783	.030	.863	.001	.532	.592	.028	.138	.872	.007
	Surgical	12.01 ± 0.16	12.03 ± 0.14	.703									
	FFP2	11.97 ± 0.22	11.98 ± 0.18	.790									
Heart rate variability parameters													
RR (ms)	No mask	825.75 ± 175.00	568.75 ± 64.91	< .001	223.320	**<.001**	.845	.024	.977	.001	.682	.511	.032
	Surgical	859.37 ± 141.58	549.45 ± 56.62	< .001									
	FFP2	840.59 ± 124.90	565.60 ± 52.89	< .001									
SDNN (ms)	No mask	76.66 ± 37.04	17.94 ± 7.45	< .001	142.079	**<.001**	.776	.294	.747	.014	.286	.753	.014
	Surgical	77.85 ± 33.35	14.27 ± 4.44	< .001									
	FFP2	70.12 ± 25.48	15.58 ± 3.12	< .001									
RMSSD (ms)	No mask	56.37 ± 30.93	6.83 ± 3.30	< .001	120.22	**<.001**	.746	.897	.416	.042	1.116	.334	.052
	Surgical	74.53 ± 44.72	5.67 ± 2.15	< .001									
	FFP2	62.15 ± 27.51	5.70 ± 2.21	< .001									
SS (ms)	No mask	12.52 ± 6.13	47.25 ± 20.11	< .001	236.863	**<.001**	.852	.949	.395	.044	.958	.392	.045
	Surgical	13.10 ± 7.26	55.45 ± 16.58	< .001									
	FFP2	12.88 ± 5.20	48.67 ± 10.36	< .001									
Ratio S-PS	No mask	0.57 ± 1.08	12.50 ± 7.89	< .001	116.259	**<.001**	.739	1.146	.328	.053	1.123	.335	.052
	Surgical	0.57 ± 1.55	17.05 ± 9.58	< .001									
	FFP2	0.27 ± .46	13.39 ± 8.24	< .001									

HIIT: high intensity interval training; SmO_2: muscle oxygen concentration; THb: total tissue hemo- (+myo-) globin; RR: R-R interval time; SDNN: standard deviation of consecutive R-R intervals; RMSSD; root mean square of successive differences of consecutive R-R intervals; SS: stress score

In addition, Figure 1 shows the changes in mean values of cycling Power, SmO_2 and RPE for each of the HIIT intervals when wearing different facemasks. Mean values of blood lactate concentration and HR are presented in Figure 2. Significant lower lactate concentration in the No facemask condition compared to FFP2 was detected 3 min after the HIIT (p = .038).

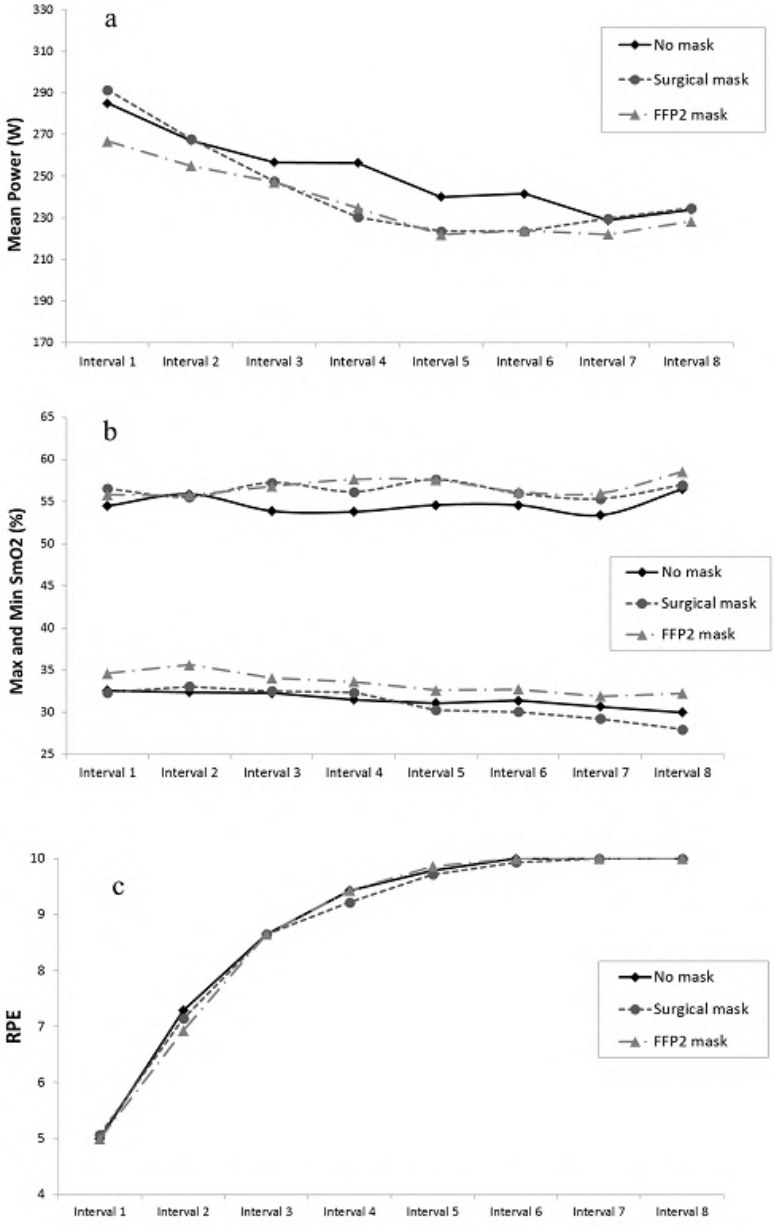

Figure 1. Mean values of cycling Power (a), SmO_2 (b) and RPE (c) for each HIIT interval wearing different face masks (No, Surgical and FFP2 mask)

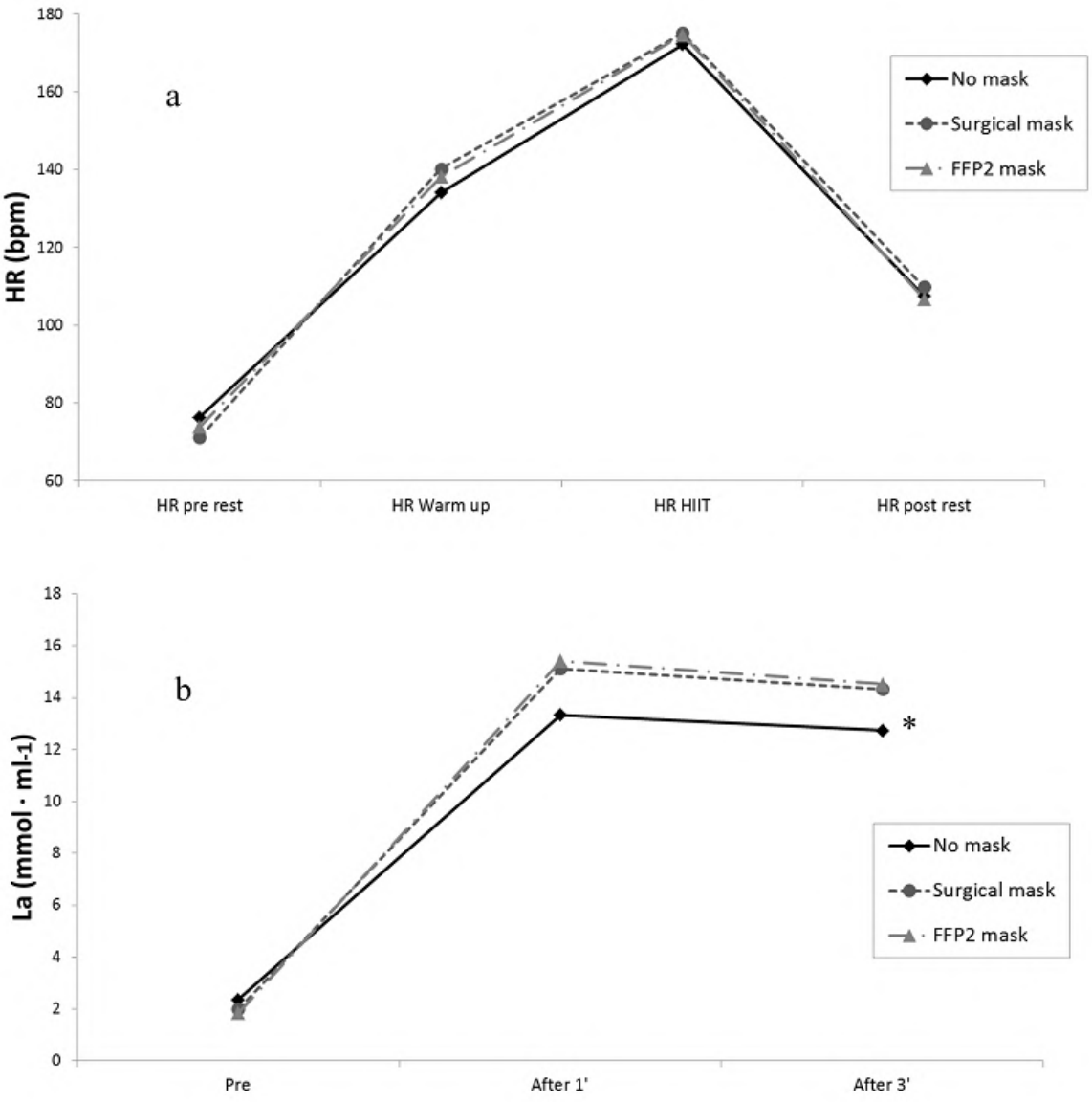

Figure 2. Mean values of HR (a) and Lactate (b) wearing different face masks (No, Surgical and FFP2 mask)
* Significant differences between No mask and FFP2 mask ($p < 0.05$)

Table 2 summarizes the general perception and comfort when wearing different facemasks during a HIIT protocol. Participants reported significant greater breathing difficulty, tightness, inadequacy and general discomfort when wearing the FFP2 facemask compared to the no facemask condition whereas only higher values of inadequacy and general discomfort were determined with the use of the surgical compared with no wearing facemask ($p < .05$).

Table 2. Perception and comfort wearing different face masks (No, Surgical and FFP2 mask)

	MASK TYPE					
	No (Mean ± s)	Surgical (Mean ± s)	FFP2 (Mean ± s)	F	*p*	η^2_p
Humidity (0-10)	4.80 ± 2.86	5.91 ± 2.21	6.91 ± 2.12	3.50	.039	.38
Hot (0-10)	6.20 ± 2.90	7.09 ± 2.66	7.55 ± 1.97	1.91	.161	.29
Breathing difficulty (0-10)	5.40 ± 2.07	6.73 ± 2.37	7.91 ± 2.12*	5.75	**.006**	.46
Stinging (0-10)	1.40 ± 0.97	1.91 ± 1.64	2.09 ± 1.64	1.55	.225	.26
Tightness (0-10)	1.40 ± 0.84	2.64 ± 2.87	3.36 ± 2.01*	4.93	**.012**	.44
Salty (0-10)	2.30 ± 1.64	2.64 ± 1.96	3.09 ± 2.74	1.24	.300	.24
Inadequacy (0-10)	2.90 ± 2.64	5.27 ± 2.33*	7.55 ± 2.25*†	16.11	**.015**	.66
Fragrant (0-10)	1.60 ± 1.07	2.64 ± 1.63	3.00 ± 2.32	4.43	.018	.42
Fatigue (0-10)	7.20 ± 1.69	7.82 ± 1.40	8.18 ± 1.40	1.23	.304	.23
General discomfort (0-10)	3.90 ± 1.91	5.18 ± 1.94	6.55 ± 1.92*†	5.35	**.009**	.45
Paces questionnaire	29.80 ± 7.76	30.64 ± 8.43	31.45 ± 9.30	0.11	.896	.07

***** Significant differences compared to No mask ($p < 0.05$)
# Significant differences compared to Surgical mask ($p < 0.05$)

Discussion

The main finding of the current investigation was that the use of different facemask compared with not wearing facemask showed no differences in physiological parameters during the HIIT protocol. However, comfort sensation was negatively affected by the use facemask type (no mask > Surgical > FFP2).

Facemask effect on Heart Rate Variability

A factor that directly affects HRV is the practice of exercise. During exercise a variety of physiological adjustments occur to meet the demands and requirements of the body to produce energy expenditure, these adjustments result in changes due to the physiological response of the body. We have observed in our results that HRV drops drastically after the HIIT protocol. It is well known that exercise causes very significant reductions in cardiac variability (Al Haddad et al., 2010) and that exercise intensity plays a determining role on the physiological impact of the organism (Stanley et al., 2013). This must be the reason why our results show such a large impact of HIIT on HRV since it is a very high-intensity training. Although this is not a novel finding, our work shows that parasympathetic tone drops to very low levels during exercise, with this change being much greater the higher the intensity of exercise. Similarly, many studies have aimed to study how sympathetic tone behaves during and after exercise as measured by HRV. However, many studies have analyzed this fact with the use of variables such as low-frequency power (Kaikkonen et al., 2008), having recently defined that these variables are not related to sympathetic activity (Martelli et al., 2014). For this reason, in our work we have used SS to quantify sympathetic tone. We have observed that at the end of exercise, sympathetic cardiac activity increases significantly along with a very significant increase in heart rate (inverse of RR), which is one of the main effects of sympathetic activity. Therefore, it is shown how the changes provoked on HRV after exercise depend not only on a depression of sympathetic activity but also on a precursor of sympathetic tone. In fact, when analyzing the relationship between sympathetic and parasympathetic activity by means of the S/PS ratio, it is observed that the value of this variable increases significantly with HIIT. Since SS is located in the numerator and RMSSD in the denominator, an increase in S/PS values leads us to assume that the increase in post-exercise sympathetic tone is greater than parasympathetic withdrawal, showing how the sympathetic-vagal balance acts with the practice of high-intensity exercise.

The use of facemasks during intense physical exercise could compromise performance as well as cause changes in various parameters on cardiovascular markers such as the HRV. Although the HIIT interaction presented very significant values in the results shown for HRV, the mask effect showed completely opposite results. At the pre measurement, there was no difference in basal HRV before each protocol, which shows that the subjects faced the protocols with the same physiological predisposition and that the results were not affected by the change of the subjects' fitness condition. Similarly, we did not observe differences in the post results between not using a mask compared to using either mask. These results suggest that the changes in sympathovagal balance after high-intensity exercise will be the same whether or not a facemask is worn during exercise, suggesting that the use of a facemask need not negatively affect the physiological impact measured as a function of HRV.

Facemask effect on physiological parameters

Some studies argued that the use facemasks might increase resistance to inspiration and breathing (Chandrasekaran & Fernandes, 2020). The hypothesis is that air trapping in the facemask will increase rebreathing of carbon dioxide, leading to hypercapnic hypoxia as a result of increased arterial carbon dioxide due to oxygen displacement from hemoglobin (Chandrasekaran & Fernandes, 2020). However, according to the current results, no statistically significant differences were observed in muscle oxygen saturation values (SmO_2). Additionally, total hemoglobin concentration at rest (THb) and during the HIIT protocol, revealed similar results than other recent investigations (Driver et al., 2021; Shaw et al., 2020).

Recent investigations found that wearing either a surgical facemask or N95 (certified filtering facepiece respirator) produces no effect on the parameters studied, but it did produce an increase in respiratory muscles during a short walk (Chen et al., 2016; Person et al., 2018). Moreover, exercising with N95 facemask was associated

with a significant increase in end-tidal carbon dioxide ($EtCO_2$) levels (Epstein et al., 2021) which could produce disturbances in respiration and consequently in general performance. Results of lactate concentrations measured 3 min after the HIIT (figure 3) showed statistically significant differences between the No facemask compared to FFP2 facemask conditions. Perhaps, the use of facemasks affects the ability of the muscle to maintain the balance between the breakdown of ATP and the production of ATP by limiting the recovery of C-reactive protein (PCr), the regulation of lactate / H + and cellular recovery after each exercise (Ramos-Campo et al., 2017). During high intensity interval training, there is a predominance of the anaerobic system and a high oxygen requirement after the cessation of activity for the conversion of the lactic acid. The use of the facemask could result in a closed circuit between oxygen and expired CO_2, which could increase arterial concentrations of carbon dioxide and thus intensify the acidity of the acidic medium (Chandrasekaran & Fernandes, 2020). Although this could explain the findings of the current research, only a few studies have investigated the use of the facemask in high intensity efforts, so it would be advisable to unify methodologies for future research.

Facemask effect on perceived effort, comfort and enjoyment of physical activity

The subjective sensations as a consequence of the use of facemasks during strenuous exercise could create discomfort and consequently, a decrease in performance during exercise (Driver et al., 2021; Li et al., 2005; Scheid et al., 2020). According to the findings of the current investigation, prior research determined no significant effects of wearing a surgical or cloth facemask on RPE (Shaw et al., 2020) during a maximal cycle ergometer test. Similarly, Wong et al., (2020) found no conclusive results regarding whether wearing a facemask impairs exercise performance. In that investigation participants reported higher ratings of perceived exertion and slightly higher heart rate while exercising on a treadmill and wearing a surgical facemask compared to no-facemask condition. Additionally, during a randomized crossover design using a Bruce treadmill protocol (Driver et al., 2021) cloth facemasks led to a 14% reduction in exercise time and 29% decrease in VO_2max, attributed to perceived discomfort associated with facemask-wearing. According to Azuma et al., (2018) acute respiratory acidosis can cause headache, confusion, anxiety, decreased exercise tolerance, and other possible symptoms such as fatigue, difficulty concentrating and increased heart rate and blood pressure (Redlich et al., 1997), which might be considered determining factors for the discomfort during a physical effort.

In the current investigation statistically significant differences were identified in breathing difficulty and tightness between FFP2 facemask and No facemask, as well as inadequacy and general discomfort between FFP2 facemask, the surgical and No facemask. Moreover, this cannot be due to a psychological perception, since the physical activity enjoyment questionnaire showed no significant differences with the use of any of the facemasks.

In addition, there are some aspects that may contribute to discomfort while using certain facemasks, such as size, tight elastic straps, inadequate hydration and even emotional stress caused by the pandemic (Ong et al., 2020).

An important limitation of this study was the absence of subcutaneous fat measurement in the vastus lateralis muscle, which could be a confounding factor in determining muscle oxygen saturation. Nevertheless, to ensure minimum alterations in SmO_2, oxygen saturation were monitored after the placement of the device and before testing

Conclusions

The use of surgical or FFP2 facemask during a HIIT protocol did not affect oxygen saturation and performance cycling levels in physically trained women. However, perceived comfort appeared to be lower while wearing any type of facemask, especially FFP2. The findings of the present investigation have confirmed that wearing facemask did not result in a physiological barrier during strenuous exercise. Therefore, the skepticism associated with its use among athletes might be due to subjective factors. It would be advisable, for future research, to unify the methodological criteria as well as to increase the number of participants.

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Design and validation of a scale for the aquatic competence assessment instrument in lifeguards

Diseño y validación de una escala para la evaluación de la competencia acuática en socorristas

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Abstract

Drowning is a serious public health problem with profound economic and health impact. The objective was to design and analyze the validity of the content within a scale as to assess aquatic competence in aquatic rescue. The content validation has been carried out in accordance to the opinion, agreement and consensus of 9 experts using the Delphi technique. The validity (of comprehension) was bear out once the scale was applied to a separate sample. Following the collection of the contributions made by the trial of experts and adjusting the scale according to the indications, a second review was carried out obtaining in all of the scenarios values higher than 0.8 in the Kendall coefficient. The validity of content such as the confirmatory factorial analysis showed adequate measurements for the dimensions of the evaluation scale: aquatic competence in rescue and lifeguard. The results presented the aquatic competence assessment instrument in lifeguard as valid and reliable, which allows the opening of a new line of work towards the development of cognitive and behavioral processes in the teaching and training of lifeguard, offering a measuring instrument to analyze its effect on the decision-making.

Keywords: aquatic rescue, cognition, knowledge, decision-making, evaluation tool.

Resumen

Los ahogamientos son un grave problema de salud pública con un profundo impacto económico y sanitario. El objetivo fue diseñar y analizar la validez del contenido de una escala para evaluar la competencia acuática en el rescate acuático en socorristas. La validación del contenido se ha realizado según la opinión, acuerdo y consenso de 9 expertos mediante la técnica Delphi. La validez (de comprensión) se ha comprobado una vez aplicada la escala a una muestra independiente. Tras la recogida de las aportaciones realizadas por el juicio de expertos y el ajuste de la escala según las indicaciones, se realizó una segunda revisión obteniendo en todos los escenarios valores superiores a 0.8 en el coeficiente de Kendall. La validez de contenido como el análisis factorial confirmatorio mostraron medidas adecuadas para las dimensiones de la escala de evaluación: competencia acuática en salvamento y socorrismo. Los resultados presentaron la Escala de Evaluación de la Competencia Acuática en Socorristas como válida y fiable, lo que permite abrir una nueva línea de trabajo hacia el desarrollo de los procesos cognitivos y comportamentales en la enseñanza y formación del socorrista, ofreciendo un instrumento de medida para analizar su efecto en la toma de decisiones.

Palabras clave: rescate acuático, Técnica Delphi, conocimiento, toma de decisiones, instrumento de evaluación.

Introduction

Drowning deaths of young children have increased in the last 3 years, with swimming pools being the most frequent site of this tragedy (White et al., 2018). Drowning is a serious public health problem with profound economic and health impact (Forjuoh, 2013), with submersion time being a key prognostic factor between saving a life and not saving a life (Abelairas-Gómez et al., 2019), which is why a lifeguard ´s decision making can determine the effectiveness of the rescue and the saving of a life.

In an aquatic environment, the risk of drowning is omnipresent and untrained bystanders are often the only resort in preventing drowning (Moran et al., 2017), which highlights the importance of training in aquatic rescue, in order to act quickly and adequately. There is currently evidence of the positive effect of work focused toward the improving of the decision-making in the teaching of sports and skills of open character (Úbeda-Colomer et al., 2017). Following the definition that literature offers on the characteristics of open-skill sports (Claver et al., 2015), rescue and lifeguard is identified within the particularities described. In the absence of studies that analyze the effect of the work of decision-making on cognitive and behavioral processes in rescue and lifeguard. Also due to the lack of adaptation of the questionnaires and scales in place for the measurement of aquatic competence in rescue and lifeguard. As a result the need to create a scale oriented to context and content becomes necessary. The knowledge imparted by The Rescue and Lifeguard in Vocational Training have undertaken an evolution in the Autonomous Decrees that develop the legislation in this context (Ministerio de Educación, 2017; Ministerio de Educación y Ciencia, 1996; Ministerio de Educación y Cultura, 1997), where they set the basic aspects of the curriculum: basic contents, terminal capacities and evaluation criteria, without including in their process the training of the student in decision-making and their evaluation. After consultation of the physical evaluation tests established by the Spanish Federation of Lifesaving and Rescue for the evaluation of the lifeguards. Only units of analysis are found, that merely include technical aspects bypassing the analysis of the cognitive and behavioral processes of decision-making during a rescue. Different studies have shown the effectiveness of decision-making work in strategy sports supporting the importance of possessing skills in cognitive development that simultaneously regulate the psychological components, been in harmony with the development of tactical behaviors that positively influence performance (García et al., 2005), and learning in physical education classes (Aarskog et al., 2018). In the training process of Lifeguard the student must develop behavioral patterns at a cognitive and behavioral level, for the development of skills aimed at successfully resolving the rescue, as a result of this a need arises to measure the success of decision-making in the aquatic rescue. This makes it possible for future professionals to improve in hypothetical rescue situations.

Decision-making

Further studies (Gréhaigne et al., 2012; Nielsen & McPherson, 2001), defined decision-making as the choice (appropriate or inappropriate) of a response to a particular context or situation. In sports the part takers are immersed in a continuous decision-making process to face numerous problems that may arise. The driving action is preceded by the prior decision-making, being this process regulated by problem solving (perception and analysis), mental solution (considering their knowledge of the material) and choice of final action (Mahlo, 1969). The quality of decision-making has the same relevance as the execution of motor skills (Thomas & Thomas, 1994) therefore it entails attention to the stimuli that is presented, the visual ability to identify and evaluate the context, the anticipation in the response to possible situations, the selection of response and motor action, in addition to the knowledge that he has of the athlete himself supporting in the adequacy when making decision (Gil Arias et al., 2012; MacMahon & McPherson, 2009) proving a determining factor.

Numerous studies show the importance of decision-making in the sporting and educational context (Aarskog et al., 2018; Gaspar et al., 2019) not finding research in the rescue and lifeguard one. One of the reasons for this limitation, among other things, is due to the context in which it develops (swimming pool), interaction of the lifeguard with the medium and the different stimuli surrounding the lifeguard (material, active victim and /or passive/drowning).

Aquatic competence assessment instrument in lifeguard

Decision-making has now been examined using different protocols and questionnaires for analysis. Based on the classification provided in the study of García-González et al. (2011) addressing the different approaches to decision-making analysis: (a)verbal protocols and questionnaires; (b) observational analyses; c) analysis of kinematic variables; (d) perceptual analysis; the evaluation method that best fits the object of study is observational analysis. The first instrument they present is the tool created by Nielsen and McPherson (Nielsen & McPherson, 2001). McPherson is one of the forerunners in the parcel of decision-making aspects and their subsequent outcome, for this purpose, it uses a coding system where it independently references both variables evaluating decision-making in terms of decisions appropriate or inadequate for the specific gaming situation, and providing different criteria for the evaluation of the decisions (García-González et al., 2011). As a second prototype they show the model of Oslin, Mitchell, and Griffin (Oslin et al., 1998) which examines decision-making through a qualitative (degree of response adequacy) and quantitative (valuation scale from 1 to 5). By not finding tools in lifeguard and and/or supported by quoted works, it seems advisable to create a tool to assess the aquatic competence in lifeguard to examine the behavioral and cognitive processes in the face of solving problems faced by the lifeguards before a rescue, not only as a student, but also as an approach to a future professional of emergencies who will act as the first link in the survival chain.

The present study

Our review of the status of content of instruments that analyze decision-making within lifeguard found that none were in line with this objective, following this it was considered necessary to design and validate its own scale that assessed aquatic competence in lifeguard. The purpose of the study was the design and validation of an instrument that validly and reliably assesses aquatic competence in lifeguard students supported by the theoretical framework of decision-making. The objectives of this work were: a) To determine the validity of content through expert judgement through the Delphi method (Dalkey & Helmer, 1963); b) Confirm the validity of understanding the scale in a pilot study in a separate sample; (c) Review the reliability of the questionnaire; and d) corroborate the one-dimensionality of construct.

Method

Participants

In line with the theoretical postulates (Reguant-Álvarez & Torrado-Fonseca, 2016) and following the Delphi method two human groups were formed to validate the designed instrument. The coordinating group consisted of four members who collaborated in the research and met the following criteria: a) Knowledge of the analysis through the Kendall Concordance Coefficient W; b) Have research and professional links in line with the study; c) The maintaining of good team communication. The study had a group of 9 experts in the field, with adequate research experience in the evaluation of instruments of this type (Escobar-Pérez & Cuervo-Martínez, 2008), other than to ensure that both the research trajectory and the professional experience of the judges were linked to the object of study and content. To measure internal consistency and perform confirmatory factorial analysis, a sample of 99 students was used, aged between 19 and 26 years (M x 20.83; *DT* 1.86) who took the subject of lifeguard in the teachings of the Superior Technician in teaching and socio sportive animation in a large (main) Spanish province.

Procedure

The study was approved by the ethics committee of the Catholic University of San Antonio, Murcia (UCAM), 30020091, and was in accordance with the Declaration of Helsinki. For the collection of information, the Delphi method was used based on a panel of experts, in accordance to the following points within the schedule structure of the evaluation of the construction phases of the aquatic competence assessment instrument in lifeguard (ECAS) (Figure 1):

1. Preliminary phase. Election and construction of the expert group whose contribution favors the study. Contact and proposal for the participation in the study in order to collaborate.
2. Exploratory phase. Design of the scale where the object of study is reflected and indications for the completion, a brief introduction together with the approach to the problem, background and theoretical basis, a record sheet to indicate the personal data of the respondent followed by the instrument for validation.

   Instrument for validation: Likert type scale with 4 categories according to their degree of suitability or belonging of the item to the dimension that we intend to investigate by adding an open question in order to be able to indicate if necessary the qualitative assessments on the items raised or the introduction of a new one. The maximum stipulated period was 30 days. It was contacted by e-mail between groups (coordinated and expert). Pick up of the completed scales.
3. Final phase. Evaluation of the information obtained on the Delphi scale by the coordinating group from a quantitative and qualitative point of view (analyzed through the introduction of an open question within the consultation instrument).

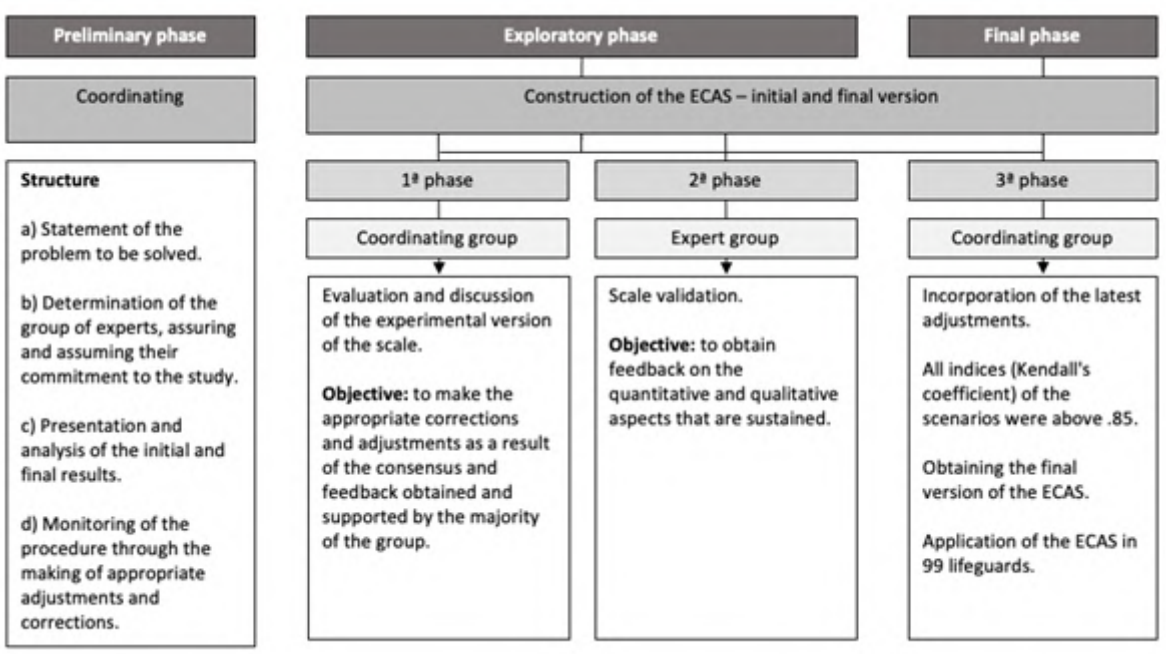

Figure 1. Timeline of the evaluation phases of the construction of the ECAS

Data analysis

Qualitative data has been analyzed using content analysis. With regard to quantitative data, preparatory data analysis, calculation of descriptive statistics and estimation of internal consistency have been carried out with the SPSS 22.0 software. The confirmatory factorial analysis (CFA) of the questionnaire has been developed with the SPSS Amos 22.0 software.

Results

Regarding the ongoing construction of the instrument

After checking and examining the limitations of the published instruments, the scale of assessment of aquatic competence in first or foremost was prepared, setting as starting requirements: (a) study variables: kinematic variables, space, time, lifeguard competence out of water

(First Aid) were discarded to assess only the lifeguard's aquatic competence in decision-making in situations where a victim is detected or danger by assessing the process from its location until it reaches the edge of the pool. It was refused to include the measurement of the time variable as the study focuses on the degree of adequacy of the lifeguard's decision-making (appropriate or inadequate). Unlike the physical tests of evaluation marked by other entities like Spanish Federation of Lifesaving and Rescue, where the physical condition of the lifeguard is evaluated this intervention studies the cognitive and behavioral process of the student to solve the situation; b) way of collection, coding and analysis of the data: according to the protocols analyzed in other investigations (García-González et al., 2011) for the data collection an evaluation instrument was designed according to the context of study; c) time of data collection: because the students belonged to the same group, the assessment had to be at the same time, so that the information obtained from the student did not interfere with the decision-making of his peers, in addition the difference between the collecting student data could not be excessively long as it would affect the state of nervousness of the student who hopes to be evaluated, and to avoid physical and mental exhaustion in decision-making four scenarios were designed; (d) comfort and clarity: for the design of the evaluation scale it was taken into account that the premises were detailed so that the reading could be clear and concise by the researcher in the face of future interventions, without generating doubts during its reading and subsequent analysis so that it indicated each of the decision-making that the lifeguard had to make for an effective rescue in each of the different scenarios.

Regarding the general procedure for the creation of the instrument

The content was determined taking into account the following premises: a) Following the contents marked by Royal Decree 653/2017 (Ministerio de Educación, 2017) that develops the legislation in this context (teachings of the Superior Technician in teaching and socio sportive animation), b) The consultation of the physical evaluation tests established by the Spanish Federation of Rescue and Lifeguard; c) To develop the evaluation scale from the theoretical decision-making framework so that its design is in line with the inputs of the studies and in line with the suggestions of the different authors, in addition to drawing on the opinion of experts. Following the model of Nielsen and McPherson (2001) that employs a coding system in terms of appropriate or inappropriate decisions. The preparation of the items focused on determining the degree of adequacy of the lifeguard's response according to the previous decision making in each of the scenarios raised in the aquatic environment.

Regarding the development of the instrument

In order to bring the victim and his own life to safety and design the different scenarios through the approach of the different common situations faced by a lifeguard, pre-setting the decision-making he must make during the development of the rescue. A first experimental version was developed where a total of 5 scenarios were developed, eliminating the expert group those scenarios that were ambiguous and confusing. The choice "torpedo material" envisaged in the third scenario (since its availability and function is not common to all swimming pools) and the corresponding premises that assessed the decision-making of having chosen the student's use: when entering the pool it is launched at the same time as the material; nothing keeping the controlled material and as the victim approaches keeps him between him and the victim; places the material correctly; tows the victim without losing sight other. In turn, the fifth scenario "active adult victim located at a distance of 125 m" was scrapped. The victim is bracing without advancing and splashes in the water. The lifeguard has auxiliary material (fins) to perform the rescue" (since it sighted a distance greater than the common size of the vessel so that the stage is not adjusted to the reality of the lifeguard) along with the premises raised for the analysis of decision-making: the material been placed well before immersion; it keeps the airways out during the swimming controlling the environment; does not submerge the victim during the rescue by keeping the airways waterproof. The answers to each question were designed according to the following parameters: it does not make any premises, it makes a premise, it makes two premises, it makes three premises, it makes four premises.

Regarding the classification of the scenarios

Following the incorporation of the adjustments provided by the expert group, the coordinating group proceeded to read each scenario by classifying them into one dimension: aquatic competence. The final version of the scale (Annex 1) obtained a bank of 4 scenarios to evaluate the aquatic competence adjusted to the reality and context of the lifeguard: a) common material available in pool to perform a rescue: hoop and/or floppy, b) state of the accident: conscious and/or unconscious, c) emotional state of the victim: heeds the indications of the lifeguard and/or is upset and confused, d) distance between the lifeguard and the victim: half of the vessel forward and/or half of the glass back, e) moment when the lifeguard detects the situation: inside the pool area and/or when leaving the changing room area, f) request for help: the victim demands help with auditory and visual stimulation of help and / or the victim is unconscious without hearing aid stimulus. The items were drafted specifically for the occasion according to Royal Decree 653/2017 (Ministerio de Educación, 2017), the consultation of the physical evaluation tests established by the Spanish Federation of Rescue and Lifeguard and the bibliographic review of studies on decision-making in sport. The order in which each of the danger situations would appear was then established, while incorporating the place of development. In order to complete the written information and ensure its understanding, the scale was accompanied by an illustration (Figure 2) where the scenarios are incorporated graphically showing the place and its order of appearance.

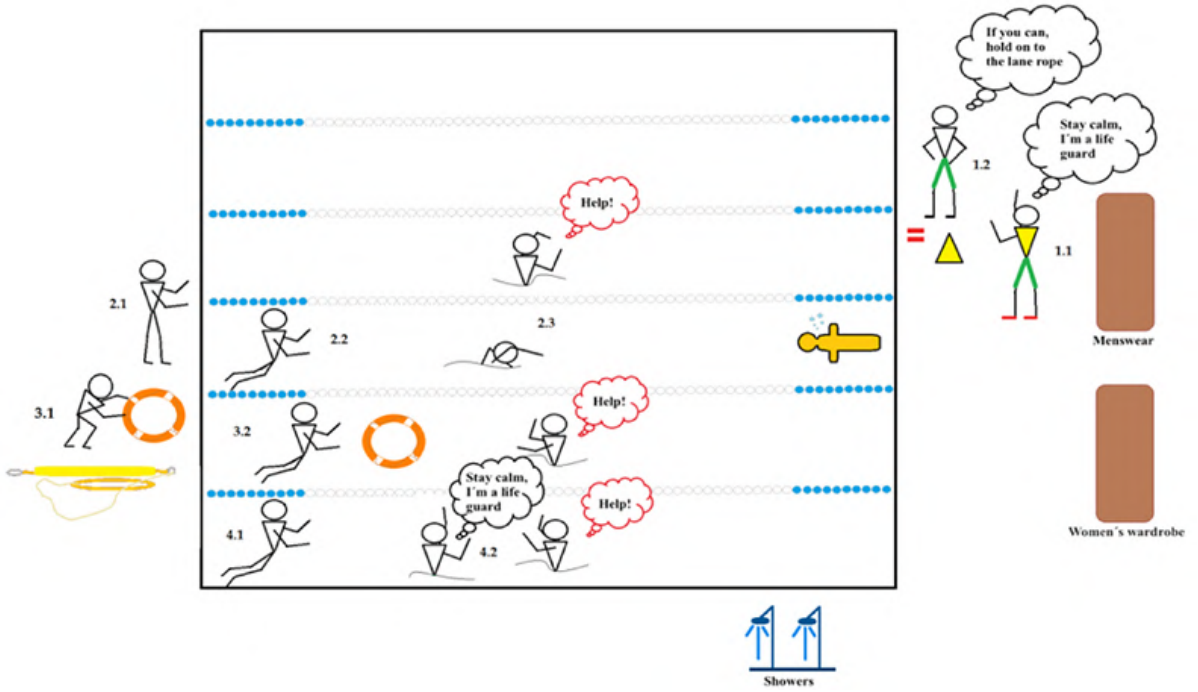

Figure 2. Graphical representation of the Aquatic Competence Assessment instrument in lifeguard (ECAS)

Regarding the validity of the instrument content

Through the use of qualitative techniques by experts, data for content analysis was collected with the intention of achieving evidence to support the conceptual, cultural and linguistic validity of the scale of assessment (Thomas & Nelson, 2007; Wiersma, 2009). To this end, the experts assessed the different aspects (considering the degree of understanding, adequacy in the wording, etc.) on the initial information, the evaluation scale, the scenarios and an overall assessment of each of them (Wiersma, 2009). This information was supplemented by the quantitative inputs of the average scores that the experts sought to each scenario. All indexes (Kendall coefficient) of the scenarios were above .85. The four scenarios that build the evaluation scale were unchanged as they reached values close to 1, therefore the group of experts did not propose another version.

Regarding the validity of understanding of the instrument

In order to verify the validity of understanding and analyzing the degree of understanding from a qualitative point of view, a pilot study was carried out, in which the instrument was provided to an independent sample composed of 22 lifeguards aged 20 and 27 years (M s 22.83; *DT* 1.67) in a large Spanish province. The questions, doubts and suggestions that students made during their completion were recorded and taken into account for their final version.

Confirmatory factorial analysis

The confirmatory factor analysis was used with the four selected scenarios. They were grouped into a component called aquatic competence. The analysis confirmed the categories, coinciding with the anticipated grouping. A positive and significant correlation was given between all scenarios (*r* .751-.888, $p < .001$). The value of the test 2 and the adjustment indices for the model were as follows: .2 (2, 98) s 7.07 (p .29), CFI .97, NFI .97, TLI .97, RMSEA .02 [.00, .06]. Factorial weights ranged from .76 to .88. By relying together on all these indices, the proposed model it is in fact 3 appropriately approximated.

Internal consistency analysis

For the reliability analysis of the aquatic competence assessment scale in lifeguard has been calculated the Alpha of Cronbach, the total reliability of the scale was .89.

Discussion

Since the 1980s, teaching approaches focused on developing decision-making capacity have been developed by modifying the conditions and situations of the game so as not to isolate the tactical aspects of the teaching models since situations similar to the real context are used (Harvey et al., 2010). Due to the importance of the development of these processes and since no study was found to measure the decision-making in first hand, the objective was to design and analyze the validity of content of an instrument that evaluated aquatic competence in lifeguard.

The results of this work indicate that the aquatic competence assessment instrument in lifeguard (ECAS), composed of four scenarios has good psychometric properties obtaining an adequate internal consistency, which allows its application in different contexts. Moreover the confirming factor analysis showed satisfactory metric quality of scale presenting an optimal fit of the proposed model. These results conclude the scale structure in a single factor: aquatic competence of lifeguard.

The four scenarios proposed for the assessment of the dimension of aquatic competence in lifeguard allowing to analyze the different aspects of the cognitive and procedural processes of decision-making by taking them with a single dimension, and connecting it with hypothetical real situations. By itself, this instrument is in line with both the context and content of lifeguard as well as the various aspects that accompany the process of decision-making. This study presents a scale for lifeguards in line with the notions proposed by Thurstone since 1929 and prolonged by Likert in the 1930s; McPherson's coding

system, a precursor in the parcel of the decisions and their subsequent result, since its appearance, this system has been used in numerous studies for the evaluation of decision-making (Gracia et al., 2009); the evaluation instrument designed by Oslin et al. (1998) being also applied in notable interventions after teaching-learning periods responding to the evaluation of the tactical aspects (Sánchez et al., 2016). In addition, this work opens a new line for decision-making assessment and incorporates a measurement tool tailored to the context of lifeguard.

Conclusions

A quick and correct decision by a lifeguard can save a life. This study provides lifesaving with an aquatic competency assessment instrument based on the open skills teaching model towards the development of lifesaving decision-making. The results open a new line of research in the field of lifeguard providing a tool that determines the effectiveness of the aquatic rescue, taking into account the degree of adequacy of the process and development of decision-making that the lifeguard takes from the time he detects the problem until he manages to bring the victim to safety as his own life. The aquatic competence assessment instrument in lifeguard (ECAS) can be employed by teachers of higher level training courses and middle and higher level sports technicians in lifeguarding, trainers and sports technicians of lifeguard, as well as professional in order to evaluate and identify the lifeguard's ability to detect a problem and effectively resolve the situation of rescue according to the degree of adequacy of his response so that the trainer not only evaluates the technical execution of the lifeguard but also incorporate a teaching model based on prevention and safety, as this tool adapts and adapts to the reality that the lifeguard faces in his day to day.

Among the limitations found, it is necessary to carry out new studies that follow the line of this research so that the results of the works can be compared with higher samples. It would also be interesting to evaluate the aquatic competence of lifeguard on beaches and design an evaluation scale tailored to its context and content.

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Conflicts of Interest

The authors declare no conflict of interest.

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ANNEX I

Evaluation of the Aquatic Competence Assessment Instrument in Lifeguard (ECAS)

Item				
1. Active adult victim located on the fourth swimming lane with the corks on. The victim is bracing without advancing and splashes in the water.				
Premises - The lifeguard is not submerged into the water. - It gets the victim's attention and directs it to grip the corks. - Stripped of garments that interfere with the possible rescue (shoes and T-shirt). - Find the nearest entry point to the event site.				
1	**2**	**3**	**4**	**5**
Doesn't make any premises	A premise	Two premises	Three premises	Four premises
2. Submerged passive adult victim (drowning) located on the third swimming lane.				
Premises - The lifeguard will enter giant step so that it advances with a step forward falling with its chest over the water and open arms. - Do not dip your head into the water in so that you do not lose the reference point where you have located the drowned/danger zone. - Keeps the airways out during the sway by controlling the environment. - Do not immerse the victim during the rescue by keeping the airways waterproof.				
1	**2**	**3**	**4**	**5**
Doesn't make any premises	A premise	Two premises	Three premises	Four premises
3. Active victim on the second swimming lanes. The lifeguard has material to perform the rescue in the pool: hoop and rescue tube. You will need to decide which material to use and use it correctly based on the decision you make.				
Premises a) Hoop - Throw in hoops before entering the water. - Swim with the hoop in front of it so as not to lose sight of it keeping the same between him and the victim. - Correctly position the hoop to the victim. - Tows the victim without losing sight of it.		Premises b) Rescue tube - When entering the swimming pool, it is launched at the same time as the material. - Nothing keeping the material under control and as you approach the victim keeps it between him and the victim. - Place the material correctly. - Tows the victim without losing sight of it.		
1	**2**	**3**	**4**	**5**
Doesn't make any premises	A premise	Two premises	Three premises	Four premises
4. Active victim on the first swimming lane. The victim ignores the lifeguard's instructions.				
Premises - This one will enter the water looking for the fastest approach (head or giant step). - Before reaching the victim, you will try to reassure her. - It will control the victim by his back. - It will help you reach the curb (trailer controlling the victim).				
1	**2**	**3**	**4**	**5**
Doesn't make any premises	A premise	Two premises	Three premises	Four premises

Accurate assessment of walking energy expenditure in the main seafront walking route of Las Palmas de Gran Canaria to promote health-related tourism

Evaluación precisa del gasto energético de la ruta peatonal del paseo marítimo de Las Palmas de Gran Canaria para promover el turismo relacionado con la salud

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Resumen

El objetivo de esta investigación fue determinar el gasto energético al caminar en la ruta peatonal más popular de Las Palmas de Gran Canaria. Se determinó la energía gastada en la ruta urbana principal a pie de Las Palmas de Gran Canaria (13 km en total, ida y vuelta) con un calorímetro indirecto portátil (COSMED K5) en 33 voluntarios de 21-69 años de edad (22 hombres y 11 mujeres). Se utilizó la geolocalización para determinar la velocidad de marcha (5.6 ± 0.5 y 5.2 ± 0.4 km.h^{-1} , para hombres y mujeres, P = 0.044) y el gasto energético exacto correspondiente a cada sector kilométrico y crear paneles informativos de interés para los caminantes para promover Turismo de salud. El gasto energético total (10.8 ± 1.0 y 10.4 ± 0.8 kcal.kg peso corporal^{-1} , respectivamente, P = 0.35) y las respuestas fisiológicas (frecuencia cardíaca y variables respiratorias) durante las caminatas fueron similares en ambos sexos. El gasto energético y la contribución de la oxidación de grasas al gasto energético total aumentaron de forma similar con la distancia recorrida en ambos sexos. En conclusión, el gasto energético al caminar aumenta con la distancia recorrida y es similar para hombres y mujeres cuando se normaliza a la masa corporal total. La calorimetría indirecta portátil se puede utilizar para mapear con precisión el gasto de energía asociado con las rutas a pie para promover el turismo de salud.

Palabras clave: Ejercicio, obesidad, turismo de salud, actividad física.

Abstract

This investigation aimed to determine the energy expenditure incurred by males and females in the most popular walking route in Las Palmas de Gran Canaria using state-of-the-art methods. The energy expended in the main walking route of Las Palmas de Gran Canaria (13 km in total, round trip) was determined with a portable indirect calorimeter (COSMED K5) in thirty-three volunteers aged 21-69 yr (22 males and 11 females). Geolocalisation was used to determine the walking speed (5.6 ± 0.5 and 5.2 ± 0.4 km.h^{-1} , for males and females, p=0.044) and exact energy expenditure corresponding to each kilometric sector and create information panels of interest for walkers to promote health tourism. The total energy expenditure (10.8 ± 1.0 and 10.4 ± 0.8 kcal.kg body weight^{-1} , respectively, P = 0.35) and physiological responses (heart rate and respiratory variables) during the walks were similar in males and females. The energy expenditure and the contribution of fat oxidation to the overall energy expenditure increased similarly with the distance walked in both sexes. In conclusion, the energy expenditure for walking routes increased with the distance walked and is similar for males and females when normalized to whole-body mass. Portable indirect calorimetry can be used to accurately map the energy expenditure associated with walking routes to promote health tourism.

Keywords: Exercise, obesity, health-related tourism, physical activity.

Introduction

Vacation periods are associated with significant weight gains persisting over time (Cooper & Tokar, 2016; Yanovski et al., 2000). Therefore, tourists may be interested in burning calories to reduce their body fat or to compensate for some culinary excesses during the holidays could be keen on receiving some information regarding the amount of energy expended during the walks (Michimi & Wimberly, 2012) to adopt better-informed decisions regarding their calorie intake and plan their daily physical activity. However, no attempt has been made to quantify the energy required in specific walking routes, beyond the information provided by phone applications or distance covered, which depends on the terrain characteristics and the velocity of walking, among other factors (Looney et al., 2019a; Looney et al., 2019b; Pandolf et al., 1977). Moreover, general equations developed to estimate the energy cost of walking have mostly used indoor (treadmill) data, which underestimate by 2-18% the actual cost of walking observed outdoors on natural terrain (Fattorini et al., 2012).

Health-oriented tourism aims at improving or maintaining health (Ferrer et al., 2016) while enjoying some of the other benefits associated with touristic activity. For example, walking along coastal and marine destinations is appealing for many tourists (Carvache-Franco et al., 2020). This attractiveness may be even more significant when accompanied by additional values, such as clean and well-maintained blue waterfront (Garrett et al., 2019), areas for children's entertainment, stores and restaurants, and the possibility of combining urban and more natural areas in the walking route (Carvache-Franco et al., 2020; Hall & Ram, 2019; Ram & Hall, 2018). In addition, walking routes can be enhanced by adding touristic points of interest (Gomez-Martin, 2019; Worndl et al., 2017), as sightseeing points, informative panels with historical descriptions, and information regarding the surrounding nature.

Therefore, the primary aim of this research was to determine the total energy expenditure incurred by males and females in the walking route that extends along the urban beach of La Playa de Las Canteras (Las Palmas de Gran Canaria, Spain) and continues through the seafront to the wild neighbour beach of La Playa del Confital, ending in La Isleta natural park. Secondary aims were to determine whether the energy expenditure of walking increases with the duration of the walks and whether there are sex differences in the energy expenditure elicited by prolonged walks. This type of information can be incorporated in information panels to enhance the attractiveness of walking routed to promote health-related touristic activities.

Methods

Study design and participants

First, we defined a walking route extending along all the waterfront of la Playa de Las Canteras in Las Palmas de Gran Canaria, one of the city's main attractions. The beach has a wide walking avenue, with terraces, bars, restaurants, and numerous hotels and touristic apartments. In addition to the tourists residing nearby, the beach is often visited by tourists travelling from their residences in other areas of the Island of Gran Canaria as well as by travellers from the cruisers regularly visiting the city de Gran Canaria. The route has 6.5 km and extends from the Plaza de la Música, near the Auditorium Alfredo Kraus (28°07'46.3 "N 15°26'59.4 "W), along the length of the beach until La Puntilla and continues following the pedestrian street Blas de Lezo and the street Rodrigo de Manrique at the seafront, which leads to la Playa del Confital. The route extends all the length of La Playa del Confital, which is a protected wilderness area and finishes at the fence where a military area starts (28°09'58.6 "N 15°26'22.9 "W) (Fig. 1). Most of the route takes place on a flat pavement, while the last kilometre corresponds to a trail with some irregularities but high walkability (see Fig. 1 for more details regarding the altitude profile). Next, we determined accurately the amount of energy needed to complete a round trip in this route. The energy requirements may be influenced by the physical characteristics of the subjects and speed of walking (Ludlow & Weyand, 2017), and factors related to the features of the terrain (Pandolf et al., 1977). An accurate assessment of energy expenditure during prolonged outdoors activities has been a challenge until the developments of high-precision and accurate portable indirect calorimeters equipped with Global Positioning System (GPS), which allows precise geolocalisation and the assessment of the distance covered and the speed of walk. Therefore, we decided to use the most precise and accurate portable indirect calorimeter available for research purposes and recruited thirty-three volunteers of both sexes with different levels of assumed cardiometabolic fitness and a wide variation in the degree of adiposity and age, with volunteers ranging from lean to overweight and moderately obese, and from young to 69 years of age.

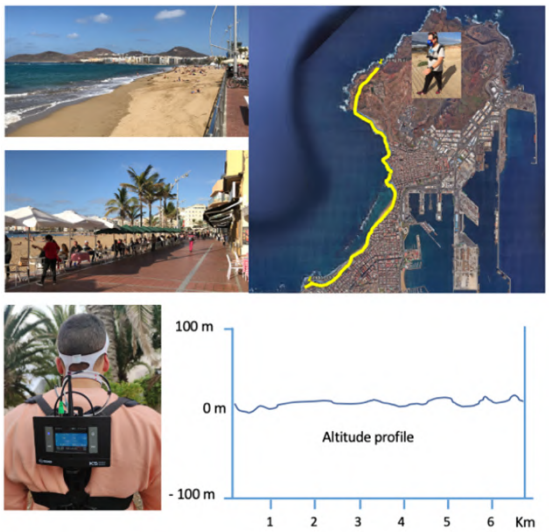

Figure 1. Some pictures of La Playa de Las Canteras walking route and the COSMED K5 device attached on the back of one of the volunteers
The route is marked in yellow, starting at the lowest part of the picture and ending in the upper part.

The study population was composed of fourteen physically active Sports Sciences students (11 male and 3 female) and nineteen sedentary volunteers with overweight or obesity (11 males and 8 females), as defined by a body mass index (BMI) ≥ 25, all of them residents in the Island of Gran Canaria. The general characteristics of males and females are reported in Table 1. Volunteers were accepted in the study under fulfilment of the following inclusion criteria: a) age from 18 to 70 years old; b) BMI > 19 $kg.m^{-2}$; c) no medical contraindications to exercise; d) smoking less than six cigarettes per day, and f) without joint or orthopaedic conditions that could limit their capacity to perform a lengthy walk lasting between 2-3 hours. The study was conducted by the Declaration of Helsinki after ethical approval (Hospital Universitario anonymised ethical committee reference number: 140187). Before giving their written consent, the volunteers received written and oral information regarding the study's purposes, risks, and benefits. In addition, participants were requested to avoid exercise other than their daily usual physical activity and to refrain from caffeinated, carbonated and alcohol- and taurine-containing beverages for the 48 hours preceding the measurements. All volunteers were non-smokers.

Table 1. Characteristics of the study population

	Males (n=22)					Females (n=11)					*p*-value
	Mean	±	SD	Range (min-max)		Mean	±	SD	Range (min-max)		
Age (years) *	33.8	±	12.5	20.9	68.5	39.0	±	10.9	24.9	55.7	.194
Weight (kg)	88.7	±	15.2	64.2	117.9	78.1	±	13.1	58.2	94.3	.060
Height (cm)	176.5	±	6.3	168.4	188.0	164.7	±	5.7	157.2	175.0	< .000
BMI ($kg.m^{-2}$) *	27.2	±	4.5	21.5	35.4	27.7	±	4.9	19.8	33.6	.779
Body fat (%)	26.6	±	8.8	11.8	41.3	38.7	±	8.7	23.1	50.7	< .001
Total lean mass (kg)	58.0	±	6.4	44.3	72.9	42.5	±	4.7	35.7	52.2	< .000
Total fat mass (kg)	23.5	±	11.0	8.7	43.7	29.8	±	10.5	12.9	45.0	.126

Analysis based on an unpaired two-tailed t-test.

***** Statistical analysis performed with logarithmically transformed variables.
BMI: body mass index; SD: standard deviation.

General procedures

Following a 12-h overnight fast, participants reported to the laboratory between 7:00 and 9:30 a.m. to assess their physical characteristics and body composition. First, their body height and mass were measured to the nearest 0.1 cm and 0.1 kg, respectively, while subjects wore light clothes and no shoes, using a balance scale (Seca, Hamburg,

Germany) calibrated using certified calibration masses (class M1, Scheck, Germany). Subsequently, their body fat % and total lean body mass were assessed using a dual-energy X-ray absorptiometer (Lunar iDXA, General Electric, Wisconsin, USA) (Martin-Rincon et al., 2020).

On a different day, the energy expenditure during a round trip (13 km) extending the total distance of the walking route (6.5 km) was assessed between 7:00 and 14:00 after a 12-h overnight fast. For this purpose, the volunteers were equipped with a portable indirect calorimeter (COSMED K5, Rome, Italy) (Fig. 1). The portable indirect calorimeter measures oxygen uptake (VO_2), carbon dioxide production (VCO_2), respiratory exchange ratio, respiratory rate and pulmonary ventilation. This device also records environmental conditions (temperature and barometric pressure) and geolocalisation data (GPS). The environmental conditions were similar during the different walking days. The environmental temperatures ranging from 15 to 29 °C (mean ± SD: 22 ± 2 °C) with a low intra-day variation in temperature (in general less than 2-3 °C) while barometric pressures ranged between 756 to 771 mmHg (mean ± SD: 766 ± 3 mmHg). The accuracy and precision of the COSMED K5 were determined by comparison with a state-of-the-art stationary metabolic cart (Vyntus CPX, Jaeger-CareFusion, Hochberg, Germany) at exercise intensities eliciting a similar energy demand as that measured during walking (Perez-Suarez et al., 2018). The validity and reliability of the stationary Vyntus CPX were previously established using a butane combustion test and repeated measurements (Perez-Suarez et al., 2018). Before the tests, the COSMED K5 was warmed up for a minimum of 15 min and then calibrated with high-grade calibration gases provided by the manufacturers. The flowmeter, used to measure pulmonary ventilation, was calibrated with a 3 L calibration syringe, following the manufacturers' recommendations (COSMED, 2015). After calibration, the K5 was attached to the back of the subjects using a harness, and a face mask of appropriate size was carefully adjusted to avoid gas leaks. The reliability of the COSMED K5 was established in this same route by performing two measurements in fourteen volunteers separated by at least four days. The COSMED K5 was operated in the mixing chamber mode during the walks.

The walks were performed on non-raining days. Volunteers we asked to maintain a walking speed close to 5 $km.h^{-1}$. For this purpose, subjects were equipped with a heart rate strap (Garmin Forerunner 210, Garmin International Inc., Olathe, KS, USA) equipped with GPS connected to the K5. All volunteers were weighed immediately before and after walking (SECA 869, Hamburg, Germany) while wearing all equipment and clothes. The scale was calibrated with certified calibration masses of class M1. Participants were allowed to drink plain water *ad libitum* during the walks.

Calculation of the energy expenditure

Gas exchange data were averaged every 15 seconds and stored for further analysis. From the VO_2 and VCO_2 values, fat and carbohydrate oxidation rates and the energy expenditure were calculated using Peronnet and Massicotte tables (1991). These values were used to calculate the energy expenditure corresponding to each km interval and the entire round trip. Additional calculations were carried out adjusted for the bodyweight of the volunteers.

Statistical analysis

Data are reported as the mean (±SD) unless otherwise stated. Values were checked for normal distribution using the Shapiro-Wilks test. The BMI was determined as $weight/height^2$. BMI and age were not normally distributed; therefore, these two variables were logarithmically transformed before further analyses. Student's t-tests for unpaired samples were run to determine between-sex differences in physical characteristics and overall energy expenditure. The impact of the distance covered on energy expenditure was determined with analysis of variance for repeated measures with one within-subjects factor (time, with 13 levels corresponding to each kilometre walked) and one between-subjects factor (sex, with two levels). The Mauchly's test of sphericity was run before the ANOVA. In the case of violation of the sphericity assumption, the degrees of freedom were adjusted according to the Huynh and Feldt correction. When a significant main effect or interaction was observed, specific pairwise comparisons were carried out with the Fisher's Least Significant Difference post-Hoc test. The statistical significance was accepted for .-values < 0.05. All statistical analyses were performed using IBM SPSS v.21.0 (IBM, New York, USA).

Results

The descriptive characteristics of the twenty-two males and eleven females that participated in the study are reported in Table 1. In addition, males and females had comparable age and BMI, while females had a greater body fat percentage than males. Males were taller and had a greater whole-body lean mass than females.

As shown in Table 2, the physiological responses were similar in males and females during the walks, as reflected by the heart rate and respiratory response, which were almost identical. Nevertheless, females walked at a marginally lower speed compared to males. Despite the marked differences in physical characteristics, the energy expenditure was similar in males and females (10.8 ± 1.0 and 10.4 ± 0.8 kcal.kg body $weight^{-1}$, respectively, p= .35). The total amount of carbohydrates and fats oxidized during the walks was similar in both sexes, after accounting for the differences in body mass (Table 2).

Table 2. Energy consumption and physiological responses to a round trip in La Playa de Las Canteras-Confital walking route (13 km)

	Men (n=22)					Women (n=11)					*p*-value
	Mean	±	SD	Range (min-max)		Mean	±	SD	Range (min-max)		
Walking velocity (km.h^{-1})	5.6	±	0.5	4.8	6.4	5.2	±	0.4	4.6	5.7	.044
Stride cadence (steps.min^{-1})	60.0	±	3.8	54.0	66.8	60.4	±	2.5	57.3	65.5	.517
Heart rate (beats.min^{-1})	113.0	±	17.3	81.0	143.7	110.0	±	15.1	86.5	133.6	.627
Respiratory rate (breaths.min^{-1})	29.5	±	6.9	20.4	50.1	28.3	±	5.0	22.4	37.0	.610
Total EE (kcal)	952	±	178	722	1400	810	±	119	572	959	.024
Total EE (kcal. kg body mass^{-1})	10.8	±	1.0	9.1	12.9	10.4	±	0.8	9.1	11.6	.345
CHO burned (mg. kg body mass^{-1})	1759	±	450	769	2581	1489	±	226	1218	2005	.072
Fat burned (mg. kg body mass^{-1})	407	±	149	162	727	479	±	67	393	612	.065

EE: Energy expenditure; CHO: carbohydrates. Analysis based on two-tailed unpaired t-tests.

The amount of energy consumed after each km is reported in Table 3 and Fig. 2. Interestingly, the energy cost of walking increased with the distance covered ($p < .001$), being 9.2% higher in the first km sector during the return trip compared to that observed in this same sector at the start of the walk ($p < .001$). Likewise, the percentage of energy obtained from fat oxidation increased from 37.6 ± 14.8 to 55.1 ± 10.8 % from the first km to the same parkour in the return trip ($p < .001$).

Table 3. Energy consumption along the first 6 kilometers of La Playa de Las Canteras-Confital walking route at 5 km.h-1.

	Males body weight				
	60 kg	70 kg	80 kg	90 kg	100 kg
WAPI [a]	Energy expenditure in Kcal				
Km 1	45	52	60	67	75
Km 2	46	54	61	69	77
Km 3	47	55	63	70	78
Km 4	51	60	68	77	85
Km 5	53	61	70	79	88
Km 6	55	64	73	82	91
Total [a]	646	754	861	969	1077
	Females body weight				
	50 kg	60 kg	70 kg	80 kg	90 kg
WAPI [a]	Energy expenditure in Kcal				
Km 1	37	37	37	37	37
Km 2	38	38	38	38	38
Km 3	38	38	38	38	38
Km 4	41	41	41	41	41
Km 5	41	41	41	41	41
Km 6	44	44	44	44	44
Total [a]	521	521	521	521	521

Data generated using the mean energy expenditure per kg of body weight recorded during the route for males and females, respectively.

WAPI: Walker's Point of Interest for walkers.
a Total: corresponds to the round trip (13 km).
Precise geolocalisation information available on request from the authors.

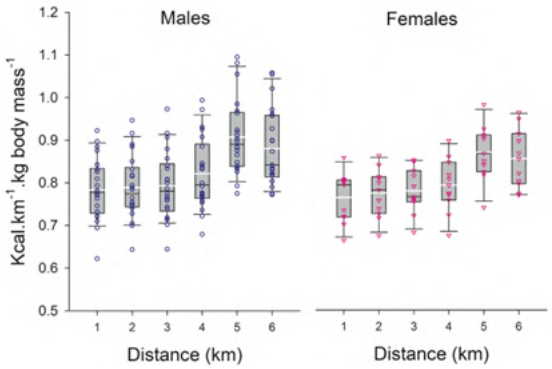

Figure 2. Mean energy expenditure in each km sector, after averaging the outgoing and the return trips for the first six kms.
Box and whisker plots and individual data for males (n = 22) and females (n = 11). The extremes of the whiskers represent the limits of the 5th and 95th percentiles, respectively; the white and black horizontal lines inside the boxes correspond to the mean and median values, respectively; and the lower and upper limits of the box delimit the 1st and 3rd quartiles, respectively. *p* = .345 for the difference between males and females (unpaired two-tailed t-test).

Discussion

This study shows that the energy expended during long outdoors walks is mostly determined by walkers' body weight and the distance covered for walking velocities ranging between 4.6 and 5.8 km.h^{-1} . These walking velocities elicit similar physiological responses and energy expenditure in males and females when adjusted for body weight.

Another aspect of interest is that we have demonstrated that the energy requirements increase slightly with the distance covered. Although this study is the first research to report such observation during prolonged walking,

previous studies have seen a similar phenomenon in long-distance runners likely caused by mitochondrial respiration changes (Sahlin et al., 2010). Several published reviews on the mechanisms by which energy expenditure may be increased by prolonged exercise mention oxidative stress, hyperthermia and muscle damage. A detailed analysis of the physiological mechanisms explaining this response is beyond the scope of the present manuscript, and therefore the readers are addressed to several excellent reviews on this topic (Enoka, 2012; Nybo & Nielsen, 2001; Westerblad & Allen, 2011).

Although the energy expenditure of walking can be estimated using prediction equations or the Compendium of Physical Activities (Ainsworth et al., 2011), this may deviate from the actual energy expenditure, which depends in part on the duration of the walk and the characteristics of the terrain, as shown in the present investigation. For example, had we used the Compendium of Physical Activities (Ainsworth et al., 2011) we would have underestimated the actual energy expenditure of the whole route by 2.4 and 13% in males and females, respectively.

Accurate assessment of energy expenditure to promote health-related tourism

The touristic industry is greatly influenced by factors affecting lifestyle and health. Therefore, a continuous adaptation to the needs and wills of consumers is required to offer the best experience to visitors, including the possibility of satisfying their wish for a healthy lifestyle, in which physical activity is a central cornerstone. This entails applying evidence-based knowledge from related disciplines such as economy, sociology, psychology and health sciences to innovate (Darbellay & Stock, 2012). Here we have applied state-of-the-art techniques used in exercise physiology to measure the energy expenditure incurred during prolonged walks in the main walking avenue of one of the most relevant touristic destinations in Europe. We have also provided the stakeholders with information on how to carry out this type of assessment and provided a practical table (Table 3) with material that could be included in what we called "walker's points of interest " (WAPI) in specific information panels, mobile devices, apps, webpages or leaflets for tourists.

In a recent report, The European Travel Commission brings attention to the societal lifestyle trends that shape consumer attitudes, emphasising how "health tourism is expanding its purview to respond to the consumer's hunger for new ways to self-improve". This organisation postulates that health is a prominent issue in tourism, which encompasses travel-friendly concepts such as mental and emotional wellbeing, spiritual growth, adventure, and athleticism, among others (The European Travel Commission, 2016). A particular emphasis is placed on the fact that physical fitness is vital for a large part of the population and that weight and appearance management is a significant-top priority for the three Atlantic markets. Customers want to be healthy, but they also wish to look healthy (The European Travel Commission, 2016). Thus, tourism organisations should market destinations taking into consideration that destinations promoting a physically active lifestyle will be more appealing for most consumers, including the growing elderly population (Diekmann et al., 2020; Ferrer et al., 2016). Moreover, according to The European Travel Commission report, those clients more interested in travelling also confer high importance to their fitness (The European Travel Commission, 2016). Given the recommendations by the medical associations (Arnett et al., 2019; Powell et al., 2018) and the impact of social media messages regarding the importance of physical activity for health, growing demand for wellness offerings within the travel packages are expected in the coming years (Diekmann et al., 2020; Ferrer et al., 2016).

The reasons tourists decide to walk are very varied and encompass social and cultural aspects, a search for adventure, physical and mental health, wellbeing, contact with nature and wilderness, pilgrimage and spirituality, and others (Buckley, 2019, 2020; Carvache-Franco et al., 2020). Distinctive destination marketing can be achieved by creating routes for walkers and cyclists and adding energy expenditure values based on scientific evidence (Davies, 2018). For example, a trail including sightseeing points (Davies, 2018), some adventure (Bichler & Peters), blue spaces (Carvache-Franco et al., 2020; Garrett et al., 2019), nature-based wildlife observation points or areas (Carvache-Franco et al., 2020), architectural and historical attractions, accompanied by maps and short stickers-type messages may enhance the attractiveness and the possibility of creating a one-off experience. Here we have generated the information required to include in these WAPIs data on energy expenditure. These WAPIs could include a map of the route and some recommendations regarding walking velocity, hydration, and the number of calories burned depending on the distance covered (see Fig. 3, as an example). These WAPIs could use pre-existing points or new small panels, which could also have information with links to apps or QR codes, specifically developed to facilitate this information in several languages, if not included in leaflets at the hotels/resorts. In the case of Las Palmas de Gran Canaria, this would add to the great effort made to provide active alternatives to the city bus tours and promote urban routes profiting from pedestrianisation. During holidays, there is more tendency to walk and enjoy the culinary virtues of the destination. Increasing physical activity with some specific aims for energy expenditure would also allow the customers to feel less guilty regarding potential food excesses (Cohen & Avieli, 2004) to achieve a more satisfying holiday experience.

Figure 3. Representation of a Walker's Point of Interest with the information of the energy expenditure accumulated after the 1st, 2nd, 3rd and 4th km.

Conclusions

This investigation has shown that the energy expenditure of walking outdoors increases with the distance covered and is similar for males and females when normalized to whole-body mass, despite remarkable differences in body composition. Portable indirect calorimetry can be used to accurately map the energy expenditure associated with walking routes to promote health tourism. The information gathered can be used to create points of interest for walkers with accurate information regarding the energy expenditure corresponding to each km sector and recommendations for walking speeds.

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Improving motor skills in children with autistic spectrum disorder through futsal

Mejora de las habilidades motrices en niños con trastorno del espectro autista a través del fútbol sala

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Abstract

Currently, it is evident that the participation in physical and sporting activities of people with Autism Spectrum Disorder (ASD) is very limited due to the characteristics of the diagnosis itself. This research work arose from the need to analyse the effect that sport practice has on the development of motor skills in children between six and 12 years of age with an ASD diagnosis, with a severity level of one. A total of 13 children with ASD aged six to 10 years (M = 7.23 years; SD = 1.42) participated in the physical-sports training programme. A pre-experimental, pretest-posttest design was adopted. Statistical analysis was performed with non-parametric tests using the Wilcoxon test in order to compare the results of the group of participants at two time points. The results of the study showed an improvement in the performance of the motor skills assessed. These data can help to consider sport as a real alternative to work with this group. Likewise, this type of programme can help to promote healthy lifestyles and improve the quality of life of the participants.

Keywords: special educational needs, ASD, sport, sports skills, sport training.

Resumen

Actualmente, es evidente que la participación en actividades físicas y deportivas de las personas que presentan un Trastorno del Espectro Autista (TEA) es muy limitada debido a las características propias del diagnóstico. Este trabajo de investigación surgió por la necesidad de analizar el efecto que tiene la práctica deportiva en niños y niñas de entre seis y 12 años con un diagnóstico TEA, con un nivel de gravedad uno, en cuanto al desarrollo de las habilidades motrices. Un total de 13 niños con TEA de entre seis y 10 años (M = 7.23 años; DT = 1.42) participaron en el programa de los entrenamientos físico-deportivos. Se adoptó un diseño preexperimental, pretest- postest. Se realizó un análisis estadístico con pruebas no paramétricas aplicando la prueba de Wilcoxon con el objetivo de comparar los resultados del grupo de participantes en dos momentos temporales. Los resultados del estudio mostraron una mejora en la ejecución de las habilidades motrices evaluadas. Estos datos pueden ayudar a considerar el deporte como una alternativa real para trabajar con este colectivo. Igualmente, este tipo de programas pueden ayudar a promover hábitos de vida saludables mejorando la calidad de vida de los participantes.

Palabras clave: necesidades educativas especiales, TEA, deporte, habilidades deportivas, entrenamiento deportivo.

Introduction

Currently, disability cannot be seen as a barrier that limits or prevents participation in any kind of regular activity, be it social, work, leisure, or any other type of activity. In this case, it is important to focus on the capabilities and not on the limitations of the person with a disability (Gómez et al., 2018). To this end, it is necessary to work on a process of regulation at both the individual and collective level, with the aim of changing the social thinking that is held about disability, as this should be seen as a characteristic of the person and not as the defining characteristic (López-Díaz, 2019).

In this sense, sport is one of the disciplines that can most affect this group. However, throughout history, until practically the present day, people with disabilities have not had equal opportunities to carry out any type of physical activity (García-Obrero & González-García, 2021; Robles-Rodríguez et al., 2017). This has also been the case for people with Autism Spectrum Disorder (ASD), as sport has not been seen as a beneficial component (Villalba, 2015).

The people with ASD are characterised by severe permanent impairments in the main areas of development (Rivière, 1998), persistent deficits in communication and social interaction, restricted interests and stereotyped behaviours (APA, 2013). In the latest DSM-5 classification, ASD groups together social and communicative impairments, while retaining the criteria referring to mental and behavioural rigidity. As a result, ASD begins to be assessed in terms of the person's 'social communication' and 'restricted and repetitive behaviour' (APA, 2013). Given this situation, ASD is classified into three levels of severity, with grade 1 being the mildest and grade 3 the most severe. This is determined by the supports required for management in the areas of 'social communication' and 'restricted and repetitive behaviour' (APA, 2013). Furthermore, although motor skill deficits are not listed as a diagnostic criterion in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders, there is evidence that this is particularly true for ASD (Ohara et al., 2020). Studies such as those by Harris (2017) and Kruger et al. (2019) confirm the presence of alterations in coordination, deficits in fine and gross motor skills or difficulties in maintaining body posture. These difficulties may limit certain body movements, influencing participation in activities with a social character. This situation results in limited participation in group physical activities, which generates a loss of opportunities for socialising in the context of the activity and an increased predisposition to inactivity (Kruger et al., 2019; Ruiz, et al., 2015). On the contrary, there are studies that recognise that working on motor skills through physical activity is beneficial, as this intervention leads to an improvement in both motor and social skills (Healy et al., 2018; Kruger et al., 2019; Ohara, et al., 2020). Therefore, it is necessary to link the practice of physical exercise to the daily life of people with ASD (Villalba, 2015).

The authors Julián et al. (2015, p. 66) point out that including physical activity in the daily life of people with ASD represents a "positive impact on mental and physical health, reduces environmental and behavioural disorders, promotes the development of socialisation, is within the focus of interest of children and adolescents, and increases satisfaction in family life". This statement becomes even more important if we take into account the latest research on the epidemiology of ASD, which shows a significant increase in the prevalence of ASD in the last 30 years (1/160 cases) (Luarte et al., 2021), reaching 1% and 2% of the incidence in children (André et al., 2020).

Taking advantage of this situation, it is important to promote continuous, regular and progressive sport practice (López-Díaz et al., 2021) that helps to achieve a correct personal and social development, and that serves as a source of health (Cuesta et al., 2016). Furthermore, if we take into consideration that sport can be included as a leisure activity, the impact it can have on the person who does it can be beneficial (Villalba, 2015).

Currently, there are programmes that are used as treatment or therapy in order to improve the lives of people with ASD. When intervening with this group, it is important to know and analyse the different needs in different contexts. This will facilitate the promotion of personal and social development and, consequently, the improvement of quality of life. According to Verdugo (2006), if the context is favourable and presents the necessary support, the person will have more chances of success in his/her development.

Several research studies have recognised that physical exercise can be beneficial at the cognitive, executive, motor coordination, social and academic performance levels (Cano et al., 2014; Gámez-Calvo et al., 2022; González-Gross & Meléndez, 2013). This recognition favours the opinion that sport has begun to be used as a therapeutic alternative to be applied to people with ASD. It should also be taken into account that the participation of children with ASD in regular schools is beneficial on a social level (Lindsay, 2007) because the contact with others helps to improve their social skills.

The aim of this study was to analyse the effect of playing sport on the development of motor skills in children with ASD through an indoor football training programme. This programme provided those interested in playing indoor football with the opportunity to do so from a playful point of view. It should be noted that play is a necessary element in the developmental process of children, regardless of whether or not they have ASD. For children, play is the working alternative in their leisure time. In this sense, games and activities should be adapted to the particular needs of each of the participants, thus acquiring a flexible and individualised character (Cuesta et al., 2016), with the intention of working on and enhancing different motor skills.

On the other hand, it should not be forgotten that, in order to play futsal, it is necessary to know a series of concepts and skills which are learned thanks to sports training. These sports spaces help to develop and enhance sporting elements such as physical preparation, technique and tactics of the sport (Gómez et al., 2008), others oriented to the social sphere such as companionship, respect, solidarity, equality and tolerance, among others (García, 2005), as well as to become familiar with the rules and regulations of the game. Cruz (2015) considers that children with ASD need programmes of these characteristics that help them to enhance their abilities, with the aim of improving their quality of life and that of the environment around them.

Method

Participants

The children who participated in the sports programme were from various municipalities in the south of the Community of Madrid. The type of sampling used was casual and intentional. Given the particularity of the

population we were going to work with in the project, it was necessary to select this type of sampling due to the voluntary nature of the participants (Hernández & Carpio, 2019; Pimienta, 2000). Individual interviews were conducted with the families of the children interested in participating. These meetings were conducted by a multidisciplinary team composed of two psychologists and a physical education teacher and senior football sports technician. The interviews were used to find out whether those interested met the selection profile:

- Ages six to 12 years.
- Have a diagnosis of ASD with a severity level of one.

The study sample consisted of a total of 13 children aged between six and 10 years (M = 7.23 years; SD = 1.42). Because the project was aimed at minors, it was necessary to have the supervision and approval of the Ethics Committee of the King Juan Carlos University, registration number 1511201714117. This Committee was responsible for ensuring compliance with current legislation to protect the rights of the participants in the sports programme. In addition, the families of the participants signed an informed consent regarding the operation and purpose of the sports programme.

Instrument

Due to the fact that there was no tool available that would fit the sport dimensions to be measured, it was necessary to use an "ad hoc" tool in order to evaluate the impact of sport practice with respect to the development of motor skills. Taking into account that the sports training was aimed at children between six and twelve years of age, it was necessary to know the stage of development of the child in their physical and sporting dimensions. Consequently, the objectives worked on in the subject of Physical Education in the Primary Education stage were reviewed. In addition to making use of the educational law itself, a review of the scientific literature on motor development and different tools measuring psychomotor skills was carried out. However, each of these questionnaires contained very specific items which could not be literally included within futsal, but served to contrast and adapt the new items to the sporting parameters of futsal. By selecting those items that were most suited to this sport and adapting them to the sporting context of the programme, a first draft of an "ad hoc" questionnaire was designed. This questionnaire was subjected to a Delphi process to confirm the content validity of the selected motor skills. The profiles that collaborated in this process were related to the type of research programme. The panel of experts was composed of two occupational therapists, two physical education teachers, one special education teacher and one psychologist. All of them had at least four years of professional experience in the field of disability and attention to diversity, working in services for people with disabilities and doing research in this field.

To complete the process, three rounds of anonymous consultation were carried out. The first consisted of providing a description of the sport programme and all the elements that were intended to be measured with each of the proposed items. The experts received the questionnaire design to be used with all the proposed items. In the second round, each expert was sent the opinions of the other participants with the intention of generating a debate and obtaining a consensus on the results. In this round, the experts provided new answers justifying those cases where there was no convergence with respect to the opinions of the group. The last round served to bring the experts' consensus closer together to form a common evaluation tool.

The final result was a questionnaire made up of 67 items grouped into seven dimensions. These dimensions included elements related to sporting technique such as throwing the ball, control, driving and dribbling. On the other hand, we worked on actions linked to tactical elements of the game such as attack and progression in the game, support, unmarking, ball conservation and the ability to position oneself on the field of play in a coherent manner. They also worked on the dimensions of movement and jumping. The items collected items such as whether the action: was executed in a static position, walking or running; frontally, laterally or backwards. When the action involved the ball, it was executed: with the ball in motion or stationary, with the head or with the feet; with the dominant or non-dominant leg; in static position, walking or running; and following the coach's instructions or performing them autonomously.

The evaluation method of the questionnaire was following a Likert-type scale with five response options: 1. "Does not do it or ignores the order"; 2. "He does it wrong or he tries, but he doesn't succeed"; 3. "He does it with help"; 4. "He does it on his own, but has difficulties"; and 5. "It does well".

Procedure

In order to work on the different motor skills of the participants, the coach designed an indoor football training programme consisting of 34 one-hour sessions. To measure the results, the evaluation tool was administered at two points in time: a diagnostic evaluation was carried out at the beginning of the sports programme to find out the initial level that the participants had with respect to the motor skills, and another evaluation was carried out at the end of the sports training sessions to find out the results achieved in the motor skills evaluated. In this way, it was possible to compare the results obtained. Each session was structured in three main blocks: warm-up, main part and cool-down. The warm-up included all the tasks aimed at increasing body temperature and heart rate in order to prepare the body for more intense physical activity. The main part is the block that carries all the specific workload of the session, i.e. it includes all the tasks that are of a more intense nature. The return to calm brought together tasks that helped the body to enter a state of relaxation (Martínez et al., 2009).

All sports activities were adjusted to the basic levels of the sport. In addition, they were all flexible in order to be individually adapted so that each child could participate according to his or her individual characteristics. The sports games were characterised by being simple and dynamic tasks with and without the ball, physical, technical and tactical elements were collected in order to learn to play indoor football and develop sporting skills with the intention of modelling new skills and enhancing others already acquired.

Data analysis

The statistical package SPSS for Windows was used for the analysis of the results. To carry out the research, a statistical analysis was carried out with non-parametric tests using the Wilcoxon test with the aim of comparing the results of the group of participants at two points in time, applying a pre-experimental, pretest-posttest design. On the other hand, to determine the practical differences in each variable, the effect size (ES) was calculated using Hedges' g, which reduces bias due to the low number of participants. In this case, effect sizes below 0.2 are considered low, between 0.2 and 0.8 are moderate and above 0.8 are high.

In addition, it should be noted that the field study required the participation of three independent external judges. These judges received prior training in order to understand the dynamics of the training sessions. This methodology was used to check whether the opinions and results of the three judges coincided or were close in terms of the evaluation of results (inter-judge consistency). To measure inter-rater consistency, Krippendorff's alpha was calculated with a result of .8095.

Results

Next, the results obtained in the sports programme are developed. The movement dimension was the most basic skill assessed (table 1). The results obtained at the beginning of the programme for the walking skill showed above average scores, which was not the case for the running skill. However, the trend of results in all cases was very positive as the mean scores improved with respect to the initial level, with significant improvements in frontal and lateral movements ($p \leq .005$).

Table 1. Movement around the playing space

Action	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
Walking (Fr)	4.08	0.57	5.00	0	-3.05	.002*	0.588
Walking (La)	2.46	0.80	3.67	0.68	-2.84	.004*	1.002
Walking (HA)	2.67	0.69	3.67	0.75	-2.53	.017	1.024
Running (Fr)	3.85	0.91	4.92	0.28	-3.02	.003*	0.902
Running (La)	2.26	0.68	3.44	0.57	-3.03	.003*	0.710
Running (HA)	2.31	0.90	3.36	0.67	-2.65	.009	0.980

Legend: Maximum score = 5; minimum score = 1; Fr = Front; La = Lateral; HA = Towards * significant values p ≤ .005; TE = effect size

The jumping dimension was divided into two blocks (table 2) because the performance of the two options was different. The data relating to the dimension of jumping with feet together showed an improvement in the scores with respect to the initial level, although in neither case were these improvements significant. Something similar happened with the jumping with feet apart modality. The results obtained at the beginning of the programme improved at the end of the programme. In addition, this improvement was significant in jumping backwards with feet apart ($p \leq .005$).

Table 2. Jumping

Action	Feet together							Feet apart						
	PRE		POS		Z	Sig.*	TE	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT				M	DT	M	DT			
From static position (Fr)	3.64	0.89	4.41	0.61	-2.24	.076	0.998	3.26	1.12	4.41	0.59	-2.62	.009	1.228
From static position (La)	2.56	0.94	3.51	0.81	-2.35	.02	1.185	2.44	0.95	3.41	0.63	-2.42	.021	1.060
From static position (HA)	2.64	0.92	3.69	0.90	-2.69	.01	1.037	2.51	1.02	3.36	0.62	-2.19	.033	1.195
Slowly (Fr)	3.33	1.00	4.31	0.77	-2.19	.037	1.320	3.33	0.89	4.23	0.79	-2.37	.02	1.119
Slowly (La)	2.18	0.90	3.38	0.88	-2.5	.018	1.264	2.23	0.87	3.23	0.66	-2.65	.009	0.986
Slowly (HA)	2.33	0.98	3.26	0.80	-2.17	.033	1.376	2.10	0.71	3.23	0.75	-2.71	.009	0.956
Fast (Fr)	2.97	1.16	4.28	0.74	-2.39	.03	1.444	2.90	0.99	3.97	0.90	-2.26	.036	1.392
Fast (La)	2.00	0.77	3.03	0.70	-2.39	.026	1.083	1.97	0.71	3.03	0.73	-2.51	.037	0.982
Fast (HA)	1.77	0.85	3.03	0.65	-2.81	.006	1.033	1.77	0.72	2.97	0.66	-3.03	.003*	0.767

Legend: Maximum score = 5; minimum score = 1; Fr = Front; La = Lateral; HA = Towards * significant values p ≤ .005; TE = effect size

The throwing dimension was divided into two modalities (table 3) because the execution of both options was different. In this case, the object of the ball was taken as a reference: hitting the ball while in motion or throwing the ball while stationary. Taking into account ball striking while the ball was in motion, it can be observed that all scores improved with respect to the initial level. Moreover, this improvement was significant when the player ran and threw the ball with the dominant leg ($p \leq .005$). Regarding the mode of throwing with the ball stationary, all the scores also improved with respect to the initial level. However, in

this case the improvement was significant when the player ran and threw the ball with the non-dominant leg ($p \leq .005$).

Table 3. Ball throwing: the player is able to hit the ball in different positions

Action	Ball in motion							Stopped ball						
	PRE		POS		Z	Sig.*	TE	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT				M	DT	M	DT			
From static position (CC)	2.97	1.32	3.64	1.06	-1.7	.093	1.335	-	-	-	-	-	-	-
Walking (CC)	2.44	1.30	3.56	0.99	-2.51	.014	1.251	-	-	-	-	-	-	-
Running (CC)	2.33	1.28	3.31	1.11	-2.4	.018	1.193	-	-	-	-	-	-	-
From static position (PD)	3.18	1.00	4.13	0.63	-2.62	.014	1.063	3.72	0.93	4.38	0.62	-1.94	.095	1.212
From static position (PND)	2.13	1.00	3.64	0.72	-2.88	.008	1.136	2.38	1.07	3.62	0.68	-2.85	.007	0.997
Walking (PD)	3.13	0.99	4.10	0.63	-2.55	.012	1.150	3.54	1.07	4.26	0.57	-1.85	.165	1.236
Walking (PND)	2.21	1.01	3.36	0.67	-2.66	.013	1.005	2.15	1.01	3.56	0.81	-2.83	.007	1.056
Running (PD)	2.64	0.94	3.87	0.76	-2.81	.005*	1.042	3.13	1.14	4.18	0.71	-2.37	.036	1.326
Running (PND)	1.90	0.89	3.10	0.61	-2.73	.011	0.961	1.74	0.98	3.38	0.69	-3.09	.002*	0.882

Legend: Maximum score = 5; minimum score = 1; CC = With the Head; PD = Leg Dominant; PND = Leg Non-Dominant; * significant values p ≤ .005; TE = effect size

Regarding the ball control dimension (table 4), all results improved with respect to the initial level. In this case, the results showed significant improvements when players wanted to control the ball with the non-dominant leg while walking ($p \leq .005$) or when they controlled the ball with the non-dominant leg while running ($p \leq .005$) on the field.

Table 4. Ball control: the player is able to hit the ball in different positions

Action	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
From static position (PD)	3.31	1.00	4.36	0.62	-2.5	.018	1.168
From static position (PND)	2.31	1.28	3.62	0.78	-2.55	.026	1.202
Walking (PD)	2.97	1.15	4.28	0.60	-2.67	.011	1.221
Walking (PND)	1.87	1.17	3.51	0.73	-2.87	.004*	1.307
Running (PD)	2.41	1.08	3.51	0.86	-2.4	.029	1.253
Running (PND)	1.46	0.90	3.10	0.78	-3.09	.002*	1.029

Legend: Maximum score = 5; minimum score = 1; PD = Leg Dominant; PND = Leg Non-Dominant; * significant values p ≤ .005; TE = effect size

Regarding the ability to drive the ball around the pitch (table 5), all the results improved with respect to the initial level. However, despite this, in no case was the improvement significant.

Table 5. Ball handling: the player is able to carry the controlled ball on the field of play

Action	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
Walking (PD)	3.49	0.69	4.31	0.66	-2.61	.016	0.794
Walking (PND)	2.62	1.04	3.67	0.76	-2.44	.016	1.251
Running (PD)	2.79	0.88	3.77	0.74	-2.39	.024	1.117
Running (PND)	2.03	1.08	3.10	0.82	-2.48	.020	1.272

Legend: Maximum score = 5; minimum score = 1; PD = Leg Dominant; PND = Leg Non-Dominant; * significant values p ≤ .005; TE = effect size

The dribbling dimension was divided into two blocks (table 6) because the execution of the skill was performed in two different ways. On the one hand, the option of dribbling an opponent was assessed. In this case, all scores improved with respect to the initial level. Moreover, when dribbling was done walking and with both legs ($p \leq .005$), or running with the non-dominant leg ($p \leq .005$), the improvement in skill was significant. On the other hand, the child's ability to dribble immobile objects such as a row of cones was measured. As before, all scores improved from baseline. When dribbling was done walking and with both legs ($p \leq .005$), or running with the dominant leg ($p \leq .005$), the improvement in skill was significant.

Table 6. Dribbling: the player is able to overcome an opposition while maintaining possession of the ball

Action	To an adversary							To a stationary object						
	PRE		POS		Z	Sig.*	TE	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT				M	DT	M	DT			
Walking (PD)	2.49	0.92	3.82	0.82	-3.22	.002	0.740	2.95	1.02	4.21	0.69	-2.94	.003*	1.087
Walking (PND)	1.56	0.84	3.05	0.79	-2.97	.003	1.095	2.05	0.87	3.56	0.57	-3.03	.002*	1.050
Running (PD)	2.31	0.89	3.41	0.91	-2.8	.007	0.876	2.36	0.95	3.77	0.89	-2.89	.004*	1.104
Running (PND)	1.49	0.82	2.97	0.84	-3.05	.003	0.944	1.74	0.90	3.03	0.83	-2.72	.008	1.184

Legend: Maximum score = 5; minimum score = 1; PD = Leg Dominant; PND = Leg Non-Dominant; * significant values p ≤ .005; TE = effect size

Regarding the tactical component (table 7), different elements were taken into account since the sporting aspects worked on were very basic actions provided by the game itself. In this case, a distinction was made between executing the action following the coach's guidelines or performing the action autonomously showing knowledge of the game. Once again, all the results improved with respect to the initial level. Furthermore, improvements were significant in the cases of unmarking ($p \leq .005$) and positioning oneself rationally on the pitch ($p \leq .005$).

Table 7. Aspects related to tactical elements of the game

Action	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
Attack/progress (DE)	2.51	0.99	3.74	0.87	-2.76	.006	1.134
Attack/progress (MA)	1.56	1.07	3.18	1.09	-2.84	.007	1.243
Support (DE)	2.49	1.19	3.41	0.95	-2.01	.063	1.440
Support (MA)	1.74	1.04	2.79	0.89	-2.31	.034	1.196
Disengage from the opponent (DE)	1.97	1.00	3.49	0.96	-2.86	.004*	1.209
Disengage from the opponent (MA)	1.23	0.83	2.82	0.83	-3.08	.002*	0.919
Keeping the ball (DE)	2.23	1.03	3.49	0.95	-2.48	.014	1.383
Keeping the ball (MA)	1.54	0.95	2.82	0.87	-2.48	.025	1.258
Positioning on the field of play (DE)	2.00	0.76	3.56	0.92	-2.91	.004*	1.156
Positioning on the field of play (MA)	1.31	0.51	2.87	0.83	-3.19	.002*	0.741

Legend: Maximum score = 5; minimum score = 1; DE = Trainer's Guidelines; MA = Autonomous Manner; * significant values p ≤ .005; TE = effect size

Discussion

At the end of the sports programme, an improvement in the performance of motor skills was observed. However, this improvement was not reflected consistently in each of the skills evaluated, nor in the individual performance of the players. It should be noted that the training design was the same for all because the children were at an introductory stage in futsal. The first dimension measured was movement, taking into account that this skill serves as the basis for the correct development of the rest of the motor skills. As recognised by Rosa et al. (2018), at around six and eight years of age, children begin to be able to coordinate somewhat complex motor movements. In this sense, Prieto (2010) considers that movement serves as a communication tool to become aware of the environment and to develop perceptual-motor skills. On the other hand, at the beginning of the programme, there were children who presented difficulties due to their motor clumsiness motivated by the characteristics of their ASD diagnosis (Harris, 2017; Kruger et al., 2019).

Although there were no problems moving frontally, there were problems moving laterally or backwards. Regarding the first modality, it is considered a basic and repetitive type of movement, used constantly from the early stages of development. However, the other two require a more complex execution such as movement in the footwork and the sense of spatial orientation. For Domínguez (2010), performing good footwork will be fundamental to achieve success, and this will depend on the number of times the action is executed and the quality of how it is performed (López-Ros, 2013).

The range of results in terms of jump size was wider due to the different modalities. The training sessions helped to produce improvements, although in some cases not with the expected result. Strength, coordination and balance are elements that will intervene in the execution of the jump (García & García, 2018). Jumping with one foot first and then with the other foot while maintaining balance increased the difficulty compared to jumping with feet together. However, the level of experimentation and repetitive use from different situations and forms of execution will allow learning about body control (Castejón, 2000). The possible difficulties shown could be derived from the age and maturational process of the participants (García & García, 2018) and the possible delay in the development of motor skills of children with ASD, alterations in motor patterns such as balance, coordination and the development of the body schema (Vega, 2005).

The four individual technical actions that were evaluated (shooting, control, driving and dribbling) showed favourable results with respect to the initial level. Despite this, there were cases where the improvement was diminished by the player's ability to respond or by the difficulty of executing the skill itself.

It should be borne in mind that technique cannot be disarticulated from the rest of the elements that influence execution (Sánchez et al., 2012). All these actions had as an element to work on laterality, that is, to execute each of the actions with both legs or with both sides of the body (Staples, & Reid, 2010), with the aim of enhancing motor skills, achieving a more complete physical development and increasing the athlete's performance. However, the motor difficulties of children with ASD must be taken into account. It is important to remember that, in order to learn to play futsal, it is necessary to go through different phases in which a series of sporting skills are acquired. Depending on the age or level of experience of the athlete, there will be certain skills that cannot be assessed in the same way, either because of their complexity or because they require a combination of several motor skills (Figueredo et al., 2019). As expected, the children performed worse when they executed the actions with the non-dominant leg. Furthermore, if they had to run, the difficulty increased due to the level of coordination required (Prieto, 2010). It is also important to take into account the external stimulus of the ball, as well as the level of attention and concentration required to execute the action well (Rojas et al., 2014). This effort to which the athlete is subjected can cause the onset of fatigue and negatively influence performance (Camacho et al., 2019). However, the constant repetition of the actions with both legs led to a reduction in the number of errors and an improvement in skills. The fact that the instructions for performing the tasks were simple facilitated learning and retention for the execution of sport skills (Camacho, 2019). For his part, López-Ros (2013) considers that both quantity and quality are fundamental for learning.

The skill of dribbling presented the particularity of direct confrontation between players. For the execution of this skill to be effective, the player must be able to make decisions instantly, since uncontrollable external elements dependent on the opponent intervene in this action, in many cases awakening the player's capacity for improvisation and imagination. However, people with ASD also present difficulties when participating in games with an imaginative or symbolic component (López-Díaz et al., 2021). Hence, children executed the action more slowly, as they required more time to plan and execute the movements, to sequence them and to foresee the consequences (Crissien-Quiroz et al., 2017).

On the other hand, it should be noted that some basic tactical actions were selected because the tactical elements help the formation of reflective athletes and evaluators of their own sporting practice (Ortín et al., 2016). To execute the tactical element well in a sport, it is necessary to know the game where the action takes place (Corcho et al., 2017). In the case of football or futsal, tactical actions require tactical thinking which will allow making the right decisions depending on the context of the game (Corcho et al., 2017). This situation is aggravated when the environments where children with ASD move do not have a concrete structure (Urrutxi & Velásquez, 2011). It was observed that, when the coach provided instructions, the players were able to play according to the rules (Ortín et al., 2016). This helped the children to gain self-confidence and improve. However, when they had to play autonomously, none of them were able to perform the action on their own due to the difficulty in understanding and interpreting the actions of the game, as well as in making the right decisions as in football (Corcho et al., 2017).

In the case of the ball keeping action, limited technical skills and poor interpretation of collective play meant that there were problems for teams to maintain possession of the ball. When it was achieved, it was because the coach intervened to generate favourable situations for the development of this skill. In this case, it is important for the coach to establish rules in order to improve collective play (Corcho et al., 2017). In addition, the level of knowledge shown by the trainer about ASD helped to produce a closer encounter between the group, contributing to improve social interaction and promoting greater confidence to carry out the action effectively. In this sense, Campos-Campos (2021) considers the reference figure that the group of people with ASD may have to be very important for the development of their activities.

The composition of the teams was an element to take into account when analysing the performance of the players. There were children who had a faster learning curve due to the ease with which they were able to execute certain skills. This was reflected in the superiority of some of them in performing certain tasks. In the training matches, the coach rotated the players in the teams in order to reinforce other elements such as motivation, sportsmanship, solidarity and effort, among others.

According to the results collected, it can be pointed out that the children went from having a rather limited sporting level, as the actions were mostly poorly executed or the coach's help was needed, to finishing the programme with a higher sporting performance in each of the actions executed.

Finally, despite achieving an improvement in the development of motor skills, it is important that children do not drop out of sport. In fact, as pointed out by Fransen et al. (2012), it is advisable not to play only one sport; participation in a variety of sports has a positive influence on the development of motor coordination, strength, endurance and speed. Abernethy et al. (2005) continued along the same lines, stating that the practice of multiple sports contributes to participating in a variety of sporting experiences, which helps children's decision-making. Furthermore, it should not be forgotten that practice should be carried out from a playful perspective, thus ensuring adherence to group sport practice (May et al., 2018). Furthermore, it is important to be patient during the process of teaching and learning, as the results are often not immediate.

Conclusions

The aim of this research project was to analyse the effect of playing sport on the development of motor skills in children with ASD. The results obtained in the study confirm that the indoor football sports programme has proved to be positive for children with ASD, as there have been improvements in the motor skills assessed with respect to the initial level.

On the other hand, the fact that there is no specific tool that measures motor skills in children with ASD makes it difficult to measure and evaluate in order to obtain more accurate data. Therefore, it is important to be cautious with the results obtained. The inter-judge observation method has a subjective component that can limit or deviate the result of the action. With regard to the duration of the programme, it is difficult to determine the effect of the impact. The trend shows that it has been positive, however, it would be advisable to carry out periodic follow-ups to check whether the improvements obtained have been maintained over time and which skills have been consolidated or weakened.

Being aware of this situation, it would be interesting to develop in the future specific instruments to help measure motor and/or sport skills in children with and without ASD. In view of the positive trend of the programme, it would be interesting to continue proposing sports facilities for children with ASD, at any level of severity. In the case of ASD level 1, to verify that the results continue to be positive, while in the cases of ASD level 2 and 3, to find out and investigate the impact that this type of programme can have on these profiles.

Finally, it should not be forgotten that such programmes can help to promote healthy lifestyles and thus improve the quality of life of their participants.

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Mejora de las habilidades motrices en niños con trastorno del espectro autista a través del fútbol sala

Improving motor skills in children with autistic spectrum disorder through futsal

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Resumen

Actualmente, es evidente que la participación en actividades físicas y deportivas de las personas que presentan un Trastorno del Espectro Autista (TEA) es muy limitada debido a las características propias del diagnóstico. Este trabajo de investigación surgió por la necesidad de analizar el efecto que tiene la práctica deportiva en niños y niñas de entre seis y 12 años con un diagnóstico TEA, con un nivel de gravedad uno, en cuanto al desarrollo de las habilidades motrices. Un total de 13 niños con TEA de entre seis y 10 años (M = 7.23 años; DT = 1.42) participaron en el programa de los entrenamientos físico-deportivos. Se adoptó un diseño preexperimental, pretest- postest. Se realizó un análisis estadístico con pruebas no paramétricas aplicando la prueba de Wilcoxon con el objetivo de comparar los resultados del grupo de participantes en dos momentos temporales. Los resultados del estudio mostraron una mejora en la ejecución de las habilidades motrices evaluadas. Estos datos pueden ayudar a considerar el deporte como una alternativa real para trabajar con este colectivo. Igualmente, este tipo de programas pueden ayudar a promover hábitos de vida saludables mejorando la calidad de vida de los participantes.

Palabras clave: necesidades educativas especiales, TEA, deporte, habilidades deportivas, entrenamiento deportivo.

Abstract

Currently, it is evident that the participation in physical and sporting activities of people with Autism Spectrum Disorder (ASD) is very limited due to the characteristics of the diagnosis itself. This research work arose from the need to analyse the effect that sport practice has on the development of motor skills in children between six and 12 years of age with an ASD diagnosis, with a severity level of one. A total of 13 children with ASD aged six to 10 years (M = 7.23 years; SD = 1.42) participated in the physical-sports training programme. A pre-experimental, pretest-posttest design was adopted. Statistical analysis was performed with non-parametric tests using the Wilcoxon test in order to compare the results of the group of participants at two time points. The results of the study showed an improvement in the performance of the motor skills assessed. These data can help to consider sport as a real alternative to work with this group. Likewise, this type of programme can help to promote healthy lifestyles and improve the quality of life of the participants.

Keywords: special educational needs, ASD, sport, sports skills, sport training.

Introducción

Actualmente, la discapacidad no puede ser vista como una barrera que limite o impida la participación en cualquier tipo de actividad habitual, ya sea social, laboral, de ocio, o de cualquier otro tipo. En este caso, es importante centrarse en las capacidades y no en las limitaciones de la persona con discapacidad (Gómez et al., 2018). Para ello, es necesario trabajar en un proceso de regulación tanto a nivel individual como colectivo, con el objetivo de cambiar el pensamiento social que se tiene sobre la discapacidad, ya que esta debe ser vista como una característica de la persona y no como la característica que la define (López-Díaz, 2019).

En este sentido, el deporte es una de las disciplinas que más puede afectar a este colectivo. Sin embargo, durante el devenir histórico, hasta prácticamente la actualidad, las personas con discapacidad no han estado en igualdad de oportunidades para realizar cualquier tipo de actividad física (García-Obrero & González-García, 2021; Robles-Rodríguez et al., 2017). Esto mismo ha sucedido con el colectivo de personas con Trastorno del Espectro Autista (TEA) pues la práctica deportiva no se ha terminado de ver como un componente beneficioso (Villalba, 2015).

Las personas con TEA se caracterizan por manifestar graves alteraciones permanentes en las principales áreas de desarrollo (Rivière, 1998), mostrar déficits persistentes en la comunicación e interacción social, intereses restringidos y conductas estereotipadas (APA, 2013). En la última clasificación del DSM-5, el TEA agrupa las alteraciones sociales y comunicativas, conservando el criterio referido a la rigidez mental y comportamental. Debido a ello, el TEA empieza a ser evaluado en función de la 'comunicación social' y el 'comportamiento restringido y repetitivo' de la persona (APA, 2013). Dada esta situación, el TEA pasa a clasificarse en tres niveles de gravedad, siendo el grado 1 el más leve y el grado 3 el más grave. Esto viene determinado por los apoyos requeridos para el manejo en las áreas de la 'comunicación social' y el 'comportamiento restringido y repetitivo' (APA, 2013). Además, a pesar de que no aparecen recogidos los déficits en las habilidades motrices como un criterio diagnóstico dentro del Manual Diagnóstico y Estadístico de los Trastornos Mentales en su última edición, hay evidencias que manifiestan esta particularidad en el TEA (Ohara et al., 2020). Estudios como los de Harris (2017) y Kruger et al. (2019) confirman la presencia de alteraciones en la coordinación, déficit en la motricidad fina y gruesa o dificultades para mantener la postura corporal. Estas dificultades pueden limitar ciertos movimientos corporales influyendo en la participación de actividades con un carácter social. Esta situación provoca que haya una limitación en la participación en actividades físicas grupales, lo que genera una pérdida de oportunidades para socializar en el contexto de la actividad y un aumento de la predisposición a la inactividad (Kruger et al., 2019; Ruiz, et al., 2015). Por el contrario, hay estudios que reconocen que trabajar las habilidades motrices a través de la actividad física es beneficiosa, pues esta intervención provoca una mejora tanto a nivel motriz como a nivel social (Healy et al., 2018; Kruger et al., 2019; Ohara, et al., 2020). Por ello, resulta necesario vincular la práctica de ejercicio físico a la vida diaria de las personas con TEA (Villalba, 2015).

Los autores Julián et al. (2015, p. 66) señalan que incluir la actividad física en la vida diaria de las personas con TEA representa un "impacto positivo en la salud mental y física, reduce los trastornos ambientales y comportamentales, promociona el desarrollo de la socialización, está dentro del foco de interés de los niños, niñas y adolescentes, e incrementa la satisfacción en la vida familiar". Esta declaración adquiere mayor importancia si se tiene en cuenta las últimas investigaciones que se han realizado sobre la epidemiologia del TEA, pues se habla de un aumento significativo de la prevalencia de TEA en los últimos 30 años (1/160 casos) (Luarte et al., 2021), alcanzando en un 1% y 2% la incidencia en niños (André et al., 2020).

Aprovechando esta situación, es importante impulsar una práctica deportiva continua, regular y progresiva (López-Díaz et al., 2021) que ayude a lograr un correcto desarrollo personal y social, y que sirva como fuente de salud (Cuesta et al., 2016). Además, si se tiene en consideración que la práctica deportiva puede ser incluida como una actividad de ocio, el impacto que pueda tener sobre la persona que lo realiza puede ser beneficiosa (Villalba, 2015).

Actualmente, existen programas que se utilizan como tratamiento o terapia con el fin de mejorar la vida de las personas con TEA. A la hora de intervenir con este colectivo, es importante conocer y analizar las diferentes necesidades en los distintos contextos. Esto facilitará la promoción del desarrollo personal y social y, en consecuencia, la mejora de la calidad de vida. Según Verdugo (2006), si el contexto es favorable y presenta los apoyos necesarios, la persona tendrá más posibilidades de éxito en su desarrollo.

Varios trabajos de investigación han reconocido que el ejercicio físico puede ser beneficioso a nivel cognitivo, ejecutivo, a nivel de coordinación motriz, a nivel social y en el rendimiento académico (Cano et al., 2014; Gámez-Calvo et al., 2022; González-Gross & Meléndez, 2013). Este reconocimiento favorece la opinión sobre que el deporte haya comenzado a utilizarse como una alternativa terapéutica para ser aplicada a las personas con TEA. También hay que tener en cuenta que la participación de los niños y niñas con TEA en las escuelas regulares es beneficiosa a nivel social (Lindsay, 2007) porque el contacto con los demás ayuda a mejorar sus habilidades sociales.

El objetivo de este estudio fue analizar el efecto que tiene practicar deporte en el desarrollo de las habilidades motrices en niños y niñas con TEA, a través de un programa de entrenamiento deportivo de fútbol sala. Este programa sirvió para que aquellos que estuvieran interesados en jugar al fútbol sala, tuviesen oportunidad de hacerlo desde un punto de vista lúdico. Cabe señalar que el juego es un elemento necesario en el proceso evolutivo de los niños, independientemente de que tengan o no TEA. Para los niños, el juego es la alternativa laboral en su tiempo de ocio. En este sentido, los juegos y las actividades deben ser adaptadas a las necesidades particulares de cada uno de los participantes, adquiriendo así un carácter flexible e individualizado (Cuesta et al., 2016), con la intención de trabajar y potenciar diferentes habilidades motrices.

Por otro lado, no hay que olvidar que, para jugar al fútbol sala, es necesario conocer una serie de conceptos y destrezas las cuales se aprenden gracias al entrenamiento deportivo. Estos espacios deportivos ayudan a desarrollar y potenciar elementos deportivos tales como la preparación física, la técnica y la táctica del deporte (Gómez et al., 2008), otros orientados al ámbito social como el compañerismo, el respeto, la solidaridad, la igualdad y la tolerancia, entre otros (García, 2005), así como a familiarizarse con las normas y reglas del juego. Cruz (2015) considera que los niños con TEA necesitan programas de estas características que les ayuden a potenciar sus capacidades, con la finalidad de mejorar su calidad de vida y la del entorno que los rodea.

Método

Participantes

Los niños que participaron en el programa deportivo fueron de varios municipios del sur de la Comunidad de Madrid. El tipo de muestreo con el que se trabajó fue casual e intencional. Dada la particularidad de la población con la que se iba a trabajar en el proyecto, era necesario seleccionar este tipo de muestreo por el carácter voluntario de los participantes (Hernández & Carpio, 2019; Pimienta, 2000). Se realizaron entrevistas individuales con las familias de los niños y niñas interesadas en participar. Estos encuentros fueron realizados por un equipo multidisciplinar compuesto por dos psicólogos y un maestro de educación física y técnico deportivo superior en fútbol. Las entrevistas sirvieron para conocer si los interesados cumplían con el perfil de selección:

- Edad comprendida entre los seis y los 12 años.
- Presentar un diagnóstico de TEA con un nivel de gravedad uno.

La muestra del estudio estuvo compuesta por un total de 13 niños con edades comprendidas entre los seis y los 10 años (M = 7.23 años; DT = 1.42). Debido a que el proyecto iba dirigido a sujetos menores de edad, fue necesario contar con la supervisión y la aprobación del Comité de Ética de la Universidad Rey Juan Carlos, con número de registro 1511201714117. Este Comité se encargó de velar por el cumplimiento de la legislación vigente para proteger los derechos de los participantes en el programa deportivo. Además, las familias de los participantes firmaron un consentimiento informado sobre el funcionamiento y la finalidad del programa deportivo.

Instrumento

Debido a que no había ninguna herramienta que se ajustase a las dimensiones deportivas que se quería medir, para poder evaluar el impacto de la práctica deportiva respecto al desarrollo de habilidades motrices, fue necesario contar con el uso de una herramienta "ad hoc". Teniendo en cuenta que los entrenamientos deportivos se iban a dirigir a menores de entre seis y doce años era necesario conocer la etapa de desarrollo del niño en sus dimensiones físicas y deportivas. En consecuencia, se revisaron los objetivos trabajados en la asignatura de Educación Física en la etapa de Educación Primaria. Además de hacer uso de la propia Ley educativa, se realizó una revisión de la literatura científica sobre el desarrollo motor y sobre diferentes herramientas que medían habilidades psicomotrices. Sin embargo, cada uno de estos cuestionarios recogían ítems muy específicos los cuales no podrían ser incluidos literalmente dentro del fútbol sala, pero sirvieron para contrastar y adaptar los nuevos ítems a los parámetros deportivos del fútbol sala. Seleccionando aquellos ítems que más se ajustaban a este deporte y adaptándolo al contexto deportivo del programa, se diseñó un primer borrador de cuestionario "ad hoc". Este cuestionario fue sometido a un proceso Delphi para confirmar la validez de contenido de las habilidades motrices seleccionadas. Los perfiles que colaboraron en este proceso fueron afines al tipo de programa de investigación. El panel de expertos estuvo compuesto por dos terapeutas ocupacionales, dos maestros con la especialidad de educación física, una maestra de educación especial y un psicólogo. Todos ellos contaban con al menos cuatro años de experiencia profesional en el ámbito de la discapacidad y la atención a la diversidad, pues trabajaban en servicios de atención a personas con discapacidad e investigaban sobre esta disciplina.

Para completar el proceso se hicieron tres rondas de consulta anónima. La primera consistió en facilitar una descripción del programa deportivo y todos los elementos que se pretendía medir con cada uno de los ítems planteados. Los expertos recibieron el diseño de cuestionario que se iba a usar con todos los ítems propuestos. En la segunda ronda se envió a cada experto las opiniones del resto de participantes con la intención de generar un debate y obtener un consenso en los resultados. En esta ronda, los expertos proporcionaron nuevas respuestas justificando aquellos casos donde no se produjeron convergencias con respecto a las opiniones del grupo. La última ronda sirvió para conseguir un mayor acercamiento en el consenso de expertos logrando así componer una herramienta de evaluación común.

El resultado final fue un cuestionario conformado por 67 ítems agrupado en siete dimensiones. Estas dimensiones recogieron elementos relacionados con la técnica deportiva tales como el lanzamiento de balón, el control, la conducción y el regate. Por otro lado, se trabajaron acciones vinculadas con elementos tácticos del juego como el ataque y progresión en el juego, el apoyo, el desmarque, la conservación de balón y la capacidad para situarse dentro del terreno de juego de manera coherente. Asimismo, se trabajaron las dimensiones de desplazamiento y salto. Los ítems recogieron elementos tales como si la acción: se ejecutaba en posición estática, andando o corriendo; frontalmente, lateralmente o hacia atrás. Cuando en la acción intervenía el balón, está se ejecutaba: con la pelota en movimiento o parado, con la cabeza o con los pies; con la pierna dominante o no dominante; en posición estática, andando o corriendo; y siguiendo las directrices del entrenador o realizándolas de manera autónoma.

El método de evaluación del cuestionario era siguiendo una escala tipo Likert con cinco opciones de respuesta: 1. "No lo hace o ignora la orden"; 2. "Lo hace mal o lo intenta, pero no lo consigue"; 3. "Lo hace con ayuda"; 4. "Lo hace solo, pero presenta dificultades)"; y 5. "Lo hace bien".

Procedimiento

Con la finalidad de trabajar las diferentes habilidades motrices de los participantes, el entrenador diseñó un programa de entrenamiento deportivo de fútbol sala compuesto por 34 sesiones de una hora de duración. Para medir los resultados, la herramienta de evaluación se administró en dos momentos temporales: se hizo una evaluación diagnóstica al comienzo del programa deportivo para conocer el nivel inicial que tenían los participantes con respecto a las habilidades motrices, y se hizo otra evaluación al terminar los entrenamientos deportivos para conocer los resultados alcanzados en las habilidades motrices evaluadas. De esta forma, se pudo hacer una comparativa con los resultados obtenidos. Cada sesión se estructuró siguiendo tres bloques principales: calentamiento, parte principal y vuelta a la calma. El calentamiento se encargó de recoger todas aquellas tareas cuyo objetivo era aumentar la temperatura corporal y el ritmo cardiaco con la finalidad de preparar al cuerpo para una actividad física más intensa. La parte principal es el bloque que lleva toda la carga específica del trabajo de la sesión, es decir, recoge todas las tareas que presentan un carácter más intenso. La vuelta a la calma reunió tareas que ayudaron al cuerpo a entrar en un estado de relajación (Martínez et al., 2009).

Todas las actividades deportivas se ajustaron a los niveles básicos propios del deporte. Además, todas ellas tenían un carácter flexible para adaptarse individualmente con la finalidad de que cada uno de los niños pudiese participar de acuerdo a sus características individuales. Los

juegos deportivos se caracterizaron por ser tareas sencillas y dinámicas con y sin balón, se recogieron elementos físicos, técnicos y tácticos con el propósito de aprender a jugar al fútbol sala y desarrollar habilidades deportivas con la intención de modelar nuevas habilidades y de potenciar otras ya adquiridas.

Análisis de datos

Para el análisis de resultados se utilizó el paquete estadístico SPSS para Windows. Para llevar a cabo la investigación se procedió a realizar un análisis estadístico con pruebas no paramétricas aplicando la prueba de Wilcoxon con el objetivo de comparar los resultados del grupo de participantes en dos momentos temporales, aplicando un diseño preexperimental, pretest-postest. Por otro lado, para determinar las diferencias a efectos prácticos en cada variable, se calculó el tamaño del efecto (TE) mediante la . de Hedges, el cual reduce el sesgo por el bajo número de participantes. En este caso, los tamaños del efecto menores a 0.2 se consideran bajos, entre 0.2 y 0.8 son moderados y por encima de 0.8 son altos.

Además, señalar que para el estudio de campo fue necesario contar con la participación de tres jueces independientes externos. Estos jueces recibieron una formación previa con el objetivo de comprender la dinámica de las sesiones de entrenamiento. Esta metodología sirvió para comprobar si la opinión y los resultados de los tres jueces, coincidían o tenían una aproximación respecto a la evaluación de resultados (consistencia interjueces). Para medir la consistencia interjueces, se calculó el alfa de Krippendorff obteniendo un resultado de .8095.

Resultados

A continuación, se pasa a desarrollar los resultados obtenidos en el programa deportivo. La dimensión del desplazamiento fue la habilidad más básica evaluada (tabla 1). Los resultados obtenidos al comienzo del programa respecto a la habilidad de moverse andando mostraron puntuaciones por encima de la media, caso contrario a lo que sucedió con la modalidad de correr. Sin embargo, la tendencia de resultados en todos los casos fue muy positiva pues las puntuaciones medias mejoraron con respecto al nivel inicial, produciéndose mejoras significativas en los desplazamientos frontales y laterales ($p \leq .005$).

Tabla 1. Desplazamiento por el espacio de juego

Acción	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
Andando (Fr)	4.08	0.57	5.00	0	-3.05	.002*	0.588
Andando (La)	2.46	0.80	3.67	0.68	-2.84	.004*	1.002
Andando (HA)	2.67	0.69	3.67	0.75	-2.53	.017	1.024
Corriendo (Fr)	3.85	0.91	4.92	0.28	-3.02	.003*	0.902
Corriendo (La)	2.26	0.68	3.44	0.57	-3.03	.003*	0.710
Corriendo (HA)	2.31	0.90	3.36	0.67	-2.65	.009	0.980

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; Fr = Frontal; La = Lateral; HA = Hacia Atrás; * valores significativos p ≤ .005; TE = tamaño del efecto

La dimensión del salto quedó dividida en dos bloques (tabla 2) debido a que la ejecución de ambas opciones fue diferente. Los datos relativos a la dimensión de saltar con los pies juntos mostraron una mejora en las puntuaciones con respecto al nivel inicial, aunque en ningún caso estas mejoras fueron significativas. Algo similar sucedió con la modalidad de saltar con los pies separados. Los resultados obtenidos al comienzo del programa mejoraron al finalizar este. Además, esta mejora fue significativa en el salto hacia atrás con pies separados ($p \leq .005$).

Tabla 2. Salto

Acción	Con pies juntos							Con pies separados						
	PRE		POS		Z	Sig.*	TE	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT				M	DT	M	DT			
Desde posición estática (Fr)	3.64	0.89	4.41	0.61	-2.24	.076	0.998	3.26	1.12	4.41	0.59	-2.62	.009	1.228
Desde posición estática (La)	2.56	0.94	3.51	0.81	-2.35	.02	1.185	2.44	0.95	3.41	0.63	-2.42	.021	1.060
Desde posición estática (HA)	2.64	0.92	3.69	0.90	-2.69	.01	1.037	2.51	1.02	3.36	0.62	-2.19	.033	1.195
Despacio (Fr)	3.33	1.00	4.31	0.77	-2.19	.037	1.320	3.33	0.89	4.23	0.79	-2.37	.02	1.119
Despacio (La)	2.18	0.90	3.38	0.88	-2.5	.018	1.264	2.23	0.87	3.23	0.66	-2.65	.009	0.986
Despacio (HA)	2.33	0.98	3.26	0.80	-2.17	.033	1.376	2.10	0.71	3.23	0.75	-2.71	.009	0.956
Rápido (Fr)	2.97	1.16	4.28	0.74	-2.39	.03	1.444	2.90	0.99	3.97	0.90	-2.26	.036	1.392
Rápido (La)	2.00	0.77	3.03	0.70	-2.39	.026	1.083	1.97	0.71	3.03	0.73	-2.51	.037	0.982
Rápido (HA)	1.77	0.85	3.03	0.65	-2.81	.006	1.033	1.77	0.72	2.97	0.66	-3.03	.003*	0.767

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; Fr = Frontal; La = Lateral; HA = Hacia Atrás; * valores significativos p ≤ .005; TE = tamaño del efecto

La dimensión del lanzamiento quedó dividida en dos modalidades (tabla 3) debido a que la ejecución de ambas opciones fue diferente. En este caso, se tomó como referencia el objeto del balón: golpear la pelota estando en movimiento o lanzar la pelota estando parada. Teniendo en cuenta el golpeo de pelota estando ésta en movimiento, se puede observar que todas las puntuaciones mejoraron con respecto al nivel inicial. Además, esta mejora fue significativa cuando el jugador corría y lanzaba el balón con la pierna dominante ($p \leq .005$). Respecto a la modalidad de lanzar con el balón parado, todos los resultados también mejoraron con respecto al nivel inicial. Sin embargo, en este caso la mejora fue significativa cuando el jugador corría y lanzaba el balón con la pierna no dominante ($p \leq .005$).

Tabla 3. Lanzamiento de balón: el jugador es capaz de golpear la pelota en diferentes posiciones

Acción	BALÓN EN MOVIMIENTO							BALÓN PARADO						
	PRE		POS		Z	Sig.*	TE	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT				M	DT	M	DT			
En posición estática (CC)	2.97	1.32	3.64	1.06	-1.7	.093	1.335	-	-	-	-	-	-	-
Andando (CC)	2.44	1.30	3.56	0.99	-2.51	.014	1.251	-	-	-	-	-	-	-
Corriendo (CC)	2.33	1.28	3.31	1.11	-2.4	.018	1.193	-	-	-	-	-	-	-
En posición estática (PD)	3.18	1.00	4.13	0.63	-2.62	.014	1.063	3.72	0.93	4.38	0.62	-1.94	.095	1.212
En posición estática (PND)	2.13	1.00	3.64	0.72	-2.88	.008	1.136	2.38	1.07	3.62	0.68	-2.85	.007	0.997
Andando (PD)	3.13	0.99	4.10	0.63	-2.55	.012	1.150	3.54	1.07	4.26	0.57	-1.85	.165	1.236
Andando (PND)	2.21	1.01	3.36	0.67	-2.66	.013	1.005	2.15	1.01	3.56	0.81	-2.83	.007	1.056
Corriendo (PD)	2.64	0.94	3.87	0.76	-2.81	.005*	1.042	3.13	1.14	4.18	0.71	-2.37	.036	1.326
Corriendo (PND)	1.90	0.89	3.10	0.61	-2.73	.011	0.961	1.74	0.98	3.38	0.69	-3.09	.002*	0.882

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; CC = Con la Cabeza; PD = Pierna Dominante; PND = Pierna No Dominante; * valores significativos p ≤ .005; TE = tamaño del efecto

En cuanto a la dimensión del control de balón (tabla 4), todos los resultados mejoraron con respecto al nivel inicial. En este caso, los resultados mostraron mejoras significativas cuando los jugadores querían controlar la pelota con la pierna no dominante a la vez que andaban ($p \leq .005$) o cuando controlaban el balón con la pierna no dominante mientras corrían ($p \leq .005$) por el terreno de juego.

Tabla 4. Control de balón: el jugador es capaz de golpear la pelota en diferentes posiciones

Acción	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
En posición estática (PD)	3.31	1.00	4.36	0.62	-2.5	.018	1.168
En posición estática (PND)	2.31	1.28	3.62	0.78	-2.55	.026	1.202
Andando (PD)	2.97	1.15	4.28	0.60	-2.67	.011	1.221
Andando (PND)	1.87	1.17	3.51	0.73	-2.87	.004*	1.307
Corriendo (PD)	2.41	1.08	3.51	0.86	-2.4	.029	1.253
Corriendo (PND)	1.46	0.90	3.10	0.78	-3.09	.002*	1.029

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; PD = Pierna Dominante; PND = Pierna No Dominante; * valores significativos p ≤ .005; TE = tamaño del efecto

Respecto a la habilidad para conducir la pelota por el terreno de juego (tabla 5), todos los resultados mejoraron con respecto al nivel inicial. Sin embargo, a pesar de ello, en ningún caso la mejora fue significativa.

Tabla 5. Conducción de balón: el jugador es capaz de llevar la pelota controlada sobre el terreno de juego

Acción	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
Andando (PD)	3.49	0.69	4.31	0.66	-2.61	.016	0.794
Andando (PND)	2.62	1.04	3.67	0.76	-2.44	.016	1.251
Corriendo (PD)	2.79	0.88	3.77	0.74	-2.39	.024	1.117
Corriendo (PND)	2.03	1.08	3.10	0.82	-2.48	.020	1.272

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; PD = Pierna Dominante; PND = Pierna No Dominante; * valores significativos p ≤ .005; TE = tamaño del efecto

La dimensión del regate se dividió en dos bloques (tabla 6) debido a que la ejecución de la habilidad se realizó de dos maneras diferentes. Por un lado, se evaluó la opción de regatear a un adversario. En este caso, todas las puntuaciones mejoraron con respecto al nivel inicial. Además, cuando el regate se hacía andando y con ambas piernas ($p \leq .005$), o corriendo con la pierna no dominante ($p \leq .005$), la mejora de la habilidad fue significativa. Por otro lado, se midió la capacidad que tenía el niño para regatear objetos inmóviles tales como una fila de conos. Al igual que sucedió anteriormente, todos los resultados mejoraron con respecto al nivel inicial. Cuando el regate se hacía andando y con ambas piernas ($p \leq .005$), o corriendo con la pierna dominante ($p \leq .005$), la mejora de la habilidad fue significativa.

Tabla 6. Regate: el jugador es capaz de superar una oposición manteniendo la posesión del balón

Acción	A UN ADVERSARIO							A UN OBJETO INMÓVIL						
	PRE		POS		Z	Sig.*	TE	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT				M	DT	M	DT			
Andando (PD)	2.49	0.92	3.82	0.82	-3.22	.002	0.740	2.95	1.02	4.21	0.69	-2.94	.003*	1.087
Andando (PND)	1.56	0.84	3.05	0.79	-2.97	.003	1.095	2.05	0.87	3.56	0.57	-3.03	.002*	1.050
Corriendo (PD)	2.31	0.89	3.41	0.91	-2.8	.007	0.876	2.36	0.95	3.77	0.89	-2.89	.004*	1.104
Corriendo (PND)	1.49	0.82	2.97	0.84	-3.05	.003	0.944	1.74	0.90	3.03	0.83	-2.72	.008	1.184

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; PD = Pierna Dominante; PND = Pierna No Dominante; * valores significativos p ≤ .005; TE = tamaño del efecto

Respecto al componente táctico (tabla 7) se tuvieron en cuenta diferentes elementos puesto que los aspectos deportivos trabajados eran acciones muy básicas proporcionadas por el propio juego. En este caso, se hizo distinción entre ejecutar la acción siguiendo las directrices del entrenador o realizar la acción de manera autónoma mostrando conocimiento del juego. Una vez más, todos los resultados mejoraron con respecto al nivel inicial.

Además, las mejoras fueron significativas en los casos de desmarcarse ($p \leq .005$) y de situarse de manera racional sobre el terreno de juego ($p \leq .005$).

Tabla 7. Aspectos relacionados con elementos tácticos del juego

Acción	PRE		POS		Z	Sig.*	TE
	M	DT	M	DT			
Ataque/progreso (DE)	2.51	0.99	3.74	0.87	-2.76	.006	1.134
Ataque/progreso (MA)	1.56	1.07	3.18	1.09	-2.84	.007	1.243
Apoyo (DE)	2.49	1.19	3.41	0.95	-2.01	.063	1.440
Apoyo (MA)	1.74	1.04	2.79	0.89	-2.31	.034	1.196
Desmarque (DE)	1.97	1.00	3.49	0.96	-2.86	.004*	1.209
Desmarque (MA)	1.23	0.83	2.82	0.83	-3.08	.002*	0.919
Conserva el balón (DE)	2.23	1.03	3.49	0.95	-2.48	.014	1.383
Conserva el balón (MA)	1.54	0.95	2.82	0.87	-2.48	.025	1.258
Colocación (DE)	2.00	0.76	3.56	0.92	-2.91	.004*	1.156
Colocación (MA)	1.31	0.51	2.87	0.83	-3.19	.002*	0.741

Leyenda: Puntuación máxima = 5; puntuación mínima = 1; DE = Directrices del Entrenador; MA = Manera Autónoma; * valores significativos p ≤ .005; TE = tamaño del efecto

Discusión

Tras finalizar el programa deportivo se pudo comprobar una mejora en el desempeño de las habilidades motrices. Sin embargo, esta mejora no se vio reflejada de manera constante en cada una de las habilidades evaluadas, como tampoco en el rendimiento individual de los jugadores. Hay que señalar que el diseño de entrenamientos fue el mismo para todos debido a que los niños se encontraban en una etapa de iniciación al fútbol sala. La primera dimensión que se midió fue el desplazamiento teniendo en cuenta que esta habilidad sirve como base para el correcto desarrollo del resto de habilidades motrices. Tal y como reconocen Rosa et al. (2018), en torno a los seis y los ocho años, los niños ya empiezan a ser capaces de coordinar movimientos motrices un tanto complejos. En este sentido, Prieto (2010) considera que el desplazamiento sirve como herramienta de comunicación para tomar conciencia del entorno y para desarrollar las capacidades perceptivo-motrices. En cambio, al inicio del programa, había niños que presentaban dificultades debido a su torpeza motriz motivado por las características propias del diagnóstico TEA (Harris, 2017; Kruger et al., 2019).

Aunque no hubo problemas para moverse frontalmente, sí que los hubo para hacerlo lateralmente o hacia atrás. Respecto a la primera modalidad, es considerado un tipo de desplazamiento básico y repetitivo, usado constantemente desde las primeras etapas del desarrollo. Sin embargo, las otras dos requieren de una ejecución más compleja como es el movimiento en el juego de pies y el sentido de la orientación espacial. Para Domínguez (2010), realizar un buen trabajo de piernas será fundamental para lograr el éxito, y este dependerá de la cantidad de veces que ejecute la acción y la calidad de cómo lo realiza (López-Ros, 2013).

El abanico de resultados en cuanto a la dimensión del salto fue más amplio debido a las diferentes modalidades. Los entrenamientos ayudaron a que se produjesen mejoras, aunque en algún caso no con el resultado esperado. La fuerza, la coordinación y el equilibrio son elementos que van a intervenir en la ejecución del salto (García & García, 2018). Saltar impulsándose primero con un pie y luego con el otro manteniendo el equilibrio, aumentaba la dificultad con respecto a saltar con los pies juntos. Sin embargo, el nivel de experimentación y el uso repetitivo desde diferentes situaciones y formas de ejecución va a permitir un aprendizaje sobre el dominio corporal (Castejón, 2000). Las posibles dificultades mostradas podrían venir derivados por la edad y por el proceso madurativo de los participantes (García & García, 2018) y del posible retraso en el desarrollo de las habilidades motrices de los niños con TEA, alteraciones de los patrones motrices como el equilibrio, la coordinación y el desarrollo del esquema corporal (Vega, 2005).

Las cuatro acciones técnicas individuales que se evaluaron (el lanzamiento, el control, la conducción y el regate) mostraron resultados favorables con respecto al nivel inicial. Pese a ello, hubo casos donde la mejora se vio mermada por la capacidad de respuesta del jugador o por la dificultad de ejecutar la propia habilidad.

Hay que tener presente que la técnica no puede desarticularse del resto de elementos que influyen en la ejecución (Sánchez et al., 2012). Todas estas acciones tuvieron como elemento trabajar la lateralidad, es decir, ejecutar cada una de las acciones con las dos piernas o con ambos lados del cuerpo (Staples, & Reid, 2010), con la finalidad de potenciar las habilidades motrices, conseguir un desarrollo físico más completo y aumentar el rendimiento del deportista. Sin embargo, hay que tener en cuenta las dificultades que presentan los niños con TEA a nivel motriz. Es importante recordar que, para aprender a jugar al fútbol sala, es necesario pasar por diferentes fases donde se va adquiriendo una serie de conocimientos deportivos. En función de la edad o del nivel de experiencia que tenga el deportista, habrá determinadas habilidades que no se puedan evaluar del mismo modo, bien por la complejidad o porque requieren de una combinación de varias habilidades motrices (Figueredo et al., 2019). Como era de esperar, los niños obtuvieron peores resultados cuando ejecutaban las acciones con la pierna no dominante. Además, si tenían que hacerlo corriendo la dificultad aumentaba debido al nivel de coordinación exigida (Prieto, 2010). También es importante tener en cuenta el estímulo externo del balón, así como el nivel de

atención y concentración que se debe prestar para ejecutar bien la acción (Rojas et al., 2014). Este esfuerzo al que está sometido el deportista puede provocar la aparición de fatiga e influir negativamente en el rendimiento (Camacho et al., 2019). Sin embargo, la constante repetición de las acciones con ambas piernas hizo que se redujese el número de errores y se produjese una mejora en las habilidades. Que las instrucciones para realizar las tareas fuesen sencillas facilitaba el aprendizaje y la retención para la ejecución de las habilidades deportivas (Camacho, 2019). Por su parte, López-Ros (2013) considera que tanto la cantidad como la calidad resultan fundamentales para el aprendizaje.

La habilidad del regate presentaba la particularidad del enfrentamiento directo entre jugadores. Para que la ejecución de esta habilidad sea efectiva, el jugador debe ser capaz de tomar decisiones al instante, puesto que en esta acción intervienen elementos externos incontrolables dependientes del adversario, despertando en muchos casos, la capacidad de improvisación e imaginación del jugador. Sin embargo, las personas con TEA también presentan dificultades a la hora de participar en juegos con un componente imaginativo o simbólico (López-Díaz et al., 2021). De ahí que los niños ejecutasen la acción más lentamente, pues requerían de más tiempo para planear y ejecutar los movimientos, para secuenciarlos y para prever las consecuencias (Crissien-Quiroz et al., 2017).

Por otro lado, señalar que se seleccionaron algunas acciones tácticas básicas debido a que los elementos tácticos ayudan a la formación de deportistas reflexivos y evaluadores de su propia práctica deportiva (Ortín et al., 2016). Para ejecutar bien el elemento táctico en un deporte, es necesario conocer el juego donde se desarrolla la acción (Corcho et al., 2017). En el caso del fútbol o fútbol sala, las acciones tácticas requieren tener un pensamiento táctico el cual va a permitir tomar decisiones acertadas en función del contexto del juego (Corcho et al., 2017). Esta situación se ve agravada cuando los entornos donde se mueven los niños con TEA no poseen una estructura concreta (Urrutxi & Velásquez, 2011). Se pudo observar que, cuando el entrenador facilitaba las instrucciones, los jugadores eran capaces de jugar siguiendo las reglas (Ortín et al., 2016). Esto propició que los niños ganasen confianza en sí mismos y mejorasen. Sin embargo, cuando tenían que jugar de manera autónoma, ninguno era capaz de realizar la acción por sí solo debido a la dificultad para comprender e interpretar las acciones del juego, así como para tomar decisiones acertadas como sucede en el fútbol (Corcho et al., 2017).

En el caso de la acción de conservar el balón, las limitadas habilidades técnicas y la escasa interpretación del juego colectivo hicieron que hubiese problemas para que los equipos mantuviesen la posesión de balón. Cuando se logró, fue debido a que el entrenador intervino para generar situaciones favorables para el desarrollo de esta habilidad. En este caso, es importante que el entrenador establezca reglas con el fin de mejorar el juego colectivo (Corcho et al., 2017). Además, el nivel de conocimiento mostrado por el entrenador sobre lo que es el TEA ayudó a que se produjese un encuentro más cercano entre el grupo contribuyendo a mejorar la interacción social y promoviendo una mayor confianza para realizar la acción de manera eficaz. En este sentido, Campos-Campos (2021) considera muy importante la figura de referencia que pueda tener el colectivo de personas con TEA para el desarrollo de sus actividades.

La composición de los equipos fue un elemento a tener en cuenta a la hora de analizar el rendimiento de los jugadores. Hubo niños que tuvieron un aprendizaje más acelerado debido a la facilidad que tenían para ejecutar ciertas habilidades. Esto se tradujo en la superioridad que mostraban algunos a la hora de realizar determinadas tareas. En los partidos de entrenamiento, el entrenador rotaba a los jugadores en los equipos con la finalidad de reforzar otro tipo de elementos tales como la motivación, la deportividad, la solidaridad y el esfuerzo, entre otras.

Según los resultados recogidos, se puede señalar que los niños pasaron de tener un nivel deportivo bastante limitado, pues las acciones mayoritariamente se ejecutaban mal o se necesitaba la ayuda del entrenador, a finalizar el programa con un mayor rendimiento deportivo en cada una de las acciones ejecutadas.

Finalmente, a pesar de lograr una mejora en el desarrollo de las habilidades motrices, es importante que los niños no abandonen la práctica deportiva. De hecho, tal y como señalaron Fransen et al. (2012), es recomendable no practicar un solo deporte, la participación en diversos deportes tiene una influencia positiva en cuanto al desarrollo de la coordinación motriz, la fuerza, la resistencia y la velocidad. Abernethy et al. (2005) continuaron por esta misma línea afirmando que la práctica de múltiples deportes contribuye a participar en diversas experiencias deportivas, lo que ayuda la toma de decisiones de los niños. Además, no hay que olvidar que la práctica debe realizarse desde una perspectiva lúdica, de esta manera se podrá garantizar la adhesión a la práctica deportiva grupal (May et al., 2018). Además, cabe señalar la importancia de tener paciencia durante el proceso de enseñanza aprendizaje del niño puesto que los resultados no suelen ser inmediatos.

Conclusiones

Este trabajo de investigación ha querido analizar el efecto que tiene practicar deporte en el desarrollo de las habilidades motrices en niños y niñas con TEA. Los resultados obtenidos en el estudio confirman que el programa deportivo de fútbol sala ha resultado ser positivo para los niños con TEA, puesto que se han producido mejoras en las habilidades motrices evaluadas con respecto al nivel inicial.

Por su parte, el hecho de que no exista una herramienta específica que mida habilidades motrices en niños con TEA dificulta la medición y la evaluación para obtener datos más precisos. Por eso, es importante ser prudente con los resultados obtenidos. El método de observación interjueces no deja de tener un componente subjetivo que puede limitar o desviar el resultado de la acción. Respecto a la duración del programa es complicado determinar el efecto del impacto. La tendencia demuestra que ha sido positivo, sin embargo, sería conveniente realizar seguimientos periódicos para comprobar si las mejoras obtenidas se han mantenido a lo largo del tiempo y qué habilidades se han consolidado o se han debilitado.

Siendo conscientes de esta situación, sería interesante desarrollar en un futuro instrumentos específicos que ayuden a medir habilidades motrices y/o deportivas en niños con y sin TEA. En vista de la tendencia positiva que ha tenido el programa, sería interesante seguir proponiendo espacios deportivos para niños y niñas que presenten TEA, con cualquier nivel de gravedad. En el caso de TEA nivel 1, para comprobar que los resultados siguen siendo positivos, mientras que en los casos de TEA nivel 2 y 3, para conocer e investigar el impacto que puede tener este tipo de programas en estos perfiles.

Por último, no hay que olvidar que este tipo de programas pueden ayudar a promover hábitos de vida saludables y, por ende, mejorar la calidad de vida de sus participantes.

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Women and competitive sport: perceived barriers to equality

Mujer y deporte de competición: barreras percibidas para la igualdad

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Abstract

Modern sport was conceived by and for men. It has been a forbidden territory for women, who are perceived as outsiders, especially those who choose to engage in competitive sport. Despite the social advances that have taken place, women's sport continues to be structurally and symbolically more precarious. This study aims to analyse the barriers women perceive to continue participating in competitive sport. A qualitative methodology framed in grounded theory was used. Forty-five women residing in Spain participated in the study. Five focus groups were formed according to the type of sport: futsal, volleyball, handball, swimming, track and field, and fencing. The participants' discourse points to the existence of multiple barriers due to the fact of being a woman, such as the differentiated perception of changes that occur in adolescence, the conciliation of sport and education, the difficulties in making a living from sport in the long term, and the work-life balance. At the same time, they identify other barriers that may also affect men, such as the sacrifice involved in competition, injuries, and competitive pressure. The results suggest that ensuring women's access to sport does not guarantee equal and barrier-free conditions for their participation.

Keywords: Gender, Inequality, Barriers, Sport, Competition.

Resumen

El deporte moderno fue concebido por y para hombres. Ha sido un territorio vedado a las mujeres, que han sido percibidas como outsiders, sobre todo aquellas que deciden practicar deporte de competición. A pesar de los avances sociales acontecidos, el deporte femenino continúa siendo estructural y simbólicamente más precario. El objetivo de este estudio es analizar las barreras que las mujeres perciben para continuar practicando deporte de competición desde una metodología cualitativa y desde la teoría fundamentada. Participaron en el estudio 45 mujeres residentes en España. Se realizaron cinco grupos focales configurados en función del deporte practicado: fútbol sala, voleibol, balonmano, natación, atletismo y esgrima. El discurso de las participantes apunta a la existencia de múltiples barreras por el hecho de ser mujer, tales como la percepción diferenciada de los cambios que acontecen en la adolescencia, la conciliación con los estudios, las dificultades para vivir del deporte a largo plazo y la conciliación laboral. Paralelamente, identifican otras que pueden afectar también a los hombres como el sacrificio que conlleva la competición, las lesiones y la presión competitiva. Los resultados sugieren que asegurar el acceso a la práctica deportiva no garantiza unas condiciones de práctica igualitarias y sin barreras.

Palabras clave: Género, Desigualdad, Barreras, Deporte, Competición.

Introduction

As a social and cultural phenomenon, sport is a reflection of the meanings of gender relations in daily life. In an analogous manner, the advancement of gender equality within a wider social context has been accompanied by a transformation of gender relations in sport (Martín et al., 2017). Such changes have not only enabled women to access sporting spaces traditionally dominated by men (Cooky & Messner, 2018), but even consider making competitive sport a way of life (Donoso et al., 2021). However, access to sport venues does not ensure that the conditions required to participate in sport, the meanings attributed to it, and the social perception of female athletes are understood and valued in the same terms as males, which is why women's sport is considered to be structurally and symbolically more precarious (Cooky, 2017; Pape & McLachlan, 2020). In this context, women, by virtue of being women, encounter more barriers to engage professionally in sport (Tjønndal, 2019).

By examining these barriers, the field in which this work is framed, we aim to identify and gain a better understanding of how such unequal spaces and practices function and suggest possible areas and lines of action for achieving de facto equality in competitive sport. Several previous studies have described three main problems that hinder young women's permanence in competitive sport: challenges to hegemonic femininity, the conciliation of sport and study, and the economic inequalities women face to continue competing in the long term. International and national research has shown that the traditional stereotype of femininity conflicts with and conditions girls' participation in competitive sport (Alfaro, 2004; Camacho-Miñano, 2013; Choi, 2000; Collado et al., 2021; Dwyer et al., 2006; Fernández-Lasa et al., 2019; Isorna et al., 2019; Martos-García et al., 2020; Rodríguez & Perrino, 2019; Whitehead & Biddle, 2008). Indeed, because 'winning' is not considered a characteristic of the hegemonic stereotype of femininity, women may find competing unattractive and prefer to choose practices more in line with their socialisation process (Martín et al., 2017). This can be even more problematic for girls who decide to participate in sports traditionally regarded as 'masculine' as they face the additional obstacle of having to overcome the gender typification of the activity itself (Camacho-Miñano, 2013). Moreover, adolescence is marked by changing priorities, which is more accentuated in girls as they attach greater importance to social life and are under more pressure to spend time with the peer group (Biscomb et al., 2000; Dwyer et al., 2006; Martínez de Quel et al., 2010; Whitehead & Biddle, 2008).

As previous studies have shown, the challenges faced by both adolescent girls (Dwyer et al., 2006; Fernández et al., 2003; Martínez de Quel et al., 2010) and young adult women (Alfaro, 2004; Galatti et al., 2019; Iglesia et al., 2013; Isorna et al., 2019) in balancing their sporting and academic commitments is another barrier that prevents them from competing. For young women, who tend to be more academically driven than their male peers, combining both spheres of their lives entail an enormous amount of effort and another 'conflict of interests' that leads them to abandon sports. For those who continue to participate in competitive sport, one of the main concerns is reaching the end of their sport career without the sufficient training and preparation required for their professional development. The demands of high performance are so huge that these athletes often lack the time needed for their academic development (Álvarez et al., 2014; Barriopedro et al., 2016) and those who drop out of school find themselves without the specific training needed to pursue a professional career (Alfaro, 2004).

The economic precariousness experienced by female athletes is perceived as yet another barrier for them to remain in competitive sport in the long term (Bowes et al., 2021; Isorna et al., 2019). In this line, Clarkson et al. (2020) highlighted how elite women football players are offered shorter contracts and lower salaries than their male counterparts and no possibility of maternity leave, thus forcing them to look for an extra job to achieve a certain economic stability (Bowes et al., 2021; López & Álvarez, 2019). In this regard, female athletes often complain about the fatigue and exhaustion involved in attempting to reconcile both spheres and how this affects their sports performance (Jaeger et al., 2010; Harrison et al., 2020).

The aim of this study is to explore the barriers female athletes perceive to continue competing. The results aim to fill the gap of empirical qualitative studies in the literature on conflicts women experience in the Spanish sports context.

Method

This study forms part of broader research (Donoso, 2021; Donoso et al., 2020) to determine how the identity of women who participate in competitive sport is constructed and the role sport plays in this process from a psycho-socio-cultural perspective. This reality is approached in the framework of the interpretative paradigm (Taylor & Bogdan, 1986) and feminist research (Flores, 2014; Harding, 1987). To do so, we start from an epistemology capable of retrieving and validating the discourses of women in the world of competitive sport as scientific knowledge (Cala, 2004) in line with Harding (1987) and Harstock's (1983) standpoint theory. This approach allows exploring different phenomena that essentially and directly influence these women through the situated knowledge they have of their own lives (De la Mata et al., 2018), a 'feminist point of view' that can only be achieved through a process of individually and collectively articulated awareness (Flores, 2014). This perspective enables the use of a qualitative methodology that does not limit the possibilities of response and heeds women's own voices (Cala, 2004). The design was based on grounded theory (Strauss & Corbin, 2002) to capture the meanings that these women attributed to the issues raised. In this framework, the representation of social reality and the generation of the theory required an inductive method supported in data analysis (Andréu et al., 2007).

Participants

Forty-five women residing in the province of Cordoba (Spain) aged 18 to 58 (M = 28.22, SD = 11.06) with 3 to 41 years of experience in sport (M = 13.58, SD = 6.99) participated in the study. Additional sociodemographic characteristics of the participants are shown in Table 1.

Table 1. Sociodemographic data of participants

		n	%
Sport	Track & Field	12	26.7
	Handball	11	24.4
	Volleyball	10	22.2
	Futsal	8	17.8
	Swimming	3	6.7
	Fencing	1	2.2
Age	< 25 years	23	51.1
	25-45 years	15	33.3
	> 45 years	7	15.5
Level of education	Primary education	1	2.2
	Secondary education	33	73.3
	Undergraduate	9	20.0
	Postgraduate	2	4.4
Employment status	Student	27	60.0
	Employed student	3	6.7
	Employed	14	31.1
	Unemployed	1	2.2
Relationship status	No partner	24	46.7
	Partner	21	53.3

The criteria for participating in the study were being female, over 18 years of age and, as a sport criterion, having participated in at least one Spanish championship in the case of individual sports or, in the case of team sports, having played in a national division or aspiring to be promoted. Individual athletes were selected by non-probability purposive snowball sampling (Taylor & Bogdan, 1986), while those on teams were contacted via their coaches. After identifying local teams that met the established criteria, the research was explained to the coaching staff and permission was asked to contact the players. Meetings were then held with the players to explain the study objectives and procedure in detail. After a period of reflection and doubts were clarified, 48 athletes decided to participate in the study, although three of them (one soccer player and two volleyball players) chose not to take part in the focus groups. The fieldwork concluded when theoretical saturation was reached (Glaser & Strauss, 1967).

Participation was voluntary and all the athletes signed an informed consent form. The participants' contributions appear under a pseudonym to ensure their anonymity.

Data production technique

The data production technique was the focus group. Five face-to-face focus groups were used, which were set up according to three criteria: type of sport, whether the sport was played individually or in teams, and the age of the participants. Three groups were comprised of team players: the first one included 9 futsal players, the second 11 handball players, and the third 10 volleyball players. The other two groups included individual athletes: one with younger women (20-38 years) in track and field, swimming, and fencing and the other with veteran track and field athletes over the age of 45. These athletes were included to detect possible intergenerational differences in the discourse.

The groups were conducted by a female researcher who acted as the moderator. All the focus groups were structured around the same script in line with the initial objectives of the research and based (in an open manner) on the following questions: Does participating in competitive sport influence women's process of identity construction?; Do women who participate in competitive sport perceive themselves differently from those who do not?; What motives and barriers do women in competitive sport perceive? Can female athletes be feminine?; Is there an association between certain sports and sexual orientation?; Do female athletes feel that they are supported and understood by their social/family environment?, How are competitive female athletes viewed externally? The script was reconstructed in line with the participants' interventions and discourse interactions. This led, for example, to the inclusion of themes of great

relevance to the discourse, such as the inequalities women face in Spanish sport; an issue that emerged in relation to the perceived barriers to sport participation.

This technique (Krueger & Casey, 2015; Morgan, 1997) allows creating a space in which women can freely express their perceptions and experiences. The focus groups were designed and implemented in such a way as to facilitate an open and spontaneous discourse and accommodate any contradictions and differences that might arise between the participants or distinct positions held by the same participant. The groups lasted approximately an hour and a half. All the discourses that emerged in each of the groups were audio-recorded with the participants' consent.

Analysis

The data were analysed using a grounded theory approach (Strauss & Corbin, 2002) through a process of inductive open coding based on the subjectivities of the participants. Prior to the analysis, the participants' discourses were transcribed verbatim in their entirety.

Simultaneously, axial coding was used to systematically construct and make connections between the subcategories until they were integrated. This finally led to the explanatory scheme presented in the results section around the main category 'Barriers to competitive sport'.

The units of meaning were operationalised in turns of talk and discourse excerpts. Turns of talk are individual interventions that are meaningful in themselves, while discourse excerpts are interactive sequences of several participants around concrete analytical content and integrated by turns.

The validation strategies included data triangulation using different data sources (focus group and sample variability) in relation to the problematic issues under study and the triangulation of the researchers in the axial coding process to introduce other observations and increase the interpretative depth of the analysis (Denzin, 1970, cited in Flick, 2014). The rigour of this qualitative research is supported in criteria of credibility, transferability, dependability, and confirmability (Ruiz-Olabuénaga, 2012).

NVivo 11 Plus software was used throughout the process.

Results

The discourse around perceived barriers to women's participation and continuity in competitive sport is represented proportionally in Figure 1 as a hierarchical map by type of sport. It should be noted that this is the most salient category and the one alluded to most often by the track and field athletes, followed by the swimmers and futsal players. It is striking to note how the participants that engage in individual sports perceive a greater number of barriers as indicated by the larger areas of the figure. These areas include a greater number of coded references and correspond to the sum of the individual sports of track and field, swimming, and fencing according to this grouping criterion.

Figure 2 shows the relationships between the barriers faced by female athletes distributed by age group, with the oldest age group (over 45 years old) having the least variety of barriers. This focus group comprised a real group of 'survivors' who were able to overcome the adverse circumstances they faced to make competitive sport their way of life.

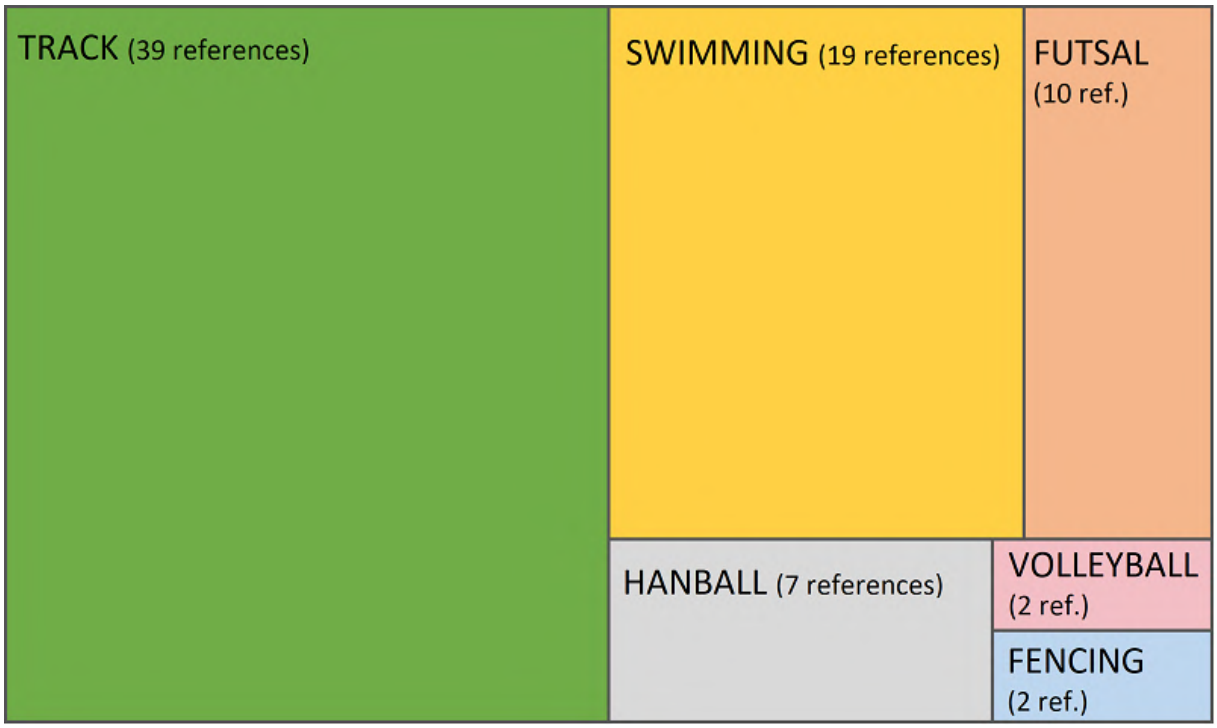

Figure 1. Hierarchical map of the category 'Barriers to competitive sport" by number of references per sport

Figure 2. Relationships between female athletes by age group and barriers in competitive sport

Social life, leisure and sport participation

Gender stereotypes and roles seem to play a specific role in the reasons why female athletes drop out of sports, especially during adolescence. The participants view sport as part of the repertoire of leisure and social activities traditionally associated with men, and that the group nature of sport prevents them from disengaging to a greater extent. This is not the case for women, who are more likely to opt for other types of activities. For those who have continued to participate in competitive sport and seen many girls abandon sport at an early age, the distinct role sports play in the social life of men and women is perceived as a differential element:

> And at that age, yes. Men's leisure time is always associated with..., sport is part of that leisure time, and for women perhaps not so much... The guys meet up on Sundays, their little match is a must, the girls don't... We meet up for coffee, go shopping..., interests change... I'm starting to dress cute, wanting to go out, flirt with the guys..., and well, men, maybe it's more common... [Susana, track and field athlete, 35 years old].

> Yeah, but for men it's like Susana says, it's their hobby, it's their... 'we go cycling on Saturdays', you're doing sport, 'on Sunday, their little game of...' [...], of course, it's a way of relating on a social level... It's not the same as us, it's rare for us to relate socially by doing sport, so obviously you finally give it up... [Teresa, swimmer, 32 years old]

In this context, the participants report that they feel pressured, perhaps unconsciously, by peers that do not do sport. Not being able to adapt to the leisure schedules of their peer networks because they coincide with training sessions, or not even being able to participate in leisure activities with their peers because they involve a series of habits that are incompatible with doing sport (drinking alcohol, going to bed late, etc.), causes feelings of doubt and discomfort, although it has not kept them from doing sport.

> Having to tell your group of girlfriends that, for example, they don't understand this world, having to tell them on a Friday: "Well, no, we can't meet at nine o'clock at night, we can meet at twelve o'clock at night because I finish training at eleven or eight and I have to take a shower... [Patricia, handball player, 26 years old].

> The fact that my classmates went to the park every afternoon, and that at the weekends they started drinking, partying had a large influence... going here, going there... And it's clear that this has an influence... [Teresa, swimmer, 32 years old]

> You're there and everyone else is with their boyfriend or going out partying... [Susana, track and field athlete, 35 years old].

First romantic relationships

Some young female athletes abandon competitive sport upon engaging in their first romantic relationship. The amount of time required, as well as the sacrifices involved in training and competitions, may cause female athletes to question their sport participation and give priority to initial romantic relationships over training. One veteran athlete stated that 'boyfriends' were one of the main reasons for dropping out of sport:

> I quit, of course..., boyfriends, if it's not one thing, it's another, you stop going and then I started to run when I could... [Manuela, track and field athlete, 47 years old].

Several participants in the focus group of individual athletes expressed similar feelings. The following discourse excerpt shows how Teresa is critical of women who abandon sport for their partners using a solid argument with which she tries to refute Alejandra: men also have relationships and do not drop out. Susana tries to justify her opinion by alleging that women's interests change, which makes them prioritise their partner more than men:

> [laughs] Boyfriends are my coach's biggest fear... [laughs], because everything gets mixed up a bit... [Alejandra, track and field athlete, 19 years old].
>
> They both have relationships, I mean, what I want to say is..., men also have [partners] [Teresa, swimmer, 32 years old].
>
> Women get more involved..., I think their interests change... [Susana, track and field athlete, 35 years old]

It is interesting to note that no intergenerational differences were observed regarding the influence of partners on the decision to remain in competitive sport. In this regard, the participants' discourse suggests that first romantic relationships continue to have a stronger effect among the younger athletes, who seem to prioritise them over sport.

Balancing sport and study

According to the participants, the difficulties of reconciling the academic and sporting spheres are one of the main reasons young female athletes drop out of sport, unlike their male counterparts.

In their discourse, they identify several factors that make it difficult to balance these two areas of their lives: the enormous responsibility and effort required of female athletes to excel in both spheres, the location of training venues, and the economic resources that can be obtained from sport. These factors condition the ability to reconcile or prioritise one sphere over the other and may lead athletes to abandon sport and dedicate themselves to their studies. Female athletes are perceived to be more committed to their studies than the male athletes with whom they have shared training sessions and competitions:

> The dropout rate of females is notable, I've noticed it in teams. I'm the only one of my team who is still in my [academic] year, and from my year all the men are still in my team... [...], the dropouts when they entered university..., women [drop out] more, they quit more than men... [Paola, handball player, 31 years old].
>
> In my case, when I was training at the club, little by little the girls gradually stopped swimming because of their studies and not because they wanted to, but because the family forced them to make a decision: 'either this or that'. So, they really threw themselves into their studies and the degrees they chose, well at least in my case, which is not necessarily the case for everyone [...] [Mercedes, swimmer, 31 years old].
>
> Women tend to be more responsible in this regard, don't they? So maybe we have a clearer idea... 'I want to be a lawyer and I'm going to pursue that, and if I have to give up sport and everything, I'll give it up, and I'll focus more on it' [...], I think that's also a conditioning factor. [Susana, athlete, 35 years old].

However, in the case of female athletes who were unable to balance their academic and sporting commitments, fears and uncertainties emerge about their adaptation to a professional career as they approach the end of their sporting careers. According to the participants, these feelings are caused by insecurity about their academic and professional qualifications. As one athlete stated:

> Another thing about it is that you seem to be wasting your time, you know... And you are wasting it... In terms of your future career, you're totally socially handicapped [...], in terms of work and socially, because you get a job and say: 'because I am the fastest... the fastest in the world'... 'Well, so what...' [...], 'Well, look, I was told that I was going to be the champion and that I wouldn't lack anything...', it's a lie, you know? Then you're dedicating all these years of your life, some people manage to balance it, other people don't balance it... Normally, those who win the super medals don't balance it. I have friends who have balanced it and they are the chosen ones, or super-responsible... [Raquel, track and field athlete, 37].

Raquel's account suggests that the difficulties involved in combining academics and sport require optimal planning and time management. At this point, a conflict of interests arises which forces them to pit their sporting objectives against their academic ones, in some cases due to the circumstances and lack of academic support:

> Where I was training, I couldn't do a degree... but if I had been living in Madrid or in a place with a bigger university, maybe I could have done both, but not there [...] [Mercedes, swimmer, 31 years old].
>
> It also depends on that, on the help you can count on, because I also know [people like] those you say, medalists, and it's not the same. For example, in Madrid, in the CAR [high performance training centre], I have lots of friends in the BLUME [athletes residence], and if they help you, for example, there when you are in secondary school, you have the same school right there, you have..., then it's okay, but then there's the case of L, the athlete from Barcelona who, in fact, didn't participate in the university championship because she says: 'I've done championships, I'm not talking about a control, but a European championship that coincided with an exam and the university couldn't help me', do it [the resit exam] in September..., so it depends on the means, on the help they give you [Alejandra, track and field athlete, 19 years old].

Challenges to making a long-term living from sport

The realisation that they will not be able to make a living from sport without a secure salary raises athletes' doubts about remaining in competitive sport and they start to consider their future from a different perspective:

> Me, in my case, I know that in my sport you can't make a living unless you're Mireia Belmonte, that is, if you don't win many international medals in a row... because there are also people who win international medals, one, and that's it and nothing happens. In my case, I earned enough to live on and I felt privileged because I was working in my job, in what I liked, my passion... So, until I could keep it.... When my head was about to explode and I knew that I wasn't going to be able to support myself the next year, that's when

> I started having doubts and decided to continue in another way, but in the case of swimming, either you are very, very, very good, or it's not worth it..., I mean, to support yourself for many more years, no, I lived from month to month, you know, from month to month [Mercedes, swimmer, 31 years old].

In addition to the difficulties associated with the type of sport, there is the added constraint of being a woman. Female athletes perceive that men who do sports considered masculine have a better chance of playing sports their main source of income and 'making a living from it'. However, women face two problems: playing a sport that 'does not befit them' and being a woman, as they explain:

> If it's men's basketball, men's football, maybe... but in women's basketball I don't think I'd earn much more, so... [Mercedes, swimmer, 31 years old].

> Since mine is such a minority sport, you don't get paid anything, nothing, nothing, nothing, but I know people who have been on the verge of going to the Olympics and nothing... working... [Clara, fencer, 27 years old]

Work-life balance

The start of working life presents one of the largest barriers to continuing in competitive sport. The athletes highlight the incompatibility of timetables, added energy expenditure, and even changes in lifestyle as factors that lead them to consider whether to continue in competitive sport. They think it is easier to find a balance with their academic lives than with their professional lives:

> I think it's also because of the lifestyle we lead; the fact that all of us, most of us, are studying, so it's not the same to combine this with... [Patricia, handball player, 26 years old].

> A job. [Gema, handball player, 25 years old]

> A study timetable with a work timetable. [Patricia, handball player, 26 years old]

> And because in any kind of job, they don't make it easy for you... [Ana, handball player, 23 years old].

> Nobody is going to give it to you on a platter... [Paola, handball player, 31 years old].

> Come on, it's the first thing they say to you... [Gema, handball player, 25 years old]

The fact that only players of team sports referred to this issue suggests that having to adhere to a fixed training schedule shared with other players makes it difficult to achieve a work-life balance; something that does not occur in individual sports where, depending on their work schedule, athletes can better organise the time they dedicate to training.

Female players have also internalised the idea that they will not be able to make a living from sport, an assumption that is presumably more widespread among women due to the fewer possibilities they have compared to their male counterparts. As a result, they must opt for employment at some point in their sport careers. Yet working is associated with an energy expenditure that takes a toll on sport performance:

> You can't live off handball..., so you have to find something else [...], obviously, anyone who not only plays handball, but who has an additional expenditure [referring to energy] such as working in a hospital as a doctor from eight to three, for example, that expenditure of being there all morning is reflected in your training... What happens? Well, if that person doesn't have to work and is only training, then physically they will be better and all that... [Bea, handball player, 23 years old].

Other life sacrifices

As the participants' discourse reveals, the pathway to competitive sport involves sacrificing other aspects of life. They are fully aware of the sacrifice, and some say that they have rationally evaluated at some point in their lives (or think they will do so in the future) whether it is worth it. In particular, not being able to spend their weekends doing other activities because they are attending competitions and being away from their families are perceived as obstacles that may deter them from participating in competitive sport in the long term. As several players report:

> Maybe having to travel at weekends... [Lucía, volleyball player, 29 years old]

> Or a weekend, organising a getaway in the countryside or whatever and you go to Madrid all weekend by car or bus and arrive on Sunday, for example [Patricia, handball player, 26 years old]

> For me, maybe it's being away from my family. And it's true that sometimes it makes you wonder, well, a lot of things, like, is it worth it to be here suffering in that sense, missing out on a lot of things in my life, my family? Is it really worth it? That's what demotivates me the most. [Gloria, futsal player, 22 years old]

> Me, for example, I have my work, my life in the morning, which is totally the opposite of when I come to train; it's hard for me to sacrifice my weekends, you don't have a life aside from this, I don't know what it's like to go away for a weekend.... because from August until now, to have a weekend off, we have to thank the Lord [...] So, when you train so many days, then the weekend too and there comes a point... For me, it's been getting very hard these last few years... [Miriam, futsal player, 26 years old].

Injuries

Injuries are yet another barrier that female athletes perceive as a demotivating factor in competitive sport. Indeed, if injuries persist over time, they can force athletes to drop out of competitive sport. Those who withdraw from training and competitions have a feeling of depersonalisation that affects them deeply. Significantly, the veteran athletes most often mention injuries as an obstacle to remaining in competitive sport in the long term. In this context, we have detected how age plays a decisive role in the construction of their narratives. The veteran athletes compare their 'sporting childhood' with the opportunities available to female athletes today, and consider that having to work so hard to succeed has given them the strength to overcome the barriers they have faced throughout their careers:

> I've had an injury since March and haven't been able to run for a long time..., I just couldn't... [...], I have to get well to continue doing what I like, otherwise..., sitting at home.... And it eats you up inside..., and then that, you start..., in my case, you start to put on weight..., I don't feel like I look good... and I need to buy clothes... I don't look good... [Manuela, veteran track and field athlete, 47 years old].

> I think that the point we're at now and our age, there are obstacles in our lives that prevent us from running..., no, it's just an injury, because our partner can ask, they can ask at work, and we've overcome it all... [Claudia, veteran track and field athlete, 54 years old].

The pressure of competing

The elite nature of high-performance sport, the lifestyle it entails, and the pressure to achieve sporting results are perceived as barriers to remaining in competitive sport. Although the participants consider themselves privileged to have been able to endure the demands of high-performance sport, they recognise how hard it is. This is illustrated by the interventions of the individual athletes:

> And it's also true that people [snorts]... That we see it as normal, but I also often think about it coldly and say, man, competing, that's not something that just anyone can do, putting on pair of cleats, entering a race, jumping into a pool... It's just not easy... [Alejandra, track and field athlete, 19 years old].

> When I was in Barcelona at the CAR [high performance training centre], people stopped swimming there because competing wasn't really their thing, people realised that the constant pressure wasn't for them... [Mercedes, swimmer, 31 years old].

> I feel privileged because I've been able to compete in high-performance sport, but it's not for everybody... [Teresa, swimmer, 32 years old].

Discussion

The participants' discourse reveals the multiple perceived barriers that prevent female athletes from remaining in competitive sport. Specifically, five of the barriers they described are partially or entirely due to gender inequalities in different life domains, mainly the socio-affective, work, and academic domains. Within this framework, we consider that gender stereotypes and roles neutralise adolescent female athletes' desire to continue participating in competitive sport. The participants perceive that, contrary to the case of female athletes, sport forms part of the repertoire of male athletes' leisure activities, as previously reported by Macías and Moya (2002). The participants added that, during adolescence, social life took on increasing importance and the pressure to spend more time with their peer groups (Biscomb et al., 2000; Dwyer et al., 2006; Tekavc et al., 2015; Whitehead & Biddle, 2008) and first partners increased; aspects that hindered them from continuing to practice competitive sports (Alfaro, 2004). It is notable how this perception is strongest among the individual athletes (both young and veteran). The 'loneliness' and demands of individual sports may be factors that are progressively driving young women away from sport. In this sense, we have detected that sport is largely incompatible with the social roles ascribed to women (Alfaro, 2004) and although the social imposition of hegemonic gender stereotypes is not as explicit today, the hegemonic model of femininity continues to be transmitted daily in society and remains in the collective imagination, although it is not institutionalised (Martín et al., 2017).

As the participants reported, the economic inequalities between male and female professional sports and the minority nature of certain sports constitute major barriers to continue participating in professional sport in the long term (Bowes et al., 2021; Isorna et al., 2019). To a certain extent, this situation forces female athletes to combine competitive sport with new life roles, such as the start of working life, as other studies have also found (Bowes et al., 2021; López & Álvarez, 2019; López de Subijana et al., 2021). In line with previous research, such as Jaeger et al. (2010) and Harrison et al. (2020), female athletes complain about the effort, difficulty, and fatigue involved in balancing these life domains, which is consequently reflected in their sport performance.

Having to reconcile studies with sport also hinders the permanence of girls in competitive sport, as the participants stated. The data produced suggest that females have a greater sense of responsibility in terms of their education, as previously noted by Tekavc et al. (2015). This situation causes a conflict of interest that 'pushes' them to drop out, as previously reported (Choi, 2000; Dwyer et al., 2006; Fernández et al., 2003; Isorna et al., 2019; Martínez de Quel et al., 2010; Whitehead & Biddle, 2008). In this sense, female athletes appear to have internalised the idea that they will be unable to make a living from sport and therefore give priority to academics since they view education as being more important for their future (Barriopedro et al., 2016; Fernández, 2011; López de Subijana et al., 2021). Added to this set of circumstances are the expectations of the athletes' families, who consider an academic career as a means to gain status, become independent, and enter the world of work (Fernández et al., 2003).

In line with the results of previous studies, the participants were aware of the importance of academic training for their future professional careers (López & Álvarez, 2019; López de Subijana et al., 2021; Tekavc et al., 2015).

The three professional high-performance female athletes participating in this study were unable to balance their sport career with their academic commitments. According to Pérez-Rivases et al. (2020), one of the competencies that athletes say they need to successfully combine studies and sport is efficient time management, which is in line with one of the accounts of an athlete in this research. As identified by Selva et al. (2013), retiring from sport and the subsequent adaptation to a professional career causes feelings of fear and uncertainty. In contrast, the 11 female players analysed in Harrison et al. (2020) were able to successfully combine both facets of their lives. They internalised the idea of education as a 'back-up plan' after retiring from sport and felt supported by the university, family, and clubs.

The results also suggest that, in some cases, no measures are taken to help athletes combine study and sport, as one participant reported. Some of the most frequent demands in this regard are changes in class groups to allow them to train, problems with compulsory internships, the adaptation of continuous assessment systems, and academic tutoring (López de Subijana et al., 2014).

The participants' discourse also points to barriers not associated with being female. They indicate that the commitment, determination, dedication, and effort involved in balancing time spent in competitive sport with their personal and social development may be a barrier that leads them to question whether it is worthwhile to continue in competitive sport, as was also noted in previous studies such as Iglesia et al. (2013) and Taylor et al. (2019).

Frequent injuries and difficulty recoveries are further barriers to remaining in competitive sport (Isorna et al., 2019). Participants report how the injuries they have suffered often take an emotional toll on them due to their deep attachment to sport, as previously identified by Roessler and Muller (2018).

The intense and continuous competitive pressure athletes are subjected to over time is another factor that causes them to retire from competitive sport, as previous research has also shown (Dwyer et al., 2006; Galatti et al., 2019; Isorna et al., 2019).

The main theoretical contribution of this work to the scientific literature on women and sport is the use of a qualitative methodology that enables identifying the principal barriers female athletes perceive to participate in egalitarian sport. Specifically, their discourse reveals that gender stereotypes and roles associated with leisure time, first romantic partners, achieving a balance between sport and studies and/or work, and the difficulty of making a living from sport in the long term affect them because they are women. As for the practical implications, we believe this study could aid sports institutions in designing equality policies that take into account the needs, concerns, and interests of female athletes. In this regard, we intend to disseminate this work to sports federations and other administrations involved in promoting equality in sports to ensure that the voices of female athletes are heard, and scientific knowledge is transferred to the social agents involved.

The main limitation of this study is the number of participants we were able to recruit. It also would have been interesting to include a larger number of sports to broaden the scope of the research, especially individual sports typified as female, such as rhythmic and artistic gymnastics or synchronised swimming, as this would have allowed for an empirical and theoretical analysis of great interest. Likewise, it would have been desirable to further investigate the participants' attributes and delve more deeply into these differences, which we have not been able to explore due to the word limit of the manuscript.

As future lines of research, we propose the implementation of mixed designs that enable using quantitative methods to increase the sample and thus complement the data produced in this study. In this line, we consider that it could be interesting to extend the sample to include women from other provinces of Andalusia and those who reside or were born in other regions of Spain to enable comparisons in different contexts.

Conclusions

The data presented in this study suggest that equal access to sport does not ensure that the conditions for participating in sport are egalitarian, as is clear from the discourse of the participants, who highlight that barriers still remain due to the fact that they are women. In short, the perception that males participate more in sport than females in adolescence because it is a socially accepted leisure activity, pressure to spend more time with the peer group, first romantic relationships, balancing study and sport, and the challenges to making a long-term living from sport constitute a set of barriers which are conditioned, according to the results of this study, by deep-rooted gender stereotypes that are still in force and have a profound impact on the sporting sphere. However, the sacrifice involved in competitive sport in relation to other areas of life, injuries, and the pressure to compete over time are barriers that can affect both women and men equally. In line with Martín et al. (2017), we believe that the challenge for our society does not end with guaranteeing access to sport, but that the main objective should be to achieve effective equality. In other words, the barriers that the results of this study point to and that still persist in social structures and individual beliefs must disappear. In this sense, we believe that it is necessary both for society to continue advancing towards a cultural change which, although slow, is modifying gender relations in sport, and for sports institutions and administrations to be more aware of their responsibility in banishing stereotypes and gender roles that hinder women's participation in competitive sport. Only in this way will athletes no longer have to face certain barriers for the mere fact of being women.

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Mujer y deporte de competición: barreras percibidas para la igualdad

Women and competitive sport: perceived barriers to equality

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Resumen

El deporte moderno fue concebido por y para hombres. Ha sido un territorio vedado a las mujeres, que han sido percibidas como *outsiders*, sobre todo aquellas que deciden practicar deporte de competición. A pesar de los avances sociales acontecidos, el deporte femenino continúa siendo estructural y simbólicamente más precario. El objetivo de este estudio es analizar las barreras que las mujeres perciben para continuar practicando deporte de competición desde una metodología cualitativa y desde la teoría fundamentada. Participaron en el estudio 45 mujeres residentes en España. Se realizaron cinco grupos focales configurados en función del deporte practicado: fútbol sala, voleibol, balonmano, natación, atletismo y esgrima. El discurso de las participantes apunta a la existencia de múltiples barreras por el hecho de ser mujer, tales como la percepción diferenciada de los cambios que acontecen en la adolescencia, la conciliación con los estudios, las dificultades para vivir del deporte a largo plazo y la conciliación laboral. Paralelamente, identifican otras que pueden afectar también a los hombres como el sacrificio que conlleva la competición, las lesiones y la presión competitiva. Los resultados sugieren que asegurar el acceso a la práctica deportiva no garantiza unas condiciones de práctica igualitarias y sin barreras.

Palabras clave: Género, Desigualdad, Barreras, Deporte, Competición.

Abstract

Modern sport was conceived by and for men. It has been a forbidden territory for women, who have been perceived as outsiders, especially those who choose to practice competitive sport. Despite the social advances that have taken place, women's sport continues to be structurally and symbolically more precarious. The aim of this study is to analyse the barriers that women perceive to continue practicing competitive sport from a qualitative methodology and from grounded theory. The methodology is qualitative. Forty-five women residing in Spain participated in the study. Five focus groups were formed according to the sport practiced: indoor soccer, volleyball, handball, swimming, athletics and fencing. The participants' discourse points to the existence of multiple barriers due to the fact of being a woman, such as the differentiated perception of the changes that occur in adolescence, the reconciliation with studies, the difficulties in making a living from sport in the long term and the work-life balance. At the same time, they identify others that may also affect men, such as the sacrifice involved in competition, injuries and competitive pressure. The results suggest that ensuring access to sport does not guarantee equal and barrier-free practice conditions.

Keywords: Gender, Inequality, Barriers, Sport, Competition.

Introducción

El deporte como fenómeno social y cultural refleja continuamente los significados de las relaciones de género en la vida cotidiana. Así, los avances de la sociedad acontecidos en materia de igualdad de género han ido acompañados de una transformación del género en el deporte (Martín et al., 2017). Este hecho no solo ha permitido que las mujeres se introduzcan en espacios deportivos tradicionalmente dominados por hombres (Cooky & Messner, 2018), sino que incluso ha supuesto que puedan plantearse hacer del deporte de competición su forma de vida (Donoso et al., 2021). No obstante, el acceso a los escenarios deportivos no garantiza que las condiciones de práctica, los significados atribuidos a la misma y la percepción social de las mujeres practicantes sea entendida y valorada en los mismos términos que la práctica masculina, por lo que se considera que el deporte femenino es estructural y simbólicamente más precario (Cooky, 2017; Pape & McLachlan, 2020). En este contexto, las mujeres, por el hecho de serlo, encuentran más barreras para poder dedicarse profesionalmente al deporte (Tjønndal, 2019).

El estudio de estas barreras, campo en el que se enmarca este trabajo, permite identificar y entender el funcionamiento de espacios y prácticas desigualitarias y, con ello, apunta a posibles áreas y líneas de acción para la consecución de una igualdad de facto en el deporte de competición. Diversos estudios previos han descrito tres principales problemáticas que obstaculizan la permanencia de las chicas en el deporte de competición: el desafío a la feminidad hegemónica, la conciliación con los estudios y las desigualdades económicas que enfrentan para poder seguir compitiendo a largo plazo. Investigaciones en el ámbito internacional y nacional han identificado que el conflicto con el estereotipo tradicional de feminidad condiciona la participación de las chicas en el deporte de competición (Alfaro, 2004; Camacho-Miñano, 2013; Choi, 2000; Collado et al., 2021; Dwyer et al., 2006; Fernández-Lasa et al., 2019; Isorna et al., 2019; Martos-García et al., 2020; Rodríguez & Perrino, 2019; Whitehead & Biddle, 2008). El hecho de que "ganar" no se encuadre dentro de las características del estereotipo hegemónico de lo que significa ser femenina puede ocasionar que el significado de la competición resulte, en principio, poco atractivo para las mujeres y desencadene que se decidan por prácticas más acordes a su proceso de socialización (Martín et al., 2017). Esto puede resultar aún más problemático para aquellas chicas que deciden practicar deportes etiquetados como masculinos, pues se añade el obstáculo de tener que superar la tipificación de género de la propia actividad (Camacho-Miñano, 2013). Además, en el periodo adolescente acontece un cambio de prioridades, que se acentúa más en las chicas, en el que aumenta la importancia de la vida social y se incrementa la presión para invertir más tiempo con el grupo de iguales (Biscomb et al., 2000; Dwyer et al., 2006; Martínez de Quel et al., 2010; Whitehead & Biddle, 2008).

La dificultad para conciliar el deporte con el ámbito académico tanto en chicas adolescentes (Dwyer et al., 2006; Fernández et al., 2003; Martínez de Quel et al., 2010) como en adultas jóvenes (Alfaro, 2004; Galatti et al., 2019; Iglesia et al., 2013; Isorna et al., 2019) se presenta como otra de las barreras para que las mujeres continúen en el camino del deporte competitivo, tal y como han recogido estudios previos. La conciliación entre ambos espacios supone un gran esfuerzo para las chicas que suelen percibir una mayor responsabilidad de cara a los estudios. Este otro "conflicto de intereses" las conduce al abandono deportivo. Las que continúan practicando deporte de competición contemplan como una de sus principales preocupaciones llegar al final de su vida deportiva sin una formación y una preparación que les facilite su desarrollo profesional. La exigencia del alto rendimiento es tan elevada que suele privar a los y las deportistas del tiempo necesario para su desarrollo académico (Álvarez et al., 2014; Barriopedro et al., 2016) y provoca, en el caso de abandono de los estudios, que se encuentren con una ausencia de formación específica que les permita acceder a algún ámbito profesional (Alfaro, 2004).

La precariedad económica que viven las mujeres deportistas se percibe como otra barrera para permanecer, a largo plazo, en el deporte de competición (Bowes et al., 2021; Isorna et al., 2019). Las voces de las mujeres participantes en el estudio de Clarkson et al. (2020) denuncian que los contratos que les ofrecen son de corta duración, con sueldos bajos y sin la posibilidad de disponer de baja por maternidad. Las deportistas, en este contexto, reportan la necesidad de buscar un trabajo extra para poder tener una cierta estabilidad económica (Bowes et al., 2021; López & Álvarez, 2019). No obstante, a menudo se quejan de la fatiga y el cansancio que supone conciliar ambos espacios y el reflejo que, consecuentemente, tiene en su rendimiento deportivo (Jaeger et al., 2010; Harrison et al., 2020).

El objetivo de este estudio es explorar las barreras que las deportistas de competición perciben para continuar con esta práctica. Los resultados obtenidos contribuyen a paliar la escasez empírica detectada de estudios cualitativos centrados en mujeres que exploren los conflictos que experimentan en el contexto deportivo español.

Método

Este trabajo parte de una investigación más amplia (Donoso, 2021; Donoso et al., 2020) que tenía como principal objetivo conocer cómo se construye la identidad de las mujeres que practican deporte de competición y el papel que desempeña el deporte en este proceso desde una perspectiva psico-socio-cultural. Nos aproximamos a esta realidad desde el paradigma interpretativo (Taylor & Bogdan, 1986) y desde la investigación feminista (Flores, 2014; Harding, 1987). Para ello, se parte de una epistemología capaz de rescatar y validar los discursos de las mujeres como conocimiento científico (Cala, 2004) en el mundo del deporte de competición desde el enfoque aportado por Harding (1987) y Harstock (1983) denominado "Standpoint Theories" o 'Teorías del punto de vista', explorando distintos fenómenos que influyen de forma esencial y directa en ellas por el conocimiento situado que tienen de sus propias vidas (De la Mata, et al., 2018). Un 'punto de vista feminista' que solo puede lograrse a través de un proceso de toma de conciencia individual y articulada colectivamente (Flores, 2014). Desde esta perspectiva, se promueve, fundamentalmente, el uso de una metodología cualitativa que no limite las posibilidades de respuesta y que recojan las propias voces de las mujeres estudiadas (Cala, 2004).

El diseño se basó en la Teoría Fundamentada (Strauss & Corbin, 2002) para captar los significados que estas mujeres atribuyeron a las diferentes temáticas planteadas. En este marco, la representación de la realidad social y generación de teoría requirieron de un método inductivo que se apoyara en el análisis de los datos (Andréu et al., 2007).

Participantes

Participaron en este estudio 45 mujeres residentes en la provincia de Córdoba (España) con una edad comprendida entre 18 y 58 años (M=28.22, SD= 11.06) y una experiencia deportiva de 3 a 41 años (M =13.58, SD=6.99). Otras características sociodemográficas se detallan en la tabla 1.

Tabla 1. Datos sociodemográficos de las participantes

		n	%
Deporte practicado	Atletismo	12	26.7
	Balonmano	11	24.4
	Voleibol	10	22.2
	Fútbol sala	8	17.8
	Natación	3	6.7
	Esgrima	1	2.2
Edad	< 25 años	23	51.1
	25-45 años	15	33.3
	> 45 años	7	15.5
Nivel de estudios	Estudios primarios	1	2.2
	Estudios secundarios	33	73.3
	Estudios universitarios	9	20.0
	Estudios de postgrado	2	4.4
Situación laboral	Estudiante	27	60.0
	Estudiante y trabajadora	3	6.7
	Trabajadora	14	31.1
	Desempleada	1	2.2
Situación sentimental	Sin pareja	24	46.7
	Con pareja	21	53.3

Los criterios para poder formar parte del estudio fueron: ser mujer; tener más de 18 años; y, como criterio deportivo, haber participado en al menos un Campeonato de España en el caso de las deportistas individuales, o, en el caso de los deportes colectivos, que el equipo jugara en una División Nacional o estuviera aspirando al ascenso. La selección de las participantes se hizo mediante un muestreo no probabilístico intencional por bola de nieve (Taylor & Bogdan, 1986), en el caso de las deportistas individuales, o contactando con los entrenadores de equipos para acceder a las deportistas. Tras una búsqueda en el entorno de los equipos que cumplieran con los criterios establecidos se presentó la investigación al cuerpo técnico de los mismos para solicitar el acceso a las jugadoras y se realizaron reuniones con ellas para explicar con detalle el objetivo y el procedimiento del estudio. Tras un tiempo de reflexión y aclaración de dudas decidieron participar 48 deportistas, aunque 3 de ellas (1 jugadora de fútbol y 2 de voleibol) finalmente no formaron parte de los grupos focales. Se detuvo el trabajo de campo una vez se alcanzó el nivel de saturación teórica (Glaser & Strauss, 1967).

Todas las deportistas participaron voluntariamente y firmaron un consentimiento informado. Sus contribuciones aparecen bajo un pseudónimo con el fin de garantizar su anonimato.

Técnica de producción de datos

La técnica de producción de datos utilizada fue el grupo focal. Se llevaron a cabo cinco grupos focales presenciales que se conformaron teniendo en cuenta tres criterios: el deporte practicado, individual o colectivo, y la edad de las participantes. Tres grupos estuvieron compuestos por jugadoras de deportes de equipo: el primero por 9 jugadoras de fútbol sala, el segundo por 11 jugadoras de balonmano y el tercero por 10 jugadoras de voleibol. Los otros dos grupos fueron conformados con las deportistas individuales: uno con mujeres "jóvenes", con edades comprendidas entre los 20 y los 38 años

practicantes de atletismo, natación y esgrima; y otro de mujeres practicantes de atletismo de categoría veterana, mayores de 45 años. La inclusión de deportistas veteranas daba la posibilidad de detectar diferencias discursivas intergeneracionales en caso de que las hubiera.

Los grupos fueron conducidos por una investigadora que ejercía el rol de moderadora. Su desarrollo se orientó bajo un mismo guion construido alrededor de los objetivos iniciales de la investigación y en el que se partía (de un modo abierto) de los siguientes interrogantes: ¿influye la práctica deportiva competitiva en el proceso de construcción de la identidad de la mujer?, ¿se perciben a sí mismas diferentes las mujeres que practican deporte de competición de las que no lo hacen?, ¿cuáles son los motivos y las barreras que perciben las mujeres que practican deporte de competición?, ¿las deportistas pueden ser femeninas?, ¿existe una asociación entre determinados deportes y la orientación sexual?, ¿se sienten las deportistas apoyadas y comprendidas por su entorno?, ¿qué visión externa se tiene de la mujer deportista de competición?. El guion se fue reconstruyendo a medida que se sucedían las intervenciones e interacciones discursivas de las participantes. Esto llevó, por ejemplo, a incluir temáticas que adquirieron gran relevancia discursiva, como es el caso de las desigualdades que sufren las mujeres en el deporte español, cuestión que emergía en relación a las barreras percibidas para la práctica deportiva.

Los rasgos que caracterizan a esta técnica (Krueger & Casey, 2015; Morgan, 1997) permiten crear un espacio en el que las mujeres pueden expresar libremente sus percepciones y experiencias. Su diseño y desarrollo intentó facilitar una discursividad abierta y espontánea donde tuvieran cabida también las contradicciones y diferencias que pudieran existir entre las distintas participantes o entre las distintas posiciones de una misma. La duración de los grupos se situó en torno a una hora y media. Todos los discursos que emergieron en cada uno de los grupos fueron grabados en audio, previo consentimiento de las participantes.

Análisis

El análisis de los datos se realizó siguiendo la Teoría Fundamentada (Strauss & Corbin, 2002) mediante un proceso de codificación abierta de tipo inductivo a partir de las subjetividades de las participantes. Previamente, se transcribieron literal e íntegramente los discursos de las participantes.

De forma simultánea, se llevó a cabo la codificación axial, a partir de la cual se fueron construyendo y ligando de forma sistemática las subcategorías, hasta que se integraron y finalmente dieron lugar al esquema explicativo presentado en el apartado de resultados en torno a la categoría principal "Barreras que dificultan la práctica deportiva competitiva".

Las unidades de significado se operativizaron en turnos y extractos discursivos. Los turnos son intervenciones individuales que tienen sentido en sí mismas. Los extractos discursivos son secuencias interactivas de varias participantes alrededor de un contenido analítico concreto e integrados por turnos.

Las estrategias de validación utilizadas fueron la triangulación de datos utilizando diversas fuentes de datos (grupos focales y variabilidad de la muestra) en relación con la misma problemática de estudio y la triangulación del personal de investigación en el proceso de codificación axial con el fin de introducir otras observaciones y aumentar la profundidad interpretativa (Denzin, 1970, citado en Flick, 2014). El rigor de esta investigación cualitativa se rige por los criterios de credibilidad, transferibilidad, dependencia y confirmabilidad (Ruiz-Olabuénaga, 2012).

Durante todo el proceso utilizamos el software NVivo 11 Plus.

Resultados

El discurso de las participantes en torno a las barreras percibidas para el desarrollo y la continuidad de la práctica del deporte de competición se representa proporcionalmente en la figura 1 como mapa jerárquico, en función del tipo de deporte practicado. Cabe señalar que la mayor presencia y alusiones a esta categoría se da en las deportistas de atletismo, seguido de las nadadoras y de las jugadoras de fútbol sala. Resulta llamativo señalar cómo las deportistas individuales perciben un mayor número de barreras tenido en cuenta que las áreas más grandes de la figura indican un mayor número de referencias de codificación y estas se corresponden con la suma de los deportes individuales de atletismo, natación y esgrima, si utilizamos este criterio de agrupación.

En la figura 2, se observan las relaciones establecidas entre las diferentes barreras que orbitan alrededor de las deportistas distribuidas por tramos de edad, siendo el de mayor edad (más de 45 años) en donde existe una menor variedad de barreras. Este grupo focal estuvo constituido por un verdadero conjunto de "supervivientes" que fueron capaces de sobreponerse a todas las circunstancias adversas que se le pusieron por delante para hacer del deporte de competición su forma de vida.

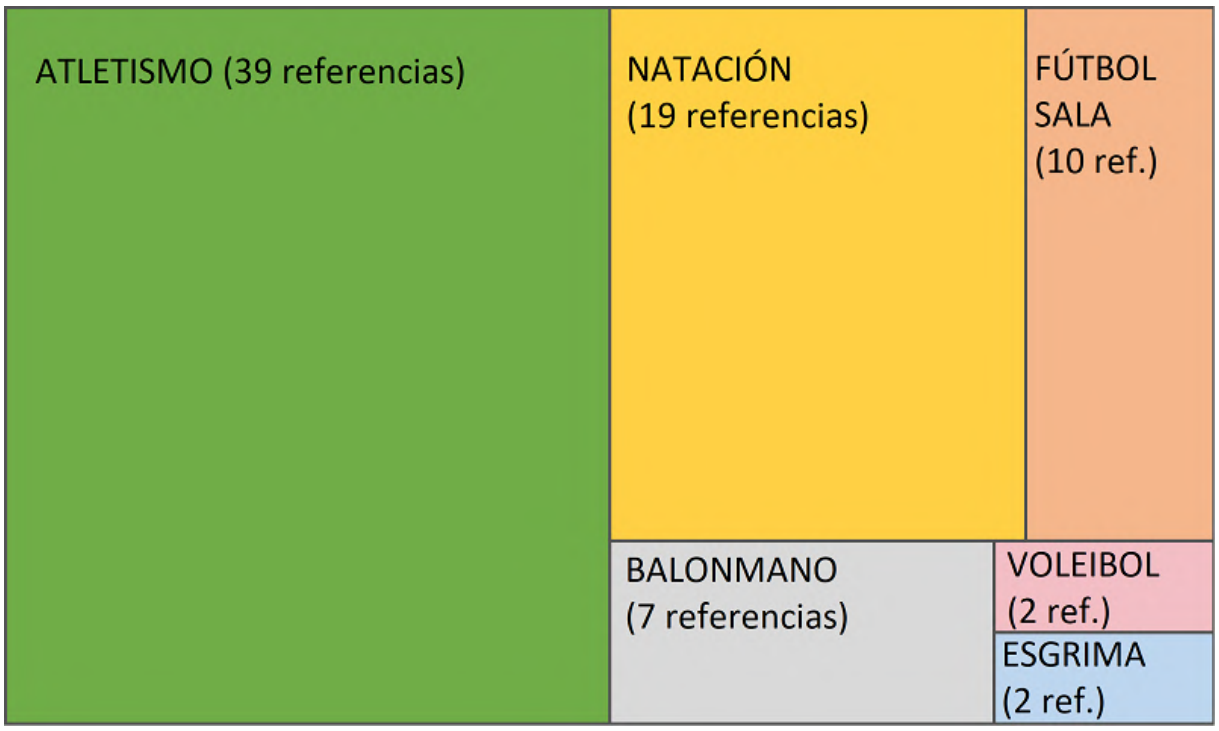

Figura 1. Mapa jerárquico de la categoría "Barreras que dificultan la práctica deportiva competitiva" en función de su presencia en cada deporte practicado

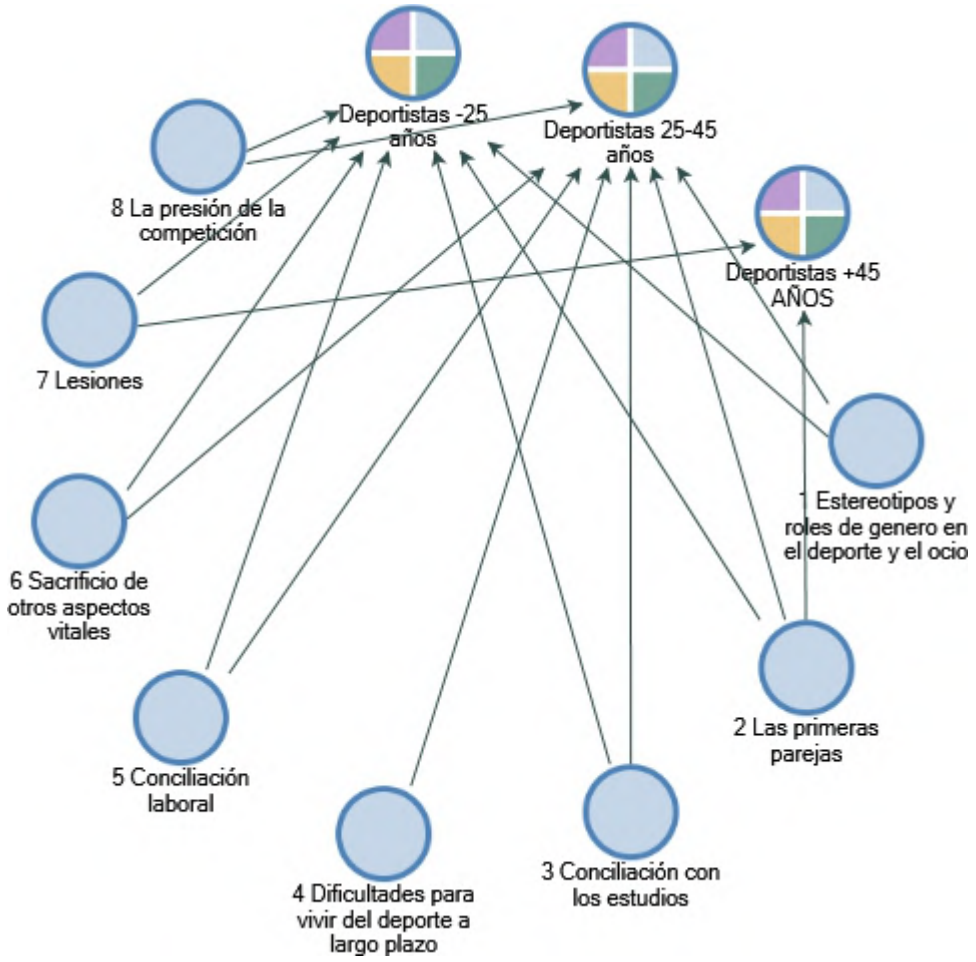

Figura 2. Relaciones entre las deportistas por grupos de edad y las barreras en el deporte de competición

Vida social, ocio y práctica deportiva

Los estereotipos y roles de género parecen tener un peso específico en los motivos de abandono de las deportistas, sobre todo en el periodo adolescente. Las participantes entienden que el deporte se encuentra dentro del repertorio de actividades de ocio y de sociabilidad tradicionalmente asociadas a los hombres y que, el carácter grupal con el que generalmente se practica, ayuda a que ellos no se desvinculen de la práctica deportiva en mayor medida. No ocurriría igual con las chicas, que se suelen decantar en mayor grado por otro tipo de actividades. Desde la perspectiva de quienes han continuado en el deporte de competición, presenciando a su alrededor el abandono temprano de muchas chicas, se percibe, por tanto, que el distinto papel que juega el deporte en la vida social de hombres y mujeres es un elemento diferencial a este respecto:

> Y a esa edad, sí. Los hombres siempre el ocio va asociado..., el deporte forma parte de ese ocio, y para la mujer quizás no tanto... Los colegas quedan los domingos, impepinable su partidito, las chicas no... Quedamos para tomar café, para irnos de compras..., los intereses cambian... ya empiezo a ponerme mona, a querer salir, a ligar con uno y con otro..., y sin embargo eso, los hombres, quizás lo llevan más... [Susana, atleta, 35 años]
>
> Bueno, pero es que para los hombres es lo que dice Susana, es su hobby, es su... "vamos con la bici los sábados", estás haciendo deporte, "el domingo el partidito de..." [...], claro, es una forma de relacionarse a nivel social... No es lo mismo que nosotras, nosotras es raro relacionarte algo social relacionarte haciendo deporte, entonces evidentemente al final lo acabas dejando... [Teresa, nadadora, 32 años]

En este contexto, las participantes relatan la presión, quizás de una manera inconsciente, que ejerce el grupo de iguales que no practica deporte sobre ellas. El hecho de no poder ajustarse a los horarios de las actividades de ocio de sus redes de iguales porque coinciden con los entrenamientos, o ni tan siquiera poder asistir a ellas porque incluyen una serie de hábitos que no son compatibles con los deportivos (alcohol, acostarse tarde, etc.) les ha generado ciertas dudas y malestar, a pesar de que, en su caso, no ha supuesto un motivo que las haya alejado del deporte.

> Tener que decirle a tu grupo de amigas que, por ejemplo, no están dentro de este mundo, tener que decirles un viernes: "pues mira no, no quedamos a las nueve de la noche, quedamos a las doce de la noche porque yo termino de entrenar a las once o las ocho, y mientras me ducho... [Patricia, jugadora de balonmano, 26 años]
>
> Influye mucho, influye mucho el hecho de que mis compañeros de colegio se fueran al parque todas las tardes, y que los fines de semana empezaran a beber, la fiesta... para acá, para allá... Y está claro que eso influye... [Teresa, nadadora, 32 años]
>
> Tú estás ahí y las otras están con el noviete o saliendo de marcha... [Susana, atleta, 35 años].

Aparición de las primeras parejas

La aparición de los primeros noviazgos se presenta como un factor que puede inducir el abandono del deporte competitivo. La cantidad de horas necesarias, así como los sacrificios asociados a los entrenamientos y competiciones, pueden provocar dudas e influir en que la deportista priorice sus relaciones amorosas iniciales frente al entrenamiento. Una atleta veterana subraya la aparición de "los novios" como uno de los principales factores por los que abandona el deporte:

> Lo dejé, claro..., los novios no sé qué, no sé cuánto, lo dejas y luego ya empecé a correr cuando pude... [Manuela, atleta veterana, 47 años]

En esta línea se sitúan varias deportistas pertenecientes al grupo focal de las deportistas individuales. En el extracto discursivo que se expone, se puede comprobar cómo Teresa adopta una actitud más crítica con las mujeres que abandonan el deporte por la pareja con un argumento sólido con el que intenta rebatir a Alejandra: los hombres también están inmersos en esas relaciones y no lo abandonan. Susana intenta buscar una justificación y alega un cambio de interés de las chicas, que hace que prioricen a la pareja más que el hombre:

> [risas] El gran temor de mi entrenador son los novios... [risas], porque se mezcla todo un poco... [Alejandra, atleta, 19 años]
>
> Relaciones tienen los dos, o sea, te quiero decir..., que el hombre también tiene [pareja] [Teresa, nadadora, 32 años]
>
> La mujer se vuelca más..., yo creo que cambian los intereses... [Susana, atleta, 35 años]

Resulta curioso que, con respecto a la influencia de las parejas en la permanencia de las chicas en el deporte de competición, no se observen diferencias intergeneracionales. En este contexto, el discurso de las participantes apunta a que el establecimiento de las primeras relaciones de pareja continúa teniendo un mayor peso para las chicas que parecen priorizarlas frente al deporte.

Conciliación con los estudios

Las dificultades asociadas a la conciliación entre los ámbitos académico y deportivo constituyen una de las principales razones de abandono de las chicas jóvenes, en comparación con sus pares masculinos, según las voces de las participantes.

En su discurso, se identifican varios factores que dificultan la conciliación entre ambos espacios: el alto grado de responsabilidad y esfuerzo que la deportista debe tener para poder llevar los dos ámbitos con un elevado nivel de rendimiento, la ubicación de un centro o lugar de entrenamiento que posibilite o no la conciliación, y los recursos económicos que pudieran obtenerse del deporte. Estos factores condicionarían la capacidad de conciliar o priorizar un ámbito sobre otro y, de esta manera, acelerar el abandono deportivo para involucrarse en los estudios. Se observa que las chicas perciben una mayor responsabilidad de cara a los estudios que los chicos con los que han compartido entrenamientos y competiciones:

> Se nota la tasa de bajas femeninas, que yo lo he notado en equipos. De mi equipo, yo soy la única que sigo de mi año, y de mi año en hombres siguen todos... [...], las bajas cuando ellas entraron en la universidad..., la mujer [se da de] baja más, lo deja más que el hombre... [Paola, jugadora de balonmano, 31 años]
>
> Yo en mi caso, cuando entrenaba en el club, las chicas fueron dejando de nadar poco a poco por el tema de los estudios y no porque ellas quisieran, sino porque la familia le imponía una decisión: "o esto o

> lo otro". Entonces, ellas sí que se volcaron con sus carreras y las carreras que eligieron, bueno eso en mi caso, que no tiene por qué ser el de todo el mundo [...] [Mercedes, nadadora, 31 años]

> En ese aspecto es que las mujeres solemos ser más responsables, ¿no?, entonces como que tenemos más claro a lo mejor... "pues quiero ser abogada y me pongo, y si tengo que dejar el deporte y todo lo dejo, y me centro más" [...], yo creo que eso también es un factor condicionante. [Susana, atleta, 35 años]

No obstante, en el caso de las deportistas que no pudieron conciliar estudios y deporte, al acercarse el final de sus carreras deportivas, los miedos e incertidumbres de cara a la retirada y a la posterior adaptación a una carrera profesional empiezan a aparecer. Estos sentimientos están generados, según sus percepciones, por la inseguridad acerca de su cualificación académica y laboral. Una atleta apunta en este sentido:

> Otra cosa que tiene es que parece que estás perdiendo el tiempo, eh... Y lo estás perdiendo... A nivel de futuro laboral, eres una discapacitada social totalmente [...], laboral y socialmente, porque tú llegas a un trabajo y dices: "porque soy la que más corre... la más rápida del mundo"... "Bueno y qué..."[...], "pues mira a mí me habían dicho que yo iba a ser la campeona que no me iba a faltar de nada...", mentira, ¿sabes?, entonces tú estás dedicando todos los años de tu vida, que hay gente que lo compagina, otra gente no lo compagina... Normalmente, quien llega a las súper medallas no lo compagina. Yo tengo amigos que sí lo han compaginado y son unos elegidos, o súper responsables... [Raquel, atleta, 37 años]

El relato de Raquel sugiere que las dificultades que entraña combinar el proceso formativo y la práctica deportiva requieren de una óptima planificación y gestión del tiempo. En este momento, surgiría un conflicto de intereses en el que se ven obligadas a enfrentar sus objetivos deportivos a los académicos, en algunos casos, por cuestiones circunstanciales y de falta de apoyo desde el ámbito académico:

> Yo donde entrenaba, no podía estudiar una carrera... pero si hubiese vivido en Madrid o en un sitio con una universidad más grande, pues a lo mejor podía haberlo compaginado, pero allí no [...] [Mercedes, nadadora, 31 años]

> Es que también depende de eso, de la ayuda con la que cuentes, porque yo conozco también a los que dices, que llegan a las medallas, y no es lo mismo. Por ejemplo, en Madrid, en el CAR, yo tengo muchos amigos en la BLUME, y si le facilitan, por ejemplo, allí cuando estás en los estudios secundarios, tienes allí el mismo instituto, tienes..., entonces está bien, pero luego te encuentras el caso de L, la atleta de Barcelona que, de hecho al Universitario no participó porque dice: "es que yo he tenido campeonatos, no te digo un control, sino un Campeonato de Europa que me coincidía con un examen y la Universidad no me lo ha podido facilitar", a septiembre..., entonces va a depender de los medios, de la ayuda que a ti te presten [Alejandra, atleta, 19 años].

Dificultades para vivir del deporte a largo plazo

La toma de conciencia de que no van a poder vivir del deporte sin un salario seguro siembra las dudas sobre su permanencia en el deporte competitivo y empiezan a plantearse su continuidad desde otra perspectiva:

> Yo en mi caso, sé que en mi deporte uno no se gana la vida si no es Mireia Belmonte, es decir, si no tienes medallas internacionales muy seguidas... porque también hay gente que tiene medallas internacionales, una, y ya está y no pasa nada. En mi caso, me dio para vivir y yo me sentía una privilegiada porque trabajaba de lo mío, en lo que a mí me gustaba, en mi pasión... Entonces, hasta que lo pude mantener... Cuando ya mentalmente me entró la neura de que mi cabeza estaba a punto de explotar y sabía que no me iba a poder mantener el año siguiente, fue cuando ya surgieron las dudas y decidí continuar de otra manera, pero en el caso de la natación, o eres muy, muy, muy bueno, o no recibes recompensa..., vamos, para mantenerte muchos más años, no, yo iba al mes, sabes, yo iba al mes [Mercedes, nadadora, 31 años]

A las dificultades asociadas al tipo de deporte practicado, se le une el condicionante de ser mujer. Las deportistas perciben que los hombres que practican deportes etiquetados como masculinos tienen mayores posibilidades de hacer del deporte su principal fuente de ingresos y "vivir de él". Sin embargo, las mujeres se enfrentan a una doble problemática: practicar un deporte que "no les pertenece" y ser mujer, tal y como relatan:

> Si hablamos de baloncesto masculino, de fútbol masculino, puede ser... pero en el femenino no creo yo que gane mucho más, con lo cual... [Mercedes, nadadora, 31 años]

> El mío es que como es un deporte tan minoritario, no da nada, nada, nada, pero que conozco a gente que ha estado a punto de entrar en las Olimpiadas y nada... trabajando... [Clara, esgrimista, 27 años]

Conciliación laboral

El inicio de la vida laboral presenta uno de los mayores obstáculos para continuar en el deporte de competición. Las deportistas subrayan aspectos como la incompatibilidad de horario, el gasto energético añadido, e incluso el cambio en el estilo de vida, como factores que pueden conducirlas a plantearse si continuar o no en el deporte en su vertiente competitiva. Las deportistas perciben que la conciliación con el ámbito académico se realiza con mayor facilidad que con el laboral:

> Yo creo que es también por el estilo de vida que llevamos, que todas, la mayoría, estamos estudiando, entonces no es lo mismo compaginar a lo mejor con... [Patricia, jugadora de balonmano, 26 años]

> Un trabajo. [Gema, jugadora de balonmano, 25 años]

> Un horario de estudio con un horario de trabajo. [Patricia, jugadora de balonmano, 26 años]

> Y porque en cualquier trabajo, no te dan las facilidades... [Ana, jugadora de balonmano, 23 años]

> Nadie te las va a dar... [Paola, jugadora de balonmano, 31 años]

> Vamos, es lo primero que te dicen... [Gema, jugadora de balonmano, 25 años]

El hecho de que solo las practicantes de deportes colectivos se hayan pronunciado a este respecto, nos induce a pensar que el tener que ajustarse a un horario de entrenamiento fijo y compartido con otras practicantes

dificulta la conciliación, aspecto que no se da en los deportes individuales, en los que las deportistas pueden, en función del horario laboral, ubicar el tiempo dedicado al entrenamiento.

Por otro lado, las jugadoras tienen interiorizada la idea de que no van a poder vivir del deporte, una asunción que se presume más presente entre las mujeres debido a la menor posibilidad que tienen en comparación con los hombres. Esto les conduce, llegadas a un punto de su carrera deportiva, a tener que apostar por la inserción laboral. El desempeño de un trabajo lleva asociado un gasto energético que pasa factura sobre el rendimiento deportivo:

> Tú no puedes vivir del balonmano..., entonces tienes que buscar algo extra [...], evidentemente, toda persona que no solo tenga balonmano, sino que tenga un gasto externo [se refiere a gasto energético] como es pegarte trabajando en un hospital de médico de ocho a tres, por ejemplo, ese gasto de estar toda la mañana ahí se ve reflejado en el entrenamiento... ¿Qué pasa? Que, si esa persona no tiene que trabajar y directamente está entrenando, pues físicamente estará mejor y todo eso... [Bea, jugadora de balonmano, 23 años]

Sacrificio de otros aspectos vitales

El discurso de las participantes refleja que el camino de las personas en el deporte competitivo conlleva sacrificar otros aspectos vitales. Ellas se muestran plenamente conscientes de ese sacrificio y algunas manifiestan que, en algún punto, han evaluado racionalmente (o piensan que en un futuro lo harán) si dicho sacrificio merece la pena. Concretamente, el hecho de no poder disponer de los fines de semana para dedicarlo a otras actividades porque los invierten en asistir a las competiciones, y el estar lejos de la familia se perciben como obstáculos que a largo plazo puede alejarlas del deporte de competición. En este contexto varias jugadoras relatan:

> Quizás, tener que viajar los fines de semana fuera... [Lucía, jugadora de voleibol, 29 años]

> O un fin de semana, organizar una casa rural o lo que sea y tú te vas todo el fin de semana a Madrid metida en un coche o en un autobús y llegas el domingo, por ejemplo [Patricia, jugadora de balonmano, 26 años]

> Yo quizás estar lejos de mi familia. Y sí que es verdad que a veces te hace plantearte, pues muchas cosas, en plan, ¿me merece la pena estar aquí sufriendo en ese sentido, perdiéndome muchas cosas de mi vida, de mi familia? ¿Me merece la pena realmente? Eso es lo que más me desmotiva [Gloria, jugadora de fútbol sala, 22 años]

> Yo, por ejemplo, que tengo mi trabajo, mi vida por la mañana, que es totalmente opuesta a cuando vengo a entrenar, a mí los fines de semana me cuesta sacrificarlos, es que no tienes vida aparte de esto, es que yo ya no sé lo que es irme un fin de semana por ahí..., porque desde agosto hasta ahora para tener un fin de semana libre, le tenemos que dar gracias al Señor [...] entonces, cuando tú entrenas tantos días, luego el fin de semana y llega un punto... A mí estos últimos años se me está haciendo muy pesado... [Miriam, jugadora de fútbol sala, 26 años]

Lesiones

Las lesiones se presentan como otra barrera que las deportistas perciben como elemento desmotivador en la práctica del deporte de competición que, de persistir en el tiempo, puede desembocar en el abandono deportivo. El hecho de verse retiradas de entrenamientos y competiciones desemboca en un sentimiento de despersonalización que les afecta profundamente. Como dato significativo queremos destacar que las atletas veteranas son las participantes que más aluden a las lesiones como un obstáculo para permanecer en el deporte competitivo a largo plazo. En este marco, detectamos cómo, en este caso, la edad juega un papel determinante en la construcción de sus relatos. Ellas comparan su "infancia deportiva" con las posibilidades con las que cuentan las niñas actualmente, y consideran que precisamente el haberse curtido en unos escenarios en los que han tenido que esforzarse para conseguirlo todo, las ha forjado con la fuerza necesaria para superar las barreras que se han ido encontrando:

> Yo he tenido una lesión desde marzo y he estado mucho tiempo sin poder correr..., es que no podía... [...], yo es que me tengo que curar para seguir haciendo lo que me gusta, es que si no..., estar en tu casa sentada... Y es que te come..., y luego eso, empezar..., yo en mi caso, empezar a engordar..., es que no me veo yo bien para mí..., y tengo que comprar ropa..., que no me veo... [Manuela, atleta veterana, 47 años]

> Es que yo creo que llegando al punto en el que estamos y la edad que tenemos, trabas que nos plantee la vida para poder no correr..., no, es únicamente una lesión, porque nos la puede plantear la pareja, nos la puede plantear el trabajo y lo hemos superado todo... [Claudia, atleta veterana, 54 años]

La presión de la competición

El carácter elitista del deporte de alto rendimiento, el estilo de vida que conlleva y la presión asociada a la consecución de resultados deportivos son percibidos como obstáculos para el mantenimiento de la práctica deportiva competitiva. A pesar de que ellas se consideran privilegiadas por haber podido soportar las características que rodean al deporte de alto rendimiento, reconocen la dureza de este. Así lo ilustran las intervenciones de las deportistas individuales:

> Y también es verdad que la gente [bufidos]... Que nosotras lo vemos normal, pero yo muchas veces también lo pienso en frío y dices, tío es que competir, eso no lo puede llevar cualquier persona, es que ponerse en unos tacos, ponerse en una salida, tirarse a una piscina... Es que no es fácil... [Alejandra, atleta, 19 años]

> Cuando estuve en Barcelona en el CAR, allí la gente dejaba de nadar porque realmente la competición no era para ellos, la gente se daba cuenta de que la presión que se tenía que mantener allí, no iba con ellos... [Mercedes, nadadora, 31 años]

> Yo me siento una elegida porque he sido capaz de estar en el deporte de alto rendimiento, pero no es para todo el mundo... [Teresa, nadadora, 32 años]

Discusión

El discurso de las participantes apunta a la percepción de múltiples barreras que estarían dificultando la permanencia en el deporte competitivo. Particularmente, cinco de las barreras descritas se derivan parcial o totalmente de desigualdades de género, las cuales son percibidas en distintos ámbitos: el socioafectivo, el laboral y el académico, principalmente. En este marco, consideramos que los estereotipos y roles de género

neutralizan el deseo de las chicas en el periodo adolescente de continuar practicando deporte de competición. Las participantes perciben que el deporte se encuentra dentro del repertorio de actividades de ocio de los chicos, pero que no es así para ellas, tal y como previamente recogieron Macías y Moya (2002). Añaden que, durante la adolescencia, notaron cómo aumentó la importancia de la vida social y la presión para invertir más tiempo con el grupo de iguales (Biscomb et al., 2000; Dwyer et al., 2006; Tekavc et al., 2015; Whitehead & Biddle, 2008) y con las primeras parejas, aspectos que perjudicaron la continuidad de la práctica deportiva competitiva en el caso de las chicas (Alfaro, 2004). Resulta curioso cómo las deportistas individuales (tanto las jóvenes como las veteranas) son las que más subrayan esta percepción. Quizás la "soledad" y la dureza de las modalidades deportivas individuales pueden ser factores que vayan progresivamente alejando a las chicas del deporte. En este sentido, detectamos que el deporte tiene una fuerte incompatibilidad con el cumplimiento de los roles sociales adscritos a la mujer (Alfaro, 2004) y a pesar de que el control social para imponer estereotipos hegemónicos de género no es tan explícito actualmente, el modelo hegemónico de feminidad se sigue transmitiendo diariamente en la sociedad actual y sigue vigente en el imaginario colectivo, aunque no esté institucionalizado (Martín et al., 2017).

Las desigualdades económicas que relatan las participantes entre el deporte profesional masculino y femenino y el carácter minoritario del deporte practicado se traducen en grandes obstáculos para continuar con la práctica deportiva profesional a largo plazo (Bowes et al., 2021; Isorna et al., 2019). Esta situación obliga a las deportistas en cierta manera a simultanear el deporte de competición con el desempeño de nuevos roles vitales, como el comienzo de la vida laboral, tal y como también reflejaron otros estudios (Bowes et al., 2021; López & Álvarez, 2019; López de Subijana et al., 2021). En consonancia con investigaciones previas como las de Jaeger et al. (2010) y Harrison et al. (2020), las deportistas se quejan del esfuerzo, la dificultad y el cansancio que supone y que se refleja, consecuentemente, en su rendimiento deportivo.

La conciliación con los estudios frena la permanencia de las chicas en el deporte de competición, según se desprende de sus voces. Los datos producidos nos inducen a pensar que el hecho de ser mujer es un factor que genera una mayor percepción de responsabilidad hacia los estudios, tal y como previamente apuntaron Tekavc et al. (2015). Esta situación desencadena un conflicto de intereses que las "empuja" hacia el abandono, tal y como previamente recogieron investigaciones precedentes (Choi, 2000; Dwyer et al., 2006; Fernández et al., 2003; Isorna et al., 2019; Martínez de Quel et al., 2010; Whitehead & Biddle, 2008). En este sentido, parece que las mujeres tienen bastante interiorizada la idea de que no van a poder vivir del deporte y priorizan la actividad académica como lo verdaderamente relevante de cara al futuro (Barriopedro et al., 2016; Fernández, 2011; López de Subijana et al., 2021). A este conjunto de circunstancias se suma las expectativas familiares, que priorizan los estudios como base del estatus e independencia que proporciona el acceso al mundo laboral (Fernández et al., 2003).

En línea con los resultados de estudios previos, las participantes fueron conscientes de la importancia de la formación académica para su futuro laboral y profesional (López & Álvarez, 2019; López de Subijana et al., 2021; Tekavc et al., 2015).

Las tres deportistas participantes en este estudio que estuvieron en el alto rendimiento y vivieron profesionalmente del deporte, no pudieron conciliarlo con el ámbito académico. Previamente, el estudio de Pérez-Rivases et al. (2020) identificó que una de las competencias que las deportistas manifestaron que necesitaban mejorar para poder combinar estudios y deporte era la gestión eficiente del tiempo en línea con uno de los relatos de una atleta de esta investigación. Tal y como identificaron Selva et al. (2013), sintieron los miedos e incertidumbres de cara a la retirada y a la posterior adaptación a una carrera profesional. En contraposición, las once jugadoras analizadas en el estudio de Harrison et al. (2020) sí pudieron realizar con éxito este proceso de conciliación. Ellas interiorizaron la idea de la educación como un "plan de respaldo" tras la retirada y sintieron apoyos del ámbito universitario, familiar y de los clubes.

Los resultados también sugieren que, en algunos casos, no se llevan a cabo actuaciones para facilitar la conciliación entre los estudios y el deporte, tal y como relataba una atleta. En esta línea, los cambios de grupos de clase para poder entrenar, los problemas con las prácticas obligatorias, la adaptación de los sistemas de evaluación continua y las tutorías académicas constituyen las demandas solicitadas con mayor frecuencia por estudiantes deportistas a las universidades (López de Subijana et al., 2014).

El discurso de las participantes apunta también a barreras que no están asociadas al hecho de ser mujer. Ellas indican que el compromiso, la determinación, la dedicación y el esfuerzo que supone realizar actos de equilibrio entre el tiempo dedicado al deporte de competición y a otros ámbitos de desarrollo personal y social puede suponer un obstáculo que les haga plantearse si merece la pena continuar en el deporte de competición, tal y como también recogieron estudios precedentes como el de Iglesia et al. (2013) y Taylor et al. (2019).

La presencia continuada de lesiones o la dificultad para recuperarse de alguna de ellas se presenta como otro de los obstáculos que dificultan la continuidad de la práctica deportiva competitiva (Isorna et al., 2019). Las participantes relatan cómo las lesiones que han padecido suelen desequilibrarlas emocionalmente debido a la profunda vinculación que sienten hacia el deporte, tal y como previamente identificaron Roessler y Muller (2018).

La presión competitiva a la que las deportistas se han visto sometidas en intensidad y continuidad en el tiempo es otro de los factores que pueden condicionar el abandono del deporte competitivo, en consonancia con algunas investigaciones anteriores (Dwyer et al., 2006; Galatti et al., 2019; Isorna et al., 2019).

La principal aportación teórica de este este trabajo es realizar una contribución a la literatura científica en el campo de mujer y deporte, visibilizando a partir de una metodología cualitativa las principales barreras que perciben para poder disfrutar de una práctica igualitaria. Concretamente, su discurso apunta a que los estereotipos y roles de género asociados al tiempo de ocio, la aparición de las primeras parejas, la conciliación con los estudios y/o con el ámbito laboral, y la dificultad para vivir del deporte a largo plazo son barreras que les afectan por el hecho de ser mujeres. Con respecto a las implicaciones prácticas, consideramos que las instituciones deportivas deben apoyarse en estudios realizados específicamente con mujeres deportistas, como el que aquí se presenta, para diseñar y ajustar las políticas de igualdad según sus propias necesidades, inquietudes e intereses. En este sentido, nos planteamos acercar este trabajo a las federaciones y a otras administraciones implicadas en el fomento de la igualdad en el contexto deportivo, para que las voces de las deportistas puedan ser escuchadas y se

apunte hacia la transferencia del conocimiento científico a los agentes sociales implicados.

La principal limitación de este estudio recae en la cantidad de participantes a las que se tuvo acceso. En este contexto, también consideramos que hubiera sido interesante, contar con un mayor número de deportes con el fin de ampliar el alcance de la investigación; sobre todo, al incluir deportes individuales claramente tipificados como femeninos, como la gimnasia rítmica y artística o la natación sincronizada. Esto habría permitido un contraste empírico y teórico de gran interés. Paralelamente, hubiera sido deseable indagar más en los análisis por atributos de las participantes y profundizar en estas diferencias, en las que no hemos podido adentrarnos por la limitación de palabras en el manuscrito.

Como futuras líneas de investigación, planteamos la puesta en práctica de diseños mixtos que permitan utilizar herramientas del método cuantitativo con el fin de aumentar la muestra y así complementar los datos producidos en este estudio. En esta línea, consideramos que podría ser interesante ampliar el muestreo con mujeres de otras provincias andaluzas y con aquellas que residen o han nacido en otras comunidades españolas con el fin de realizar posibles comparaciones en contextos distintos.

Conclusiones

Los datos de este estudio sugieren que la igualdad en el acceso a los escenarios deportivos no garantiza que las condiciones de práctica sean igualitarias ya que del discurso de las participantes se desprende que aún continuán existiendo barreras por el hecho de ser mujer. En resumen, la percepción de que los chicos superan la etapa adolescente practicando deporte en mayor proporción que ellas debido a que el deporte se encuentra dentro del repetorio de actividades de ocio socialmente aceptado, la presión para invertir más tiempo con el grupo de iguales, la aparición de las primeras parejas, la conciliación con los estudios y las dificultades para poder vivir del deporte a largo plazo constituyen un conjunto de barreras que están condicionadas, según los resultados de este estudio, por los aún arraigados estereotipos de género que siguen vigentes y que tienen un profundo calado en el ámbito deportivo. Sin embargo, el sacrificio que conlleva el deporte de competición en relación al resto de los ámbitos vitales, las lesiones y la presión de la competición mantenida en el tiempo son barreras que pueden afectar en igual medida tanto a mujeres como a hombres. En línea con Martín et al. (2017), consideramos que el reto de nuestra sociedad no termina en asegurar el acceso a la práctica deportiva, sino que debe tener como principal objetivo alcanzar la igualdad efectiva. En otras palabras, las barreras más o menos visibles que apuntan los resultados de este estudio y que aún persisten en las estructuras sociales y en las creencias individuales deben desaparecer. En este sentido, consideramos que es necesario tanto que la sociedad siga avanzando hacia un cambio cultural que, aunque lento, va modificando las relaciones de género en el deporte, como en que las instituciones deportivas y administraciones sean más conscientes de su responsabilidad en el destierro de estereotipos y roles de género, que dificultan la participación de las mujeres en el deporte de competición. De esta forma, las deportistas no tendrán que seguir enfrentándose a determinadas barreras por el hecho de ser mujeres.

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Participation habits, physical complaints and injuries in a sample of Portuguese female artistic roller skaters

Hábitos de participación, quejas y lesiones físicas en una muestra de patinadores artísticas portuguesas

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Abstract

Educators and health professionals need to gain knowledge of the special needs of artistic roller skaters if they seek effective training and preventing physical complaints or injuries. In the absence of epidemiological studies on artistic roller skaters, it is useful to characterize the participants, their participation habits, and the occurrence of physical complaints or injuries. A web-based survey was designed to collect epidemiological information on female artistic roller skaters. The self-report questionnaire included information about the participant, her participation habits, injury history, and physical complaints in the past 12 months. A total of 143 female artistic roller skaters were included in the study. Sixty-seven [46.9%] of the participants had 175 physical complaints in the past 12 months, for an average of 2.61 complaints per skater. The physical complaints mainly affected the lower limbs (53.1%), followed by the trunk (24.0%) and upper limbs (22.9%). The most affected sites were the knee (16.6%), back (10.9%) and wrist (10.3%). Our results suggest that physical complaints are common in artistic roller skating. It becomes crucial to study the etiology of physical complaints and/or injuries. Preventing physical complaints and injuries is crucial for athletes' well-being. Our study results may draw attention and help coaches and educators implement adequate preventive measures.

Keywords: Artistic roller skating, injuries frequency, participation rates, physical complaints, web-based questionnaire.

Resumen

Los educadores y profesionales de la salud deben conocer las necesidades especiales de los patinadores artísticos sobre ruedas si buscan un entrenamiento eficaz y previenen quejas o lesiones físicas. En ausencia de estudios epidemiológicos sobre patinadores artísticos, es útil caracterizar a los participantes, sus hábitos de participación y la ocurrencia de quejas o lesiones físicas. Se diseñó una encuesta basada en la web para recopilar información epidemiológica sobre patinadoras artísticas femeninas. El cuestionario de autoinforme incluía información sobre la participante, sus hábitos de participación, historial de lesiones y quejas físicas en los últimos 12 meses. Se incluyeron en el estudio un total de 143 patinadoras artísticas femeninas. Sesenta y siete [46,9%] de los participantes tuvieron 175 quejas físicas en los últimos 12 meses, con un promedio de 2,61 quejas por patinador. Las quejas físicas afectaron principalmente a los miembros inferiores (53,1%), seguido del tronco (24,0%) y miembros superiores (22,9%). Los sitios más afectados fueron rodilla (16,6%), espalda (10,9%) y muñeca (10,3%). Nuestros resultados sugieren que las quejas físicas son comunes en el patinaje artístico sobre ruedas. Se vuelve crucial estudiar la etiología de las molestias y/o lesiones físicas. La prevención de molestias y lesiones físicas es crucial para el bienestar de los atletas. Los resultados de nuestro estudio pueden llamar la atención y ayudar a los entrenadores y educadores a implementar medidas preventivas adecuadas.

Palabras clave: Patinaje artístico sobre ruedas, frecuencia de lesiones, tasas de participación, quejas físicas, cuestionario basado en la web.

Introduction

Skating is a fitness sport for life, suitable for both children and adults. It helps improve cardiovascular fitness as well as balance and coordination. As a sport, it requires efficient speed, balance, power, strength, endurance, coordination, and agility (Ferrara & Hollingsworth, 2007; Sehgal & Esht, 2019). It can also promote social adaptability in children and adolescents (Zhao et al., 2020).

Most skaters are female and start skating at the age of 5 to 8 years. Usually, they reach the peak of their career at puberty before they are 20 years old (Porter et al., 2007). In terms of disciplines, there are four aspects of the sport: free skating, pairs skating, show and precision, and figure skating (Moreira, 2013; Porter et al., 2007).

Training young children helps them develop from beginners to champions. The athlete would improve his performance from the beginning if he adapted to the exercises, which will lead to his success (Alcaraz-Ibáñez et al., 2022; Sehgal & Esht, 2019).

Artistic roller-skating is considered an evolving sport that is gaining more and more followers in recent years (Lime Survey, 2013), especially children and teenagers. Although it has little recognition at both national and international levels, the increasing number of active athletes, which doubled between 2010 (3268 active athletes) and 2018 (7760 active athletes), has ensured that artistic roller-skating has become a highly competitive sport. High performance demands, rigorous and intense training are usually associated with this sport, which can lead to an increased risk of injury (Porter et al., 2007).

As a significant number of young people experience increased training intensity, the stresses on the dynamics of skeletal growth and muscle development are issues that may arise and deserve investigation (Stricker et al., 2020). Some studies have shown that skating can stimulate muscles and smaller joints and play a positive role in the balanced development of different body parts (Zhao et al., 2020).

However, skating helps to improve the health of athletes through exercise and puts children at particular risk of injury (Knox et al., 2006). Future injuries may be associated with recurrent problems, such as acute or chronic, and appear to be common in artistic roller skating. Therefore, training hourmay increase the prevalence of injuries and physical complaints, either in a regular training regime or in the specific preparation phases for specific events or championships (Porter et al., 2007).

The main objective of this study was to describe the participation habits and physical complaints in a sample of Portuguese female artistic roller skaters within the last 12 months.

Materials and Methods

Sampling frame

A cross-sectional observational study was conducted to collect self-reported data using a web-based questionnaire in the Portuguese language. Data were collected between August and December 2018 by recruiting participants in artistic roller-skating who were members of the Federação Portuguesa de Patinagem (FPP).

Regardless of age, gender, category or discipline, a group of Portuguese artistic roller skaters who are members of the FPP were invited to participate in this study. Normative data were collected from the FPP online platform to ensure that our study sample differed significantly from the Portuguese artistic roller-skating community (FPP, 2019). No additional restrictions were imposed to ensure representativeness.

A total of 1840 artistic roller-skating participants registered in the FPP and their regional association were invited to participate in the web-based survey. Of these, we received responses from 368 individuals (346 women and 22 men). Due to incomplete responses, 212 were excluded. Of the remaining sample of 156 participants, we excluded 13 men based on the study objective. In this way, we were able to obtain complete responses from 143 female artistic roller-skating participants (Figure 1).

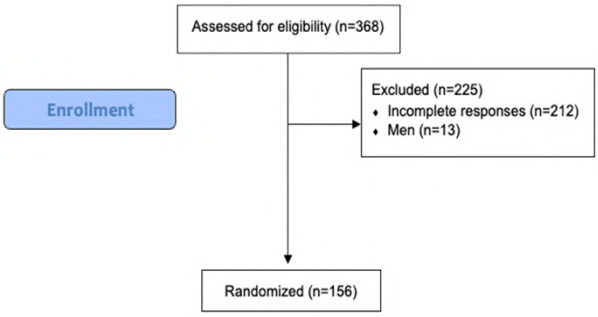


Figure 1. Flow Diagram

Although a substantial proportion (82.5%) were minors, more than half (58.7%) completed the questionnaire without assistance, while the remainder sought help from their parents or guardians. No duplicate responses were detected when monitoring each participant's IP address and email. The web-based survey took an average of eight minutes to complete.

The sample intended to integrate the largest number of female figure skating practitioners in Portugal. Thus, as inclusion criteria were defined: [1] being a federated figure skating practitioner and/or being exposed to training and/or National or International competitions; [2] be a skater in Portugal including the Azores and Madeira archipelagos; [3] be a skating practitioner of any technical level (District, National and/or International); [4] be a skating practitioner of any skating style (free skating, mandatory figures, solo dance, show and precision); [5] be a female skater; and (4) be a skater of any age group.

All 143 skaters were divided into two groups. About 124 (86.7%) children and adolescents who were under 20 years of age were included in the first group (G1), while 19 (13.3%) young adults who were over 20 years of age formed the second group (G2).

Initially, we performed an anthropometric and body composition assessment, through the analysis of weight and height. For 19 female G2 participants, we calculated BMI index using the Centers for Disease Control and Prevention (CDC) adult calculator.

The CDC calculators were used to calculate height, weight, and body mass index (BMI) for children and adolescents (girls). The calculated z-scores and percentiles were adjusted to the Portuguese population (DGS, 2006). For weight <55 kg (percentile >5 and <50 underweight), 60-65 kg (percentile >50 and <75 healthy weight), 70-75kg (percentile >85 and <95 overweight) and >80 kg (percentile >95 obesity). For stature <150 cm (percentile <5 short stature), 155-170 cm (percentile ³5 and <95 normal stature) and ³172 cm (percentile ³95 tall stature). For people < 20 years old, obesity > 95th percentile and overweight > 85th percentile and < 95th percentile.

For adults 20 years old and older, BMI is interpreted using standard weight status categories. For weight status, if the BMI is below 18.5 (124 pounds or less) it is underweight, if it is between 18.5-24.9 (125 pounds to 168 pounds) it is healthy weight, if it is 25, 0-29.9 (169 pounds to 202 pounds) is overweight, and 30.0 or above (203 pounds or more) is obese.

The variables analyzed within the participation habits and training characteristics were initiation and years of practice, associations, categories, disciplines, number of coaches, floors, equipment, participation in tournaments, training area and weekly training hours.

The questions that were used to answer the variables were: What is your category distribution: Iniciation (3 to 7 years old), tot (8 and 9 years old), minis (10 and 11 years old), espoir (12 and 13 years old), cadet (14 and 15 years old), youth (16 years old), junior (17 and 18 years old) and senior (19 or more years old) - for the category variable; Which Figure Skating discipline do you practice: Free, Figures, Show and Precision, Solo Dance or Mixed - for the discipline variable; Which floor do you train on: cement, wood or synthetic - for the floor variable; How many coaches did you have: 1, 2, 3, 4 or more - for the coaches variable; How often do you change the material (boots, chassis, bearings, wheels): every use, weekly, monthly, yearly or when there are problems - for the equipment variable; In the last 12 months did you participate in tournaments, what kind of tournaments did you participate: district, national, international or others - for the variable participation in tournaments; On average, how many hours per week did you skate, in the last 12 months: up to 2h, from 2 to 5h, from 5 to 10h or more than 10h for the variable hours of training.

Web-based questionnaire

The web-based questionnaire was specifically designed to collect information about participants' details, participation habits, and physical complaints related to the practice of artistic roller-skating in the past 12 months. This instrument was made available on the servers of Limesurvey (Lime Survey, 2013).

Before distribution of the final version of the questionnaire, a preliminary version was created and distributed to a representative group of female artistic roller skaters (n=25) to assess instrument's reliability and identify potential complications in its use. The preliminary version was then adapted, and the resulting questionnaire was used in this study.

The final version consisted of five groups of questions: (1) personal data; (2) general details of participation; (3) participation within the past 12 months; (4) injury history; and (5) physical complaints within the past 12 months.

Definition of outcomes

Well-established definitions of 'chronic health conditions', 'previous injuries', and 'physical complaints' were required for some outcomes. A chronic health condition (CHC) was defined as "a heart condition, respiratory disease, osteoarthritis, or the like that might limit the practice of artistic roller skating." A previous injury (PI) was defined as "an injury related to participation in artistic roller-skating that occurred more than 12 months ago." Physical complaints (PC) related to artistic roller-skating participation was defined as "a simple complaint such as complaints or more disturbing symptoms such as pain or complaints, regardless of the need for medical treatment, effect on performance, or absence from artistic roller-skating participation."

Ethical Considerations

Ethical approval for this study was obtained from the Ethics Committee of the Universidade de Évora (CEICASHBE/UE/18032). Although identifying parameters were recorded, they were used only to exclude duplicate responses. After this procedure, each participant was given a code that precluded further identification at any study stage, thus ensuring complete anonymity. A written informed consent form was also signed by each participant for their participation in this study. For those younger than 18 years of age, the consent form was signed by their legal guardian, who assisted in completing the questionnaire and understanding it.

Statistical analysis

Responses to the questionnaire were summarized in the web-based data set and exported to a syntax/data file. The files were then imported into IBM® SPSS® Statistics version 26 (IBM Corp. Released 2019. Armonk, NY), providing descriptive statistics.

The univariate analysis focused on summarizing and describing the results of each question. For categorical variables, we counted frequencies of responses using percentages. For continuous questions, we used measures of central tendency (mean, median) and dispersion (standard deviation, range).

Results

Participant details

The general descriptive elements of the sample are presented in Figure 2.

Categorizing 124 G1 women by percentiles, we found that 103 (83.1%) had normal stature, 14 (11.3%) were tall, and 7 (5.6%) were short.

After classifying weight status into percentiles in 124 G1 women, we found that 105 skaters (84.7%) were at a healthy weight, 14 (11.3%) were overweight, 3 (2.4%) were underweight, and 2 (1.6%) were obese.

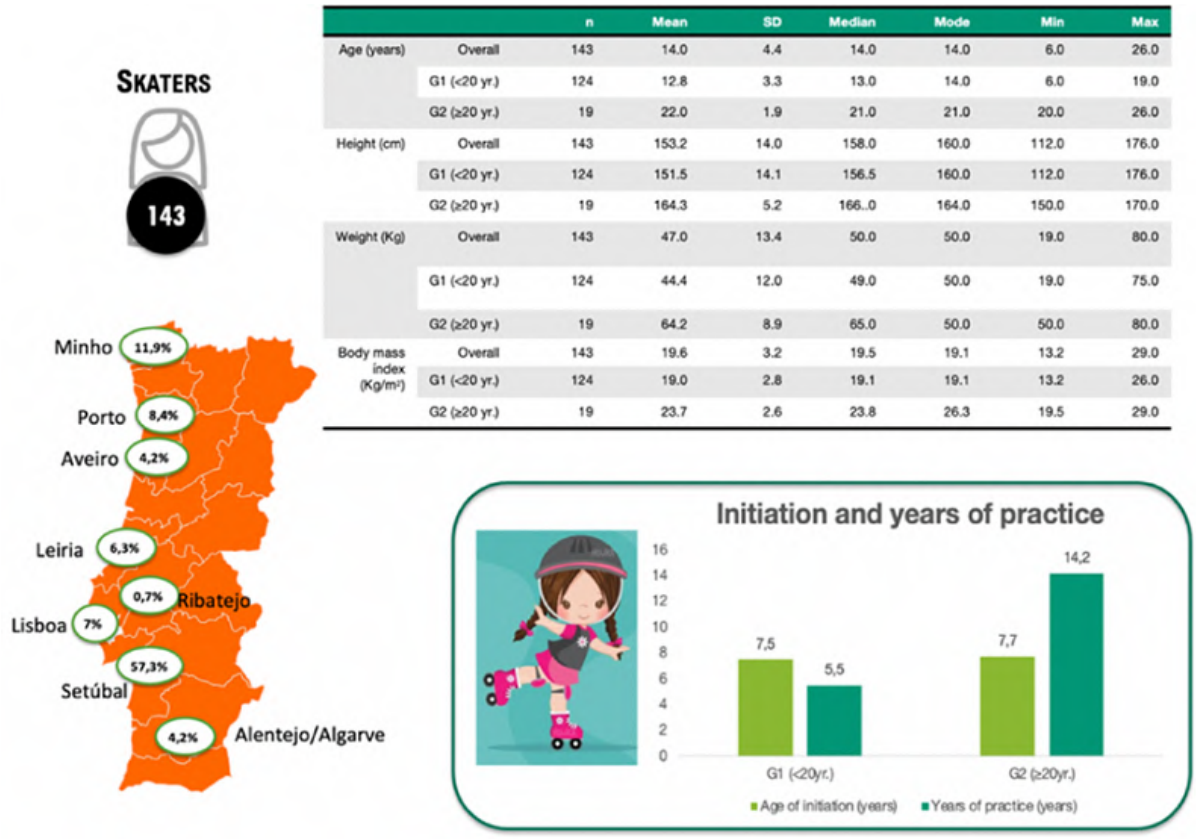
In addition, female skaters frequently reported being right-handed (89.5%) and right footed (86.7%). However, 4 right-handed skaters preferred to use their left foot as the leading side during training.

Participation Habits

About 88.1% of the participants were active out of admiration for artistic roller skating.

A much smaller percentage (11.9%) began training out of a need to engage in physical activity regularly. The most represented regional association was the *Associação de*

Patinagem de Setúbal, with 82 (57.3%) artistic roller skaters, as shown in Figure 2.



		n	Mean	SD	Median	Mode	Min	Max
Age (years)	Overall	143	14.0	4.4	14.0	14.0	6.0	26.0
	G1 (<20 yr.)	124	12.8	3.3	13.0	14.0	6.0	19.0
	G2 (≥20 yr.)	19	22.0	1.9	21.0	21.0	20.0	26.0
Height (cm)	Overall	143	153.2	14.0	158.0	160.0	112.0	176.0
	G1 (<20 yr.)	124	151.5	14.1	156.5	160.0	112.0	176.0
	G2 (≥20 yr.)	19	164.3	5.2	166..0	164.0	150.0	170.0
Weight (Kg)	Overall	143	47.0	13.4	50.0	50.0	19.0	80.0
	G1 (<20 yr.)	124	44.4	12.0	49.0	50.0	19.0	75.0
	G2 (≥20 yr.)	19	64.2	8.9	65.0	50.0	50.0	80.0
Body mass index (Kg/m²)	Overall	143	19.6	3.2	19.5	19.1	13.2	29.0
	G1 (<20 yr.)	124	19.0	2.8	19.1	19.1	13.2	26.0
	G2 (≥20 yr.)	19	23.7	2.6	23.8	26.3	19.5	29.0

Figure 2. Participant´s details

Initiation and experience

On average, initiation in artistic roller-skating began at age 7.5 (± 2.8) years. The youngest skater started practicing at the age of 2 years. The longest practice time was 23 years and involved a skater who started at age 3. Overall, the average experience was 6.5 (±4.9) years. Skaters younger than 20 years had an average experience of 5.31 (±3.8) years. For those over 20 years of age, the average experience was 14.21 (±4.6) years. The overall skater onset and experience data are presented in Figure 2.

Training characteristics

The variables analyzed within the training characteristics were categories, disciplines, number of coaches, floors, equipment, participation in tournaments, training area and weekly training hours.

Categories

Participants in artistic roller-skating are categorized according to the age reached in each sport during the calendar year. Each age group represents a specific category. The distribution of our sample by category is shown in Figure 3. The figure shows that the most frequently observed category in our sample was cadets (21.0%).

Disciplines

A total of 108 (75.5%) skaters mastered free skating. They were followed by 16 (11.2%) in mixed disciplines, with the remainder distributed among solo dance (7.0%), show and precision (3.5%), and figures (2.8%). The distribution of skaters per discipline is shown in Figure 3.

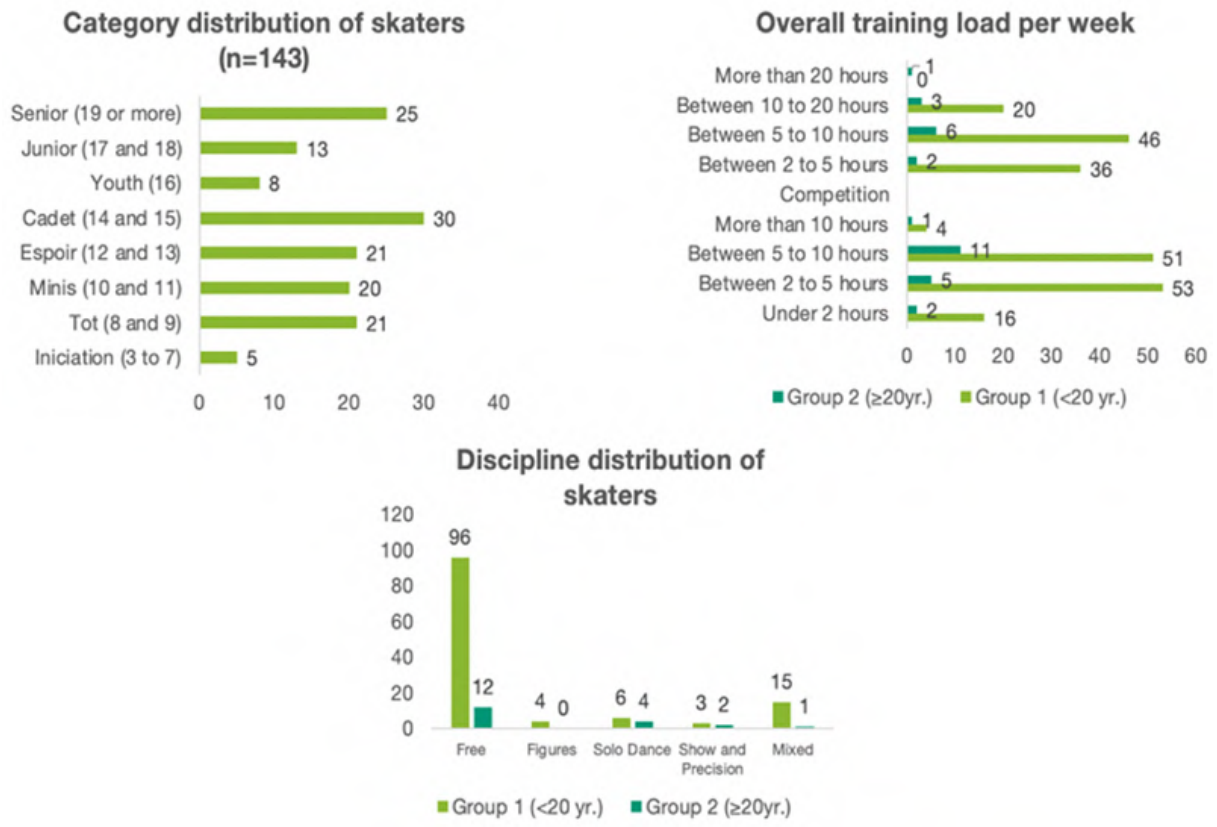


Figure 3. Habits and training characteristics

Coaches

A total of 129 (90.2%) skaters had a coach since they started artistic roller skating. In terms of the number of coaches over the years, most reported having one coach (n=45; 31.5) and 4 or more coaches (n=44; 30.8%). The percentage of those who had 2 or 3 coaches was lower at 21.7% and 16.1%, respectively.

Floors

In the last 12 months, most of the respondents exercised more frequently on wooden floors (79.2%). Only 31 individuals exercised on other floors such as cement (n = 21; 14.1%) or synthetic (n = 10; 6.7%).

On synthetic and wooden floors, skating is mainly "free" (60% and 74.6%, respectively). On cement floors, the "free" and "other" styles were equally distributed, 47.6% and 42.9%, respectively.

Equipment

Skaters maintained their wheels and bearings monthly (44.8%) or whenever they exhibited problems (32.9%). A smaller percentage (13.3%) was found among those who used a weekly maintenance schedule. The most common time periods for skate replacement were over 3 years (48.3%) and within 1 to 2 years (38.5%).

Fewer skaters replaced their artistic roller skates annually (13.3%).

Most skaters replaced their roller plates within 3 or more years (65.7%), followed by those who replaced every 1 to 2 years (32.9%). Only 2 skaters (1.4%) replaced their plates annually. General descriptive details of equipment behavior can be found in Figure 4.

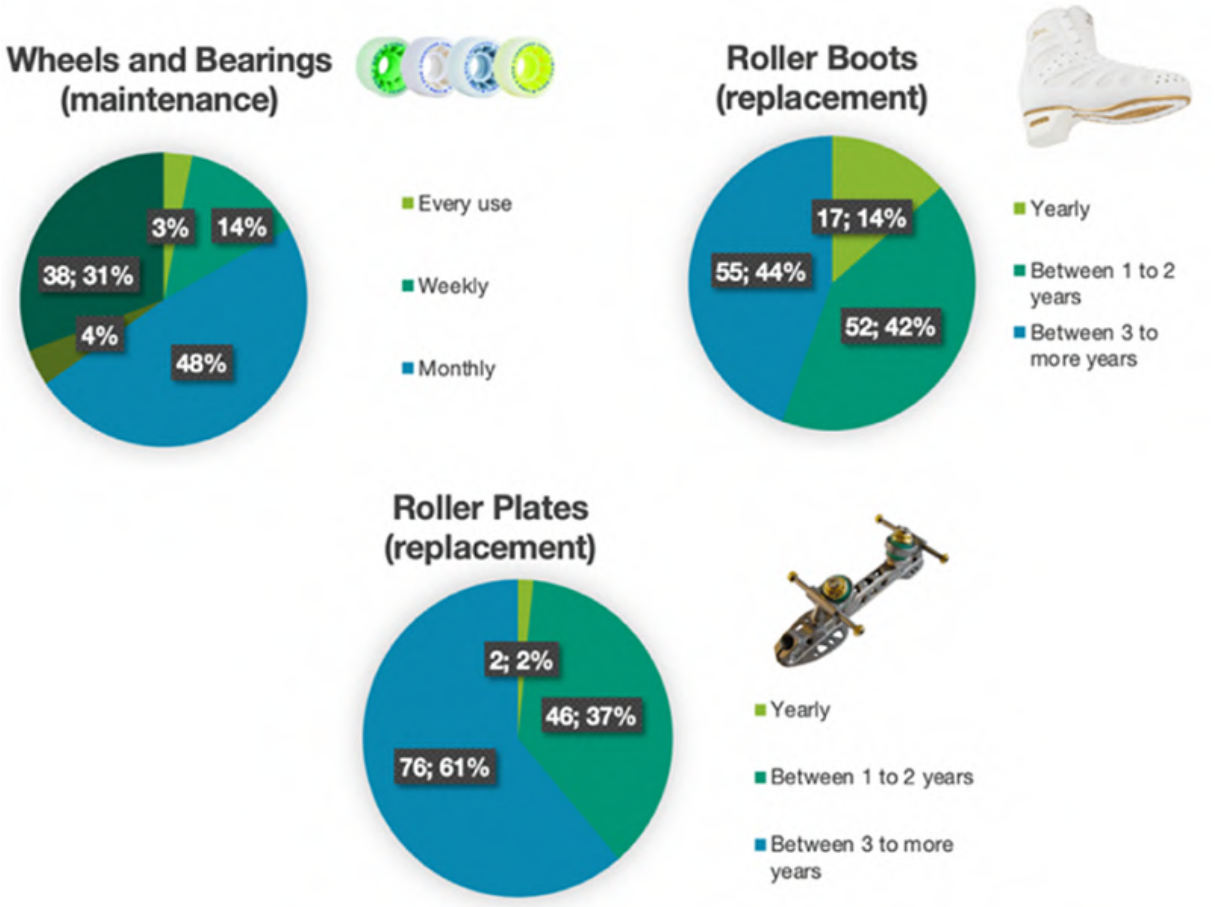


Figure 4. Equipment changes

Participation in tournaments

Participation in tournaments was reported by 114 skaters (79.7%). Seventy-five (52.4%) skaters participated at the district level, 22 (15.4%) at the national level, and 12 (8.4%) at the international level. Only 5 (3.5%) skaters competed at all levels.

Training area and Weekly Training hours

In terms of training load per week, most skaters trained between 2 and 10 hours in the past 12 months [84.0%]. Within this interval of training hours, 62 (43.3%) trained between 5 and 10 hours, while 58 (40.6%) trained between 2 and 5 hours per week.

Eighteen (12.6%) reported training less than 2 hours and 5 (3.5%) more than 10 hours per week.

During the preparation for a tournament, the training hours were adjusted. We analyze the behavior within each category and find that 60 (52.6%) skaters maintained their training load despite preparing for a competition, while 46 (40.4%) skaters followed the opposite approach and increased their training load.

The larger percentages of increase were found in the junior (63.6%) and senior (55.6%) categories. Maintaining training volume was more pronounced in the minis (78.6%) in terms of percentage. Only 8 skaters (7.0%) apparently, decreased their training load in preparation for a competition. The categories in which we did not observe any tendencies to reduce training load were the beginning and the minis. Details of pre-competition training load compared to normal training habits can be found in Figure 5.

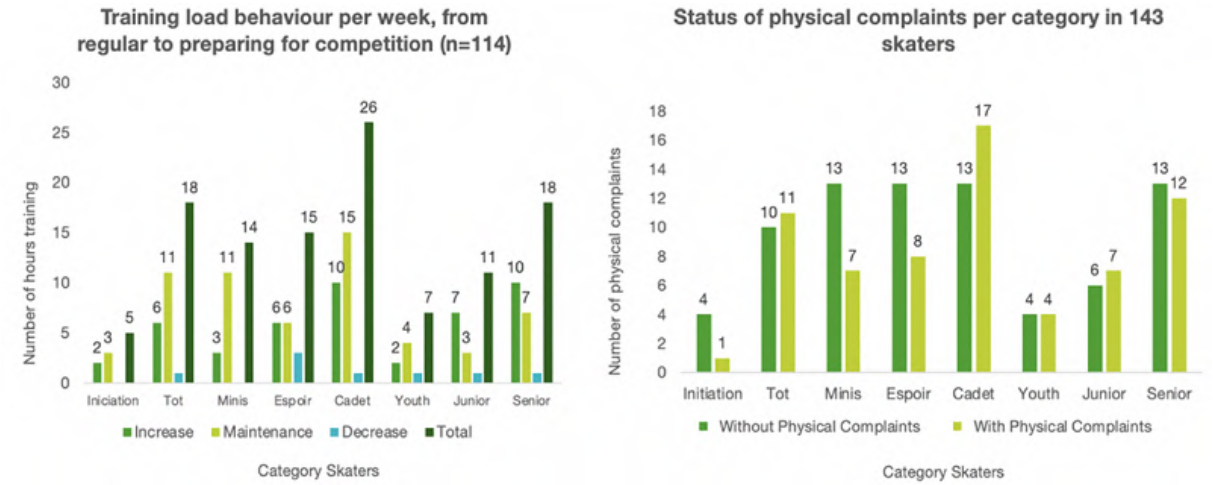


Figure 5. Weekly hours of training and number of physical complaints considering the category of skaters

Health-related results

Physical complaints

Sixty-seven (46.9%) skaters had PC in the past 12 months. Their mean age was 14.2 years (range, 7 to 24 years). The anatomical distribution of 175 PC per 67 skaters is summarized in Figure 6. Physical complaints were most reported in the lower limbs (53.1%), followed by head and boot (24.0%) and upper limbs (22.9%).

When looking at 143 skaters, on the status of PC during the past 12 months per category, we found that only three categories (Tot, Cadet, and Junior) had more skaters reporting complaints (Figure 6). The numerical difference between absence and presence of PC was found in the cadet category (n=4).

As mentioned earlier, there were 67 skaters with a total of 175 PC, which is an average of 2.6 complaints per person. When broken down by category, the highest rate was found in the adolescent category (4.0 PC). The lowest rate was found in the minis (1.86 PC). Except for the former category, the average rate for each level was over 2.0 complaints per skater. The separate PC rates for each level of play are shown in Figure 6.

Of the 67 skaters who reported physical complaints, 67.2% described multiple episodes. The highest number of multiple episodes (n=10) was found in a 21-year-old (senior) female skater.

Anatomical location	n	%
Leg	16	9,1%
Wrist	18	10,3%
Back	19	10,9%
Knee	29	16,6%

Figure 6. Distribution of physical complaints per anatomical distribution of physical complaints

Discussion

This study aimed to investigate the participation habits and physical complaints in a sample of Portuguese female artistic roller skaters within the last 12 months. To the best of our knowledge, this is the first study to analyze training characteristics and the distribution of physical complaints in the Portuguese artistic roller-skating population.

Since there are no epidemiological studies in Portugal, we discussed our results using previous epidemiological information from other countries. In America, inline sports

such as roller hockey, speed skating, roller skating, and roller dancing have become very popular. In addition, millions of Americans have taken up in-line Skating to get around or exercise. Unfortunately, in-line Skating injuries and deaths have increased, especially given the increase in in-line Skating (Schieber et al., 1996).

The study population was categorized using the CDC calculator. When we analyzed the height and weight of the study participants, we found that most were of average height and weight, with a small percentage of overweight and obese (CDC, 2019). Body composition is a critical determinant of athletic performance in various sports and requires safe, practical, and valid instruments to determine body composition and identify changes that occur during the training season (Ackland et al., 2012).

The high-intensity mechanical efforts imposed by existing training loads indicate that there must be musculoskeletal responses to hyperfunction, and if body gestures are asymmetrical from the standpoint of laterality or due to biomechanical factors, adaptations will behave asymmetrically (Massada, 2000). Most participants in this study have homogeneous dominance on the right side, but four have dominance on the right side but use the left lower limb as dominant. In the latter case, it is ambidextrous laterality. They can use both the right and left sides to perform a task efficiently (Faquin et al., 2015).

According to our study, the average age at the onset of practice was 7.5 years, which is consistent with the findings of Porter et al. (2007) that young people start practicing this modality very early, at the age of 5-8 years, and reach the peak of their competitive career in adolescence or early adolescence (Porter et al., 2007). According to our data those who started earlier had longer experience.

Our study's most frequently observed category was that of cadets (14 and 15 years old), one of the categories with the highest number of athlete entries (FPP, 2019). Consequently, it was the second most important category reporting physical complaints. The senior category had the highest number of reported physical complaints. This is consistent with Albaladejo-Saura et al., (2022) and AAOS (2013) data that adolescents are more susceptible to sports injuries because they participate in sports earlier and more intensively and are in the process of rapid growth and neurobiological maturation while navigating an increasingly competitive and selective psychosocial environment.

The pattern of onset of physical complaints in young adolescents is like that of adult athletes (Micheo & Figueroa, 2006). Fortin and Roberts' (2003) study also found that the category with the highest prevalence was seniors (64%). The authors attributed this to pre-existing and overuse injuries and their exacerbation in seniors (Fortin & Roberts, 2003).

Changes in the number of coaches are common. Most of our sample reported changing coaches at least once during their athletic careers. Replacing leaders outside of their natural periods is undoubtedly one of the most important decisions an organization can make. When circumstances lead to mid-cycle changes, there is evidence of a negative correlation between the number of coaching changes and team results (Silvestre, 2011). Coaches are interested in knowing and finding suitable training venues and the safest ones to maintain the athletes' training. In addition, they are equally interested in monitoring the development of equipment and other training materials because when used properly, they can help prevent injuries. Although it is almost always in the background, both the equipment used by the athlete and the location where the training or competition takes place are potential sources of traumatic injury (Massada, 2000). A large percentage of skaters exercised on wooden floors. However, half of the cadets practiced on a cement floor. Differences were found between the type of floor and the type of skating. More than half of the skaters trained on synthetic and wooden floors.

Maintenance of the material is fundamental to the technical quality/performance of the athletes. According to our study, almost half of the participants performed monthly maintenance on wheels and bearings. For boots and chassis, half of the participants usually replaced them within three years. Our results do not agree with those of Porter et al. (2007), in whom boots are usually changed every 6 to 12 months, depending on the care and maintenance that the skater gives to their equipment to prevent its deterioration. Boots have become increasingly rigid over the last 20 years. This situation seems to have contributed to skaters' ankles becoming more brittle (Porter et al., 2007). This could explain why the ankles were the second most affected by physical complaints in our study.

Regarding the training load per week in the last 12 months, most skaters trained between 2 and 10 hours. A much smaller percentage reported training less than 2 hours per week. Very few reported training more than 10 hours per week. During tournament preparation, training hours were adjusted, with half of the skaters maintaining their training load during this period, while the remainder went the opposite way and increased their training load. In youth, roller skaters typically spend 15 to 30 hours on the ice and another 5 to 15 hours doing off-ice activities. Training continues throughout the year to prepare for the competitive season (Ferrara & Hollingsworth, 2007).

Most skaters reported participating in tournaments, both nationally and internationally, although the latter was less common. It is hypothesized that the pressure of competition and the pursuit of success tend to lead the athlete to a higher level of risk, and they are more likely to have physical complaints and/or injuries. Thus, it is hypothesized that athletes who compete more regularly and at a higher level are more likely to suffer physical ailments and/or injuries (Porter et al., 2007).

According to our study results, half of the artistic roller skaters had physical complaints within the last 12 months. Most physical complaints were reported in the lower limbs, followed by the head, trunk, and upper limbs. The most common sites were the knees, followed by the back and wrists. In contrast, Tse et al. (1987), found that the wrist was the most affected region.

Although lower extremity injuries are common in individual skaters, pair skaters are at increased risk for the trunk, shoulder, and upper limb injuries, as well as concussions and lacerations (Ferrara & Hollingsworth, 2007).

According to data from American skaters, injuries wrist fractures were the most common. As we can see in our study, wrist physical ailments were the third most cited. Studies have shown that most of these injuries occurred in skaters who did not receive adequate skating instruction (Schieber et al., 1996).

Limitations

Our study presents limitations regarding the choice of material because it does not present the reason for the exchange of material, in this case if they were exchanged for technical reasons or because the athlete's foot grew.

In addition, our study has several limitations related to the chosen methodological design that may limit the generalizability of the results.

A major limitation of this study is that it was conducted retrospectively. Even with a shorter time of 12 months, the possibility of recall error must be considered. In addition, due to the study's retrospective nature, only a relationship between the variables and physical complaints could be established, not causality. Thus, in future studies, authors should consider the distinction between complaints and injuries due to falls and bumps, and position due to overuse (overtraining, among others), which allows results that can provide the technician with more practical information.

The self-report nature of the questionnaire and the reliance on respondents to answer truthfully should also be seen as a limitation. There was an implicit assumption that all tutors and respondents completed their survey honestly to reflect their actual attendance habits and status [with or without] physical complaints.

We were unable to validate self-reported physical complaints because we relied only on respondents' honesty. However, in CHC, self-reports are usually 90% valid, which increases the likelihood that they are accurate (Brener et al., 2003). The possibility of misinterpretation of the questions and incomplete responses should also not be ruled out.

In addition, we do not believe that any possible overrepresentation of incidents was due to the likelihood that skaters who experienced physical complaints participated in the survey. The web-based questionnaire was advertised as a tool to investigate participation habits. Therefore, response bias was not expected.

A low response rate and small sample size could affect the generalizability of the results. However, to ensure the sample's representativeness, we used normative data from the FPP to compare the study sample to the general skating population in terms of gender and category.

Finally, we suggest that you maintain good supervision of the skaters to avoid physical complaints.

Conclusions

Our results suggest that physical complaints are common in figure skating. Multiple episodes were common. Most reports of physical complaints were found at the knees, followed by the back (lower), ankles, and legs.

In addition, instructions and guidelines must be available to all athletes, groups of skaters must be formed according to their abilities and skills, and boots must be of a high standard and have sufficient leg length to support the ankle, as many of the fractures involve the lower part of the tibia and fibula.

Prevention of sport-related physical complaints is crucial, and epidemiological investigation is considered the first step. By studying the etiology of physical complaints and implementing effective preventive measures, we can reduce the number of cases and their recurrence, the duration of disability, and the associated economic burden.

Recommendations for future studies

More research is needed. Analyze a larger sample comparing athletes by level and specific sport. And finally, create associations between the variables studied so that we can understand how these variables influence each other.

Author Contributions

Conceptualization, Jorge Bravo and João Sousa; Data curation, Jorge Bravo and João Sousa; Formal analysis, Jorge Bravo and João Sousa; Investigation, Carolina Cabo; Methodology, Carolina Cabo; Resources, Carolina Cabo; Supervision, Jorge Bravo and João Sousa; Validation, Jorge Bravo and João Sousa; Visualization, Jorge Bravo and João Sousa; Writing – original draft, Carolina Cabo; Writing – review & editing, Carolina Cabo.

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Effect of the intervention 'Deportigualízate' on the attitudes towards equality of physical education professionals in training

Efecto de la intervención "Deportigualízate" en las actitudes hacia la igualdad de profesionales de la educación física en formación

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Abstract

Recent studies show the need to include the gender perspective in the training of pre-service professionals in physical education and physical activity, as well as the scarcity of existing interventions in this field, specifically, in the Spanish context. The purpose of this article is, on the one hand, to present the intervention '*Deportigualízate*,' an intervention based on the principles of critical feminist pedagogy in the context of Physical Activity and Sport Science (PASS) undergraduate program. On the other hand, to study its effect on the attitudes towards gender equality of pre-service professionals in physical education and physical activity. To this end, a sample of 39 students from the PASS degree of the University of A Coruña participated in the study. A quasi-experimental design of two groups with pre-test and post-test was followed. Data was collected through the *School Doing Gender/ Teachers* scale (Piedra, 2010). The results found show an improvement in the attitudes towards gender equality of the students participating in the intervention, concluding that '*Deportigualízate*' has a positive effect on the profesional profile towards gender-sensitive teaching of PASS students.

Keywords: Gender-senstive teaching, Pre-service training, Physical education, Higher education, Critical feminist pedagogy.

Resumen

Investigaciones recientes demuestran la necesidad de incluir la perspectiva de género en la formación de profesionales de la actividad física y la educación física, así como la existencia de un escaso número de intervenciones existentes en dicho campo, específicamente, en el contexto español. La finalidad de este artículo es, por un lado, presentar la intervención "*Deportigualízate*", una intervención basada en los principios de la pedagogía crítica feminista en el contexto del Grado de Ciencias de la Actividad Física y el Deporte (CAFYD). Por otro, estudiar su efecto en las actitudes hacia la igualdad de género de los y las futuras profesionales de la actividad física y la educación física. Para ello, se contó con una muestra de 39 estudiantes del grado de CAFYD de la Universidade da Coruña. Se siguió un diseño cuasiexperimental de dos grupos con pre-test y post-test, utilizando la escala *School Doing Gender/Teachers* (Piedra, 2010) para la recogida de datos. Los resultados encontrados muestran una mejora en las actitudes hacia la igualdad de género del alumnado participante en la intervención, pudiendo concluir que "*Deportigualízate*" tiene un efecto positivo en el perfil profesional hacia la coeducación de estudiantes de CAFYD.

Palabras clave: Coeducación, Formación inicial, Educación física, Enseñanza universitaria, Pedagogía crítica feminista.

Introduction

Despite great advances in terms of equality, recent research shows that some issues related to gender and physical education (PE) are still present (Scraton, 2018; Stride et al., 2022). Thus, for example, Kirk (2000b) already pointed out (more than twenty years ago) that the low participation of girls in sport and PE was worrying and, as recent global statistics reflect, this reality continues to be maintained (for example, see Emmonds et al., 2021). However, the problem lies not only in the amount of practice, but in the type, the existing barriers or the implications of the fact that the physical sports context continues to be an androcentric and heteronormative construction (Bevan et al., 2021; Devís-Devís, Pereira-García, López-Cañada, et al., 2018).

In this sense, despite the fact that educational contexts have been considered for decades fundamental agents of change in favor of more democratic societies (hooks, 1994; Postman & Weingartner, 1971), the reality of PE is that it is a space in which discourses that marginalize certain identities and corporalities predominate, (re)producing the *status quo* of gender (Fitzpatrick, 2019; Kirk, 2020; Landi et al., 2016; Martos-García et al., 2020). Thus, both national and international research indicates that PE teachers, through hidden curricula, continue to perpetuate gender relations and stereotypes based on inequality (Alvariñas-Villaverde & Pazos-González, 2018; Gerdin, 2017; Walseth et al., 2017).

Therefore, numerous studies focus on the importance of initial training received by physical education professionals (Cameron & Humbert, 2020; Flintoff & Scraton, 2006; González-Calvo et al., 2021; Ovens et al., 2018). Likewise, in the case of Spain, the current legislation also calls for the creation of initiatives that allow changes to be made in the university system in favor of gender equality. For example, we could highlight Organic Law 3/2007, of March 22, for the effective equality of women and men; or the State Pact against gender violence (Ministry of the Presidency, 2019), among others.

This is why numerous authors have demonstrated how critical theory and pedagogy can be put into practice in the classroom, both in the international (Fitzpatrick, 2013; Kirk, 2000a; Luguetti et al., 2019; Oliver & Oesterreich, 2013), and national context (Devís-Devís, Pereira-García, Fuentes-Miguel, et al., 2018; Lleixà Arribas et al., 2020), recognizing that "it is the ability of students to reflect and criticize dominant discourses and practices that makes transformation possible" (Varea & Tinning, 2016, 1013).

However, recent studies carried out in our context show that despite this regulatory framework, the incorporation of the gender perspective in the degrees of Physical Activity and Sports Sciences (PASS) in Spain is anecdotal (Serra, Soler, et al., 2018) , determining that 74.6% modules do not make any reference to issues related to gender. In this context, it is necessary to add that the social representation of these studies acts as a form of symbolic violence towards people who want to study this career, an aspect that results in an enormous masculinization of these studies (Serra et al., 2019, 2021).

However, when studying the curricular matrices of the degrees in PASS, the authors also highlight that the subjects have a great transformative potential in favor of equity and social justice (Serra et al., 2016). In this sense, there are very complete and accessible works that provide some of the fundamental bases for the incorporation of the gender perspective in PASS studies, such as the Decalogue for university professors and research staff, published by the Association of Professionals of Physical Education and Sport of Catalonia (Serra, Soler, & Vilanova, 2018).

Even so, despite initiatives like this, recent studies affirm that there is no research on transformative proposals in the context of PASS, based on feminist principles and perspectives (Lynch & Curtner-Smith, 2018). Likewise, the research points out the importance of understanding the reality of students and practices in relation to them, at specific times and contexts (Neto et al., 2020). Therefore, detecting the need to continue building knowledge in relation to how sexist discourses can be challenged in the context tertiary education, the following study is proposed.

The purpose of this article is to present an intervention designed and carried out under the principles of feminist critical pedagogy (Crabtree et al., 2009; Dewar, 1991; hooks, 1994) in the specific context of the PASS degree at the University of A Coruña, and to study its effect on the participants. For this, both the design of the intervention proposal, as well as the collection and analysis of data, is based on the theory Doing Gender (West & Zimmerman, 1987) later developed by Crawford and Chaffin (1997). Thus, it is understood that gender is the result of a social construction that is created through individual, interpersonal and sociocultural relationships.

In this article, first, the methodological aspects of the study will be detailed and the intervention 'Deportigualízate' will be briefly presented. Next, the results of the study in relation to the attitudes and profile towards gender equality of the participants will be shown. Finally, the results will be discussed by providing conclusions in relation to them, as well as presenting the limitations of the study, in order to continue contributing to future research.

Method

Design

The data presented in this paper are part of a larger project, framed within a transformative research paradigm (Chilisa & Kawulich, 2012; Sweetman et al., 2010), for which a mini-ethnographic case study was carried out (Fusch et al., 2017) with a critical approach (Creswell & Poth, 2018; Madison, 2012; Suárez, 2012), using mixed methods, and adopting the parallel convergent design proposed by Creswell and Plano-Clark (2017).

It should be noted that, due to a matter of space limitation, the study data generated qualitatively through written reflections, research journals, workbooks, or discussion groups (among other methods), will be presented in another article that is in preparation.

Therefore, this article will only present the results obtained quantitatively, after collecting the data through a quasi-experimental design of two groups with pre-test and post-test. Thus, one of the groups participated in the intervention 'Deportigualízate' (experimental group), while the other group did not receive the intervention and, therefore, was the control group.

Participants

For the selection of the sample, an intentional and convenience sampling was followed. Specifically, the sample of the study is made up of third- and fourth-year students of the Degree in PASS of the University of A Coruña during the 2020-2021 academic year. Specifically, the experimental group was studying an elective subject (offered to both third and fourth grade students) called 'Women and Sport;' while the students of the control group were not taking the indicated optional subject.

The intervention was framed in the optional subject 'Women and Sport' due to the interest and support of

the teachers responsible for the subject, as well as the alignment of 'Deportigualízate' with the objectives and contents of the subject. In this regard, it should be noted that while attendance at the 'Deportigualízate' sessions was not optional because such intervention was included in the teaching guide of the subject; participation in data collection was voluntary.

It should also be noted that, before the intervention, all students (both in the control group and the experimental group) indicated that they had not received specific training in gender issues, although they did indicate that, during the degree at PASS, they had taken three subjects that included contents related to the gender perspective.

Prior to the intervention, a total of 43 students participated in the data collection, aged between 19 and 31 years (age 21.98±2.74; 30.2% women and 69.8% men). A total of 39 students aged between 20 and 32 years participated in the data collection after the intervention (age 22.01±2.81; 38.5% women and 61.5% men).

The experimental group that participated in the intervention is made up of a total of 24 students (11 women and 13 men), aged between 20 and 29 years (age 22.08±2.302). The unusual number of women in the group may be due to the optional nature of the subject. For this same reason, the profile of the students in the group may not be representative of the reality of the degree.

On the other hand, in the control group participated a total of 22 students in the pre-test aged between 19 and 31 years (age 21.86±3.12; 18.2% women and 81.8% men), and 15 students in the post-test aged between 20 and 32 years (age 22±3.82; 26.7% women and 73.3% men). The reduction of participants in data collection may be related to the voluntary nature of participation in the study, the fact that they were at examination period, and all the difficulties arising from the COVID19.

Instrument

For the collection of the data presented in this article, the scale School Doing Gender/Teachers was used (Piedra, 2010; Rebollo et al., 2011), with the dual objective of characterizing the sample, and evaluating the effect of the intervention on the attitudes towards gender-sensitive teaching of the sample. It should be noted that the modified version was used for future and future professionals (Fernández & Piedra, 2010; Piedra, 2010), which presents certain language adaptations in some items in order to adapt to the circumstances of professionals who are in training.

This scale is made up of 30 items with closed response Likert type of 5 points, where 1 corresponds to 'totally disagree' and 5 with 'totally agree.' All items are organized around the three dimensions involved in the construction of gender according to the Doing Gender theory of West and Zimmerman (1987) and later developed by Crawford and Chaffin (1997): sociocultural (items 1 to 10), relational (items 11 to 20) and personal (items 21 to 30).

Following Rebollo et al. (2011), the global sum of the items allows to obtain a score to determine the profile of the subjects towards gender-sensitive teaching. Thus, if a sum of less than 89 points is obtained, a blocking profile is determined, understood as one that expresses rejection of gender-sensitive proposals and makes negative assessments of them; if between 90 and 119 points are obtained, the profile is adaptive, being one that recognizes the signs of inequality present in the social discourse and showing a politically correct position; finally, if more than 120 points are obtained, a gender-sensitive profile is considered, being the one that recognizes inequality, positively and publicly values the proposals and initiatives aimed at eradicating them, and shows a clear attitude of collaboration in the promotion of equality values.

Procedure

The scale Doing Gender/Teachers was completed in a pre-test, both by the experimental and the control group, without any explanation being made about the contents or objectives of the intervention in question. Subsequently, the modules were developed normally for a month, implementing the intervention 'Deportigualízate' with the experimental group. After the intervention (which will be explained below) a post-test was performed, using the same scale again in both groups.

All participants gave their informed consent to obtain personal data in the two moments of data collection, after having been informed of the objective of the study, as well as the processing of the data and their rights. All data has been treated confidentially and anonymously in accordance with current regulations on the protection of personal data.

In this regard, Regulation (EU) 2016/697 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC has been followed; as well as Organic Law 3/2018 of December 5, on the protection of personal data and guarantee of digital rights.

Description of the intervention

The intervention 'Deportigualízate' is based on the principles of feminist critical pedagogy (Crabtree et al., 2009; hooks, 1994; Shrewsbury, 1997), with special emphasis on the challenge of power relations. For this, both the design of the intervention and its own implementation were based on democratic and dialogic principles, understanding education as a practice for freedom (Freire, 1970). In this way, the intervention was designed in several phases, after holding meetings with PASS students, as well as with recently graduated professionals, or experts in equality.

All these meetings served to define, together with the existing scientific evidence, the concrete form that the intervention would take. In this way, in addition to bearing in mind the importance of establishing non-hierarchical relationships, it was also determined the need to implement participatory activities that would allow the critical analysis of the environment, the incorporation of intersectionality and the promotion of action and social transformation; being all key aspects of feminist pedagogy (Crabtree et al., 2009).

To this end, four 90-minute sessions were designed based on a task-based approach (Kirk, 2000a), which were complemented by an individual workbook outside the classroom hours. The entire intervention was built around four main thematic axes, following the theory Doing Gender proposed by West and Zimmerman (1987):

1. The problem of inequalities.
2. The social construction of gender.
3. The social construction of gender in sport.
4. Students as agents of change.

With the aim to comply with the established principles, all tasks were oriented to the self-discovery and self-learning of students (McKay & Pearson, 1984), facing what Freire (1970) calls the 'banking' conception of education as a form of oppression. Likewise, in order to promote a safe space in which all people had a voice and could be heard,

different strategies were used, such as working in small groups, watching videos, or debating with the whole class, following the feminist proposal of Dewar (1991).

Finally, it should be noted that an Instagram profile was created as a strategy to promote dialogue between peers, as well as to have a platform in which to share the reflections and artifacts created by the students. In addition, a questionnaire developed in Microsoft Forms was shared so that, anonymously and voluntarily, students could leave their comments after each session (what they liked most and what they liked the least, on what topics they would like to have more information, etc.), an element that facilitated the fact of being able to adapt the intervention to the reality of the students and, thus, to allow it to take a truly student-centered approach.

Although it is true that, due to the short duration of the intervention, the adaptations were minimal, the fact of having constant feedback from the students allowed to include certain topics in the classroom debates that had not been taken into account in the previous design (such as, for example, the use of social networks as a form of social activism). In addition, this feedback allowed to elaborate and disseminate works and complementary literature so that the students could expand their knowledge based on their interests.

Data analysis

Both the items of the scale School Doing Gender/Teachers, as well as the indices of the general scale (sum of all items) and the sociocultural, relational and personal subscales (sum of the corresponding items), have been treated as quantitative variables, so they will be described by the corresponding measures of central tendency and dispersion.

For the comparison between the control and experimental group, the following analyses have been performed for both the pre-test and the post-test: the t test has been used for two independent samples to verify if there are differences between the means, and as prerequisites the Shapiro-Wilk test has been used (since the sample size is less than 30) for both the subjects of the control group and those of the experimental. In addition, the Levene test has been used to contrast the equality of variances. If any of these prerequisites are not met, the non-parametric route has been used with the Mann-Whitney test. Specifically, the non-parametric route has been used when comparing the control group with the experimental in the personal sum variable; both in the pre-test and in the post-test.

For the comparison of the pre-test with the post-test, both in the control group and in the experimental group the following analyzes have been carried out: the t test has been used for two related samples to verify if there are differences between the means, and as prerequisites the Shapiro-Wilk test has been used (since the sample size is less than 30) for both the subjects of each group in the pre-test and in the post-test. If any of these prerequisites are not met, the non-parametric route has been used with the Wilkoxon test and the Signs test. Specifically, the non-parametric route has been used when comparing the pre-test of the experimental group with the post-test of the same group, in the personal sum variable.

In the case of variables in nominal scale, crosstabs, and association measures (Cramér's V) have been used to assess the association between them.

Results

Preliminary analysis

First, as shown in Table 1, when comparing the means of both groups in the pre-test, no statistically significant differences were found in the sociocultural and relational subscale between the control and experimental groups (p > .05), although statistically significant differences were found between both groups in the general sum of the scale (p = .03) and the personal subscale (p = .012). Therefore, although it cannot be said that both groups are statistically equal as a starting point, there is similarity in terms of the sociocultural dimension, that is, in relation to conceptions about equality policies and center organization; as well as in terms of the relational dimension, which measures issues related to future professional practice, as well as gender expectations and relations.

Table 1. Description and comparation of the control and experimental group in the pre-test

Variable	Group	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	Sig. Levene	Sig. Comparation
Total sum	Control	22	121.41±10.6	0.074	0.195	**.030**[1]
	Experimental	21	127.86±8.01	0.738		
Sociocultural sum	Control	22	40.41±3.9	0.384	0.627	.915[1]
	Experimental	21	40.29±3.64	0.076		
Relational sum	Control	22	39.73±4.24	0.284	0.804	.072[1]
	Experimental	21	42.1±4.17	0.668		
Personal sum	Control	22	41.27±6.2	0.17	0.054	**.012**[2]
	Experimental	21	45.48±3.94	**0.006**		

[1] Significance of the t-test for two independent samples.

[2] Significance of the Mann-Whitney test.

Effect of the intervention

Analysis of the groups: post-test

When comparing the means of the control and experimental group in the post-test (Table 2), statistically significant differences were found both in the scale at the general level (p = .000), and in the sociocultural (p = .000) and relational (p = .000) subscales. Therefore, it can be determined that the increase in the means of the experimental group with respect to the control is statistically significant, which means a more favorable profile towards gender-sensitive teaching and gender equality. However, even though in the personal dimension

there is also an increase in scores, this difference cannot be considered statistically significant (p > .05).

Table 2. Description and comparation of the control and experimental group in the post-test

Variable	Group	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	Sig. Levene	Sig. Comparation
Total sum	Control	15	113.41±5.85	0.078	0.009	**.000**[1]
	Experimental	24	132.54±7.89	0.197		
Sociocultural sum	Control	15	36.2±2.65	0.28	0.95	**.000**[1]
	Experimental	24	43±2.52	0.05		
Relational sum	Control	15	31.2±2.68	0.706	0.007	**.000**[1]
	Experimental	24	41.71±5.4	0.46		
Personal sum	Control	15	46.2±2.7	0.221	0.72	.062[2]
	Experimental	24	47.83±2.66	**0.000**		

[1] Significance of the t-test for two independent samples.

[2] Significance of the Mann-Whitney test.

Analysis of the control group: pre-test and post-test

After comparing the means of the control group of the pre-test with the post-test, statistically significant differences were found both at the general level (p = .000), and in each of the subdimensions of the scale: sociocultural (p = .000), relational (p = .000) and personal (p = .001). Therefore, the results indicate that the students of the control group significantly decreased their score in relation to favorable attitudes towards gender-sensitive teaching both in the total summation, as in the sociocultural and relational summation, but not in the personal summation (Table 3).

Table 3. Description and comparation of the control group pre-test and post-test

Variable	Pre-test			Post-test			Sig.
	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	Comparation
Total sum	22	121.41±10.6	0.074	15	113.6±4.49	0.078	**.000**[1]
Suma sociocultural	22	40.41±3.9	0.384	15	36.2±2.65	0.28	**.000**[1]
Sociocultural sum	22	39.73±4.24	0.284	15	31.2±2.68	0.706	**.000**[1]
Suma personal	22	41.27±6.2	0.17	15	46.2±2.7	0.221	**.001**[1]

[1] Significance of the t-test for two related samples.

However, when studying the association between the profile of the professionals in training of the control group towards gender-sensitive teaching and the moment of data collection, it is found that there is a strong dependence between both variables (Table 4). Thus, it is interesting to note that while in the pre-test there were statistically more people than expected with a gender-sensitive profile; in the post-test, the entire sample showed an adaptive profile towards gender-sensitive teaching, while, statistically, it was expected that there would be six students with a gender-sensitive profile.

Table 4. Crosstab and measures of association between the profile towards gender-sensitive teaching of the control group according to the moment

			Profile towards gender-sensitive teaching		Total
			Adaptive	Gender sensitive	
Moment	Pre	Count	7	15	22
		Expected count	13.1	8.9	22.0
		Residue	-6.1	6.1	
		Typified residue	-1.7	2	
	Post	Count	15	0	15
		Expected count	8.9	6.1	15.0
		Residue	6.1	-6.1	
		Typified residue	2	-2.5	
Total		Count	22	15	37
		Expected count	22.0	15.0	37.0

Sig.: 0.000; Valor V de Cramer: 0.682

Therefore, even though the aforementioned results indicate an improvement in the beliefs of the personal dimension, at a general level, the results suggest the possibility that the fact of not participating in the intervention 'Deportigualízate' has a negative effect on the attitudes towards equality of the people of the control group, since they statistically worsen their profile towards gender-sensitive teaching.

Analysis of the experimental group: pre-test and post-test

When studying the impact of the intervention in the specific case of the experimental group, comparing the pre-test and post-test means, statistically significant differences were found both at the general level (p = .000) and in all the dimensions studied: sociocultural (p = .000), relational (p = .005) and personal (p = .000; table 5). Thus, it can be assured that the increase in scores both in the total sum, as well as in the sociocultural and personal summations, are significant.

Table 5. Description and comparation of the experimental group pre-test and post-test

Variable	Pre-test			Post-test			Sig. Comparation
	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	
Total sum	21	127.86±8.01	0.738	24	132.54±7.89	0.197	**.000**[1]
Suma sociocultural	21	40.29±3.64	0.076	24	43±2.52	0.05	**.000**[1]
Sociocultural sum	21	42.1±4.17	0.668	24	41.71±5.4	0.46	**.005**[1]
Suma personal	21	45.48±3.94	**0.006**	24	47.83±2.66	**0.000**	**.000**[2]

[1] Significance of the t-test for two related samples.

[2] Significance of Wilcoxon test and Sign test.

It is also interesting to note that when studying the association between the profile towards gender-sensitive teaching of the experimental group and the moment (i.e., pre-test and post-test), no dependence is found between both variables (p > .05). Therefore, unlike what happened in the control group, the results found indicate that the intervention has eliminated the dependence between the moment and the profile towards gender-sensitive teaching (Table 6).

Table 6. Crosstab and measures of association between the profile towards gender-sensitive teaching of the experimental group according to the moment

			Profile towards gender-sensitive teaching		Total
			Adaptive	Gender sensitive	
Moment	Pre	Count	2	19	21
		Expected count	1.4	19.6	21.0
		Residue	0.6	-0.6	
		Typified residue	0.5	-0.1	
	Post	Count	1	23	24
		Expected count	1.6	22.4	24.0
		Residue	-0.6	0.6	
		Typified residue	-0.5	0.1	
Total		Count	3	42	45
		Expected count	3.0	42.0	45.0

Sig.: 0.472

Discussion and conclusions

The results obtained after this research, corroborate that an intervention designed and implemented under the principles of feminist critical pedagogy has a positive effect on attitudes towards gender equality among PASS students. Thus, on the one hand, it has been proven that not only the professionals in training of the experimental group increased their attitudes towards gender-sensitive teaching and gender equality significantly; but, in addition, the professionals in training of the control group decreased them both in the general scale, as well as in the sociocultural and relational scale. Moreover, the control group went from presenting a mostly gender-sensitive profile to a completely adaptive profile.

However, despite the fact that the increase in the score of the personal subscale of the experimental group, compared to the control group, was not significant, in the post-test, all the students of the control group presented an adaptive profile towards gender-sensitive teaching (compared to a gender-sensitive profile of the experimental group), which indicates the need to continue investigating which aspects of the social construction of gender have an impact on PASS students at the individual level.

However, returning to the overview of the effect of the intervention, the positive results reinforce the importance of the initial training that these professionals receive, as indicated in different studies (Cameron & Humbert, 2020; Flintoff & Scraton, 2006; González-Calvo et al., 2021; Ovens et al., 2018).

In addition, these results are consistent with other studies carried out in the Spanish context implementing interventions with a gender perspective in the context of the PASS Degree. In this sense, Camacho-Miñano and Girela-Rejón (2017) demonstrated that, after the implementation of a seminar that aimed to offer basic training in relation to the introduction of the gender perspective, the intervention promoted consciousness and reflection, an aspect that allowed students to learn strategies about how to intervene and increase their commitment to gender equality.

In this sense, the results of the intervention 'Deportigualízate' coincide with the previously mentioned findings since, on the one hand, the students of the experimental group increased their scores with respect to the relational subscale, which is related to how to relate and act with the rest of the educational community. On the other hand, the increase in students in the experimental group with a gender-sensitive profile seems to indicate, in turn, a greater commitment to equitable practices.

Likewise, the results presented also coincide, to some extent, with the findings of Fernández and Piedra (2010). In this case, although their intervention did not have a significant effect when comparing the results of the pre-test and post-test of the experimental group, nor of the control group; their research does show, in line with the results obtained in the present work, that students who participate in an intervention of these characteristics significantly increase their scores towards coeducation.

Therefore, as also demonstrated by Devís-Devís, Pereira-García, Fuentes-Miguel, et al. (2018), this type of intervention can promote the consciousness of PASS students towards inequalities and other realities, being able to allow them to transform their future professional practice, an aspect related to the profile towards gender-sensitive teaching. However, it is necessary to interpret these conclusions cautiously since, although feminist critical pedagogies may provide "the knowledge and perspective necessary to kick their own [students'] habitus" (Philpot, Smith, et al., 2021, 456. See Bourdieu (1990) for more detail on the term), it would be naïve to think that a single intervention or action can change the practices, values, and thoughts of all participating students.

However, it is also interesting to take these results constructively and positively, understanding that the change towards a more democratic and fairer society starts from small changes (Luguetti et al., 2019), what Weick (1984) calls 'small wins.' These findings also contribute to covering, little by little, the research gap of transformative proposals in the context of the PASS Degree with a feminist perspective, pointed out by Lynch and Curtner-Smith (2018).

Likewise, it is necessary to take into account that these 'small wins' in terms of critical practices that seek social transformation in relation to equality and equity, are usually led, in the Spanish context and according to some research, by individual actions of teachers involved (Serra, Soler, et al., 2018), thus falling the weight on their individual

commitment. This aspect coincides with what happened in this research, in which the researcher had the support of professors involved that allowed the development of this study.

In addition, recent research shows that, despite the fact that in the specific case of Spain current legislation points out the need for the gender perspective to be present in curricular discourses and university teaching practices, this is not a reality (Garay et al., 2018; Serra, Soler, et al., 2018). However, university programs equivalent to PASS in other contexts, such as Australia, where there is a clear curricular alignment between national laws, faculty philosophies, and teachers' activism, have proven to be a powerful generator of change (Ovens et al., 2018).

Thus, following Devís-Devís, Pereira-García, Fuentes-Miguel, et al. (2018), we are aware that a deeper change in the thoughts, attitudes, and profiles towards gender equality of future professionals in education and physical activity, requires greater commitment on behalf everybody involved. Therefore, in order to foster the much-needed critical vision in future professionals (Lynch & Curtner-Smith, 2018; Philpot, Gerdin, et al., 2021), new research and curricular proposals are needed to address and challenge social inequalities, specifically in the context of the initial training of professionals in physical education and physical activity.

Limitations and future lines

As mentioned in the previous section, one of the greatest limitations of this study is related to the short duration of the curricular intervention. In this sense, it is necessary to understand the results cautiously. Moreover, the fact that the study was carried out in a specific context and with a small sample size, entails methodological limitations that do not allow the results to be generalized.

In the same sense, as already indicated, the experimental group and the control group, despite having had the same training in the degree, at the time of the study were studying different optional modules. This aspect may have conditioned the profile of the students and, therefore, is considered a limitation.

Taking into account these considerations, it would be interesting to implement 'Deportigualízate' in other contexts, with a larger sample, and including diverse students, in order to study in greater depth the effect of feminist critical pedagogy on attitudes towards equality.

Finally, as it is a transformative and critical experience, the qualitatively generated results will help to better understand the dimension of the addressed problem. Therefore, presenting only quantitative study data can be considered a limitation.

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Efecto de la intervención "Deportigualízate" en las actitudes hacia la igualdad de profesionales de la educación física en formación

Effect of the intervention 'Deportigualízate' on the attitudes towards equality of physical education professionals in training

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Resumen

Investigaciones recientes demuestran la necesidad de incluir la perspectiva de género en la formación de profesionales de la actividad física y la educación física, así como la existencia de un escaso número de intervenciones existentes en dicho campo, específicamente, en el contexto español. La finalidad de este artículo es, por un lado, presentar la intervención "*Deportigualízate*", una intervención basada en los principios de la pedagogía crítica feminista en el contexto del Grado de Ciencias de la Actividad Física y el Deporte (CAFYD). Por otro, estudiar su efecto en las actitudes hacia la igualdad de género de los y las futuras profesionales de la actividad física y la educación física. Para ello, se contó con una muestra de 39 estudiantes del grado de CAFYD de la Universidade da Coruña. Se siguió un diseño cuasiexperimental de dos grupos con pre-test y post-test, utilizando la escala *School Doing Gender/Teachers* (Piedra, 2010) para la recogida de datos. Los resultados encontrados muestran una mejora en las actitudes hacia la igualdad de género del alumnado participante en la intervención, pudiendo concluir que "*Deportigualízate*" tiene un efecto positivo en el perfil profesional hacia la coeducación de estudiantes de CAFYD.

Palabras clave: Coeducación, Formación inicial, Educación física, Enseñanza universitaria, Pedagogía crítica feminista.

Abstract

Recent studies show the need to include the gender perspective in the training of pre-service professionals in physical education and physical activity, as well as the scarcity of existing interventions in this field, specifically, in the Spanish context. The purpose of this article is, on the one hand, to present the intervention '*Deportigualízate*,' an intervention based on the principles of critical feminist pedagogy in the context of Physical Activity and Sport Science (PASS) undergraduate program. On the other hand, to study its effect on the attitudes towards gender equality of pre-service professionals in physical education and physical activity. To this end, a sample of 39 students from the PASS degree of the University of A Coruña participated in the study. A quasi-experimental design of two groups with pre-test and post-test was followed. Data was collected through the *School Doing Gender/Teachers* scale (Piedra, 2010). The results found show an improvement in the attitudes towards gender equality of the students participating in the intervention, concluding that '*Deportigualízate*' has a positive effect on the profesional profile towards gender-sensitive teaching of PASS students.

Keywords: Gender-senstive teaching, Pre-service training, Physical education, Higher education, Critical feminist pedagogy.

Introducción

A pesar de los grandes avances que ha habido en materia de igualdad, las investigaciones recientes demuestran que algunos problemas relacionados con el género y la educación física (EF) siguen presentes (Scraton, 2018; Stride et al., 2022). Así, por ejemplo, Kirk (2000b) ya señalaba hace más de veinte años que la escasa participación de las niñas en el deporte y en EF era preocupante y, tal y como recientes estadísticas mundiales reflejan, esta realidad se sigue manteniendo (por ejemplo, véase Emmonds et al., 2021). No obstante, el problema no estriba solamente en la cantidad de práctica, sino en el tipo, las barreras existentes o las implicaciones que tiene el hecho de que el contexto físico deportivo continúe siendo una construcción androcéntrica y heteronormativa (Bevan et al., 2021; Devís-Devís, Pereira-García, López-Cañada, et al., 2018).

En este sentido, a pesar de que los contextos educativos se han considerado desde hace décadas agentes fundamentales de cambio a favor de sociedades más democráticas (hooks, 1994; Postman & Weingartner, 1971), la realidad de la EF es que es un espacio en el que predominan discursos que marginalizan ciertas identidades y corporalidades, (re)produciendo el *status quo* del género (Fitzpatrick, 2019; Kirk, 2020; Landi et al., 2016; Martos-García et al., 2020). Así, investigaciones tanto nacionales como internacionales, señalan que el profesorado de EF, a través de currículum oculto, sigue perpetuando relaciones de género y estereotipos basados en la desigualdad (Alvariñas-Villaverde & Pazos-González, 2018; Gerdin, 2017; Walseth et al., 2017).

Por ello, numerosas investigaciones ponen el foco en la importancia de la formación inicial que reciben las y los profesionales de la educación y la actividad física (Cameron & Humbert, 2020; Flintoff & Scraton, 2006; González-Calvo et al., 2021; Ovens et al., 2018). Asimismo, en el caso de España, la legislación vigente también insta a crear iniciativas que permitan introducir cambios en el sistema educativo universitario a favor de la igualdad. Por ejemplo, se podría destacar la Ley Orgánica 3/2007, de 22 de marzo, para la igualdad efectiva de mujeres y hombres; o el Pacto de Estado contra la violencia de género (Ministerio de la Presidencia, 2019), entre otras.

Este es el motivo por el cual numerosas autoras y autores han demostrado cómo se puede llevar a la práctica la teoría y pedagogía crítica en las aulas, tanto en el contexto internacional (Fitzpatrick, 2013; Kirk, 2000a; Luguetti et al., 2019; Oliver & Oesterreich, 2013), como nacional (Devís-Devís, Pereira-García, Fuentes-Miguel, et al., 2018; Lleixà Arribas et al., 2020), reconociendo que "es la capacidad del alumnado para reflexionar y criticar los discursos y prácticas dominantes lo que hace posible la transformación" (Varea & Tinning, 2016, 1013).

No obstante, estudios recientes llevados a cabo en nuestro contexto, demuestran que a pesar de ese marco normativo, la incorporación de la perspectiva de género en los grados de Ciencias de la Actividad Física y del Deporte (CAFYD) de España, es anecdótica (Serra, Soler, et al., 2018), determinando que el 74.6% de las guías docentes no hacen alusión alguna a cuestiones relacionadas con el género. A esta realidad, es preciso añadirle que la representación social de estos estudios actúa como una forma de violencia simbólica hacia las personas que quieren estudiar esta carrera, aspecto que resulta en una enorme masculinización de dichos estudios (Serra et al., 2019, 2021).

Sin embargo, al estudiar las matrices curriculares de los grados en CAFYD, las autoras también destacan que las asignaturas tienen un gran potencial transformador a favor de la equidad y justicia social (Serra et al., 2016). En este sentido, existen trabajos muy completos y accesibles que aportan algunas de las bases fundamentales para la incorporación de la perspectiva de género en los estudios de CAFYD, como es el Decálogo para el profesorado universitario y personal investigador, publicado por el Colegio de Profesionales de la Educación Física y el Deporte de Catalunya (Serra, Soler, & Vilanova, 2018).

Aun con todo, a pesar de iniciativas como ésta, estudios recientes afirman que no hay investigaciones en torno a propuestas transformadoras en el contexto de CAFYD, basadas en los principios y perspectivas feministas (Lynch & Curtner-Smith, 2018). Asimismo, la investigación señala la importancia de entender la realidad del estudiantado y las prácticas en relación a él, en momentos y contextos concretos (Neto et al., 2020). Por ello, detectando la necesidad de seguir construyendo conocimiento en relación con cómo se pueden desafiar los discursos sexistas en el contexto de formación de profesionales de la educación y la actividad física, se propone el siguiente estudio.

El propósito de este artículo es presentar una intervención diseñada y llevada a cabo bajo los principios de la pedagogía crítica feminista (Crabtree et al., 2009; Dewar, 1991; hooks, 1994) en el contexto concreto del grado de CAFYD en la Universidade da Coruña, y estudiar su efecto en las personas participantes. Para ello, tanto el diseño de la propuesta de intervención, como la recolección y análisis de datos, se basa en la teoría "*Doing Gender*" (West & Zimmerman, 1987) posteriormente desarrollada por Crawford y Chaffin (1997). Así, se entiende que el género es el resultado de una construcción social que se crea a través de relaciones individuales, interpersonales y socioculturales.

En este artículo, en primer lugar, se detallarán los aspectos metodológicos del estudio y se presentará brevemente la intervención "*Deportigualízate*". A continuación, se mostrarán los resultados del estudio en relación con las actitudes y perfil hacia la igualdad de género de las personas participantes. Finalmente, se discutirán los resultados aportando unas conclusiones en relación con ellos, así como presentando las limitaciones del estudio, con la finalidad de seguir contribuyendo a la investigación futura.

Método

Diseño

Los datos que se presentan en este trabajo forman parte de un proyecto mayor, enmarcado dentro de un paradigma de investigación transformativo (Chilisa & Kawulich, 2012; Sweetman et al., 2010), para el cual se llevó a cabo un estudio de caso mini-etnográfico (Fusch et al., 2017) con enfoque crítico (Creswell & Poth, 2018; Madison, 2012; Suárez, 2012), utilizando métodos mixtos, y adoptando el diseño convergente paralelo propuesto por Creswell y Plano-Clark (2017).

Cabe señalar que, por una cuestión de limitación de espacio, los datos del estudio generados cualitativamente a través de reflexiones escritas, diarios de investigación, cuadernos de trabajo, o grupos de discusión (entre otros métodos), serán presentados en otro artículo que se encuentra en elaboración.

Por ello, en este artículo se expondrán únicamente los resultados obtenidos de forma cuantitativa, tras recolectar los datos mediante un diseño cuasiexperimental de dos grupos con pre-test y post-test. Así, uno de los grupos

participó en la intervención "Deportigualízate" (grupo tratado), en tanto que el otro grupo no recibió la intervención y, por tanto, fue el grupo control.

Participantes

Para la selección de la muestra se siguió un muestreo intencional y de conveniencia. Concretamente, la muestra del estudio está conformada por estudiantes de tercer y cuarto curso del Grado en CAFYD durante el curso 2020-2021 de la Universidade da Coruña. Específicamente, el grupo experimental estaba cursando una materia optativa (ofertada para estudiantes tanto de tercero como de cuarto) llamada "Mujer y Deporte"; mientras que el alumnado del grupo control no estaba cursando la asignatura optativa previamente indicada.

La intervención se enmarcó en la asignatura optativa "Mujer y Deporte" debido al interés y apoyo de las profesoras responsables de la materia, así como a la alineación de "Deportigualízate" con los objetivos y contenidos de la asignatura. En este sentido, cabe señalar que mientras que la asistencia a las sesiones de "Deportigualízate" no fue opcional debido a que dicha intervención estaba recogida en la guía docente de la materia; la participación en la recogida de datos sí fue voluntaria.

Asimismo, cabe destacar que, antes de la intervención, la totalidad del alumnado (tanto del grupo control como del grupo experimental) indicó no haber recibido formación específica en cuestiones de género, aunque sí señalaron que, durante el grado en CAFYD, habían cursado tres materias que incluían contenidos relacionados con la perspectiva de género.

Previo a la intervención, participaron un total de 43 estudiantes en la toma de datos, con edades comprendidas entre los 19 y los 31 años (edad 21.98±2.74; 30.2% mujeres y 69.8% hombres). En la toma de datos tras la intervención, participaron un total de 39 estudiantes con edades comprendidas entre los 20 y los 32 años (edad 22.01±2.81; 38.5% mujeres y 61.5% hombres).

El grupo experimental que participó en la intervención está conformado por un total de 24 estudiantes (11 mujeres y 13 hombres), con edades comprendidas entre los 20 y los 29 años (edad 22.08±2.302). El inusual número de mujeres en el grupo puede ser debido al carácter optativo de la asignatura. Por este mismo motivo, puede que el perfil del alumnado del grupo no sea representativo de la realidad del grado.

Por su parte, en el grupo control participaron un total de 22 estudiantes en el pre-test con edades comprendidas entre los 19 y los 31 años (edad 21.86±3.12; 18.2% mujeres y 81.8% hombres), y 15 estudiantes en el post-test con edades comprendidas entre los 20 y los 32 años (edad 22±3.82; 26.7% mujeres y 73.3% hombres). La reducción de participantes en la toma de datos puede estar relacionada con el carácter voluntario de la participación en el estudio, el hecho de que estuviesen en época de exámenes y todas las dificultades derivadas por la pandemia por COVID19.

Instrumento

Para la recogida de los datos presentados en el presente artículo, se utilizó la Escala de Actitudes *School Doing Gender/Teachers* (Piedra, 2010; Rebollo et al., 2011), la cual fue usada con el doble objetivo de caracterizar la muestra, y evaluar el efecto de la intervención en las actitudes hacia la coeducación de la muestra. Cabe destacar que se empleó la versión modificada para futuras y futuros profesionales (Fernández & Piedra, 2010; Piedra, 2010), la cual presenta ciertas adaptaciones de lenguaje en algunos ítems con la finalidad de adecuarse a las circunstancias propias de profesionales que aún no están ejerciendo.

Dicha escala está conformada por 30 ítems con respuesta cerrada tipo Likert de 5 puntos, donde 1 se corresponde con "totalmente en desacuerdo" y 5 con "totalmente de acuerdo". Todos los ítems están organizados alrededor de las tres dimensiones que intervienen en la construcción del género según la teoría"*Doing Gender*" de West y Zimmerman (1987) y posteriormente desarrollada por Crawford y Chaffin (1997): sociocultural (ítems 1 al 10), relacional (ítems 11 al 20) y personal (ítems 21 al 30).

Siguiendo a Rebollo et al. (2011), el sumatorio global de los ítems permite obtener una puntuación para determinar el perfil de los sujetos hacia la coeducación. Así, si se obtiene un sumatorio menor de 89 puntos, se determina un perfil bloqueador, entiéndelo como aquel que expresa rechazo ante propuestas coeducativas y realiza valoraciones negativas sobre ellas; si se obtienen entre 90 y 119 puntos, el perfil es adaptativo, siendo aquel que reconoce los indicios de desigualdad presentes en el discurso social y mostrando una postura políticamente correcta; finalmente, si se obtienen más de 120 puntos, se considera un perfil coeducativo, siendo aquel que reconoce la desigualdad, valora positiva y públicamente las propuestas e iniciativas orientadas a erradicarlas, y muestra una actitud clara de colaboración en la promoción de valores de igualdad.

Procedimiento

El cuestionario de Actitudes *School Doing Gender/Teachers* fue completado en un pre-test, tanto por parte del grupo experimental como del control, sin que se realizara explicación alguna sobre los contenidos u objetivos de la intervención en cuestión. Posteriormente, se desarrollaron las materias con normalidad durante un mes, llevándose a cabo la intervención "*Deportigualízate*" con el grupo experimental. Tras la intervención (que se explicará a continuación) se realizó un post-test, volviéndose a utilizar la misma escala en ambos grupos de clase.

Todas las personas participantes dieron su consentimiento informado para la obtención de datos personales en los dos momentos de toma de datos, tras haber sido informadas del objetivo del estudio, así como del tratamiento de los datos y sus derechos. Todos los datos se han tratado confidencialmente y de forma seudonimizada de acuerdo con la normativa vigente en materia de protección de datos personales.

En este sentido, se ha seguido el reglamento (UE) 2016/697 del Parlamento Europeo y del Consejo de 27 de abril de 2016 relativo a la protección de las personas físicas en lo que respecta al tratamiento de datos personales y a la libre circulación de estos datos y por el que se deroga la Directiva 95/46/CE; así como la Ley Orgánica 3/2018 de 5 de diciembre de protección de datos personales y garantía de los derechos digitales.

Descripción de la intervención

La intervención "Deportigualízate" está basada en los principios de la pedagogía crítica feminista (Crabtree et al., 2009; hooks, 1994; Shrewsbury, 1997), haciendo especial énfasis en el desafío de las relaciones de poder. Para ello, tanto el diseño de la intervención como su propia implementación, estuvo basado en principios democráticos y dialógicos, entendiendo la educación como una práctica para la libertad (Freire, 1970). De esta manera, la intervención fue diseñada en varias fases, tras mantener encuentros tanto con estudiantes de CAFYD, como con profesionales recién egresados, o personas expertas en coeducación.

Todas estas reuniones sirvieron para definir, junto con la evidencia científica existente, la forma concreta que tomaría la intervención. De esta manera, además de tener presente la importancia de establecer relaciones no jerárquicas, también se determinó la necesidad de implementar actividades participativas que permitieran el análisis crítico del entorno, la incorporación de la interseccionalidad y el fomento de la acción y transformación social; siendo, todos ellos, aspectos clave de la pedagogía feminista (Crabtree et al., 2009).

Para ello, se diseñaron cuatro sesiones de 90 minutos fundamentadas en un enfoque basado en tareas (Kirk, 2000a), que fueron complementadas con un cuaderno de trabajo individual fuera del aula. Toda la intervención se construyó alrededor de cuatro grandes ejes temáticos, siguiendo la teoría "Doing Gender" propuesta por West y Zimmerman (1987):

1. La problemática de las desigualdades.
2. La construcción social del género.
3. La construcción social del género en el deporte.
4. El alumnado como agente de cambio.

Con la finalidad de cumplir con los principios establecidos, todas las tareas estaban orientadas al autodescubrimiento y autoaprendizaje del alumnado (McKay & Pearson, 1984), haciendo frente a lo que Freire (1970) denomina la concepción "bancaria" de la educación como forma de opresión. Así mismo, con la finalidad de promover un espacio seguro en el que todas las personas tuviesen voz y pudiesen ser escuchadas, se recurrió a diferentes estrategias, como el hecho de trabajar en pequeños grupos, el visionado de vídeos, o el debate con la totalidad de la clase, siguiendo la propuesta feminista de Dewar (1991).

Finalmente, cabe destacar que se creó un perfil de Instagram como estrategia para promover el diálogo entre iguales, así como para tener una plataforma en la que compartir las reflexiones y artefactos creados por el alumnado; además, se compartió un cuestionario elaborado en Microsoft Forms para que, de forma anónima y voluntaria, el alumnado pudiera dejar sus comentarios tras cada sesión (qué es lo que más le había gustado y lo que menos, sobre qué temas les gustaría tener más información, etc.), elemento que facilitó el hecho de poder adaptar la intervención a la realidad del alumnado y, así, permitir que tomara un enfoque realmente centrado en el estudiantado.

Si bien es cierto que, debido a la corta duración de la intervención, las adaptaciones fueron mínimas, el hecho de tener feedback constante del alumnado permitió incluir ciertos temas en los debates del aula que no se habían tenido en cuenta en el diseño previo (como, por ejemplo, el uso de las redes sociales como forma de activismo). Además, dicho feedback permitió poder elaborar y difundir trabajos y literatura complementaria para que el estudiantado pudiera ampliar sus conocimientos en base a sus intereses.

Análisis de los datos

Tanto los ítems de la Escala de Actitudes School Doing Gender/Teachers, como los índices de la escala general (suma de todos los ítems) y las subescalas sociocultural, relacional y personal (suma de los ítems correspondientes), se han tratado como variables cuantitativas, por lo que se describirán mediante las correspondientes medidas de tendencia central y de dispersión.

Para la comparación entre el grupo control y el experimental, se han realizado los siguientes análisis tanto para el pre-test como para el post-test: se ha utilizado la prueba t para dos muestras independientes para verificar si existen diferencias entre las medias, y como prerrequisitos se ha utilizado la prueba de Shapiro-Wilk (dado que el tamaño muestral es menor de 30) tanto para los sujetos del grupo control como los del experimental. Además, se ha utilizado la prueba de Levene para contrastar la igualdad de varianzas. En caso de no cumplirse alguno de estos prerrequisitos, se ha empleado la vía no paramétrica con la prueba de Mann-Whitney. Específicamente, se ha usado la vía no paramétrica al comparar el grupo control con el experimental en la variable suma personal; tanto en el pre-test como en el post-test.

Para la comparación del pre-test con el post-test, tanto en el grupo control como en el experimental se han realizado los siguientes análisis: se ha utilizado la prueba t para dos muestras relacionadas para verificar si existen diferencias entre las medias, y como prerrequisitos se ha usado la prueba de Shapiro-Wilk (dado que el tamaño muestral es menor de 30) tanto para los sujetos de cada grupo en el pre-test y en el post-test. En caso de no cumplirse alguno de estos prerrequisitos, se ha usado la vía no paramétrica con la prueba de Wilkoxon y la prueba de los Signos. Específicamente, se ha usado la vía no paramétrica al comparar el pre-test del grupo experimental con el post-test del mismo grupo, en la variable de suma personal.

En el caso de variables en escala nominal, se han usado tablas de contingencia y medidas de asociación (V de Cramer) para valorar la asociación entre las mismas.

Resultados

Análisis preliminar

Análisis de los grupos: pre-test

En primer lugar, tal y como se muestra en la Tabla 1, al comparar las medias de ambos grupos en el pre-test, no se encuentran diferencias estadísticamente significativas en la subescala sociocultural y relacional entre los grupos control y experimental ($p > .05$), aunque sí que se encuentran diferencias estadísticamente significativas entre ambos grupos en el sumatorio general de la escala ($p = .03$) y la subescala personal ($p = .012$). Por lo tanto, a pesar de que no se puede afirmar que ambos grupos son estadísticamente iguales como punto de partida, sí que se halla similitud en cuanto a la dimensión sociocultural, es decir, en relación con las concepciones acerca de las políticas de igualdad y organización de centro; así como en cuanto a la dimensión relacional, la cual mide cuestiones referidas a la futura práctica profesional, así como a las expectativas y relaciones de género.

Tabla 1. Descripción y comparación del grupo control y experimental en el pre-test

Variable	Grupo	N	x̄±σ	Sig. Shapiro-Wilk	Sig. Levene	Sig. Comparación
Suma total	Control	22	121.41±10.6	0.074	0.195	**.030**[1]
	Experimental	21	127.86±8.01	0.738		
Suma sociocultural	Control	22	40.41±3.9	0.384	0.627	.915[1]
	Experimental	21	40.29±3.64	0.076		
Suma relacional	Control	22	39.73±4.24	0.284	0.804	.072[1]
	Experimental	21	42.1±4.17	0.668		
Suma personal	Control	22	41.27±6.2	0.17	0.054	**.012**[2]
	Experimental	21	45.48±3.94	**0.006**		

[1] Significación de la prueba t para dos muestras independientes.

[2] Significación de la prueba de Mann-Whitney.

Efecto de la intervención

Análisis de los grupos: post-test

Al comparar las medias del grupo control y experimental en el post-test (tabla 2) sí se encuentran diferencias estadísticamente significativas tanto en la escala a nivel general (p = .000), como en las subescalas sociocultural (p = .000) y relacional (p = .000). Por lo tanto, se puede determinar que el incremento de las medias del grupo experimental con respecto al control es estadísticamente significativo, lo que significa un perfil más favorable hacia la coeducación y la igualdad de género. No obstante, a pesar de que en la dimensión personal también se observa un incremento en las puntuaciones, dicha diferencia no puede considerarse estadísticamente significativa (p > .05).

Tabla 2. Descripción y comparación del grupo control y experimental en el post-test

Variable	Grupo	N	x̄±σ	Sig. Shapiro-Wilk	Sig. Levene	Sig. Comparación
Suma total	Control	15	113.41±5.85	0.078	0.009	**.000**[1]
	Experimental	24	132.54±7.89	0.197		
Suma sociocultural	Control	15	36.2±2.65	0.28	0.95	**.000**[1]
	Experimental	24	43±2.52	0.05		
Suma relacional	Control	15	31.2±2.68	0.706	0.007	**.000**[1]
	Experimental	24	41.71±5.4	0.46		
Suma personal	Control	15	46.2±2.7	0.221	0.72	.062[2]
	Experimental	24	47.83±2.66	**0.000**		

[1] Significación de la prueba t para dos muestras independientes.

[2] Significación de la prueba de Mann-Whitney.

Análisis del grupo control: pre-test y post-test

Tras comprar las medias del grupo control del pre-test con el post-test, se hallan diferencias estadísticamente significativas tanto a nivel general (p = .000), como en cada una de las subdimensiones de la escala: sociocultural (p = .000), relacional (p = .000) y personal (p = .001). Por lo tanto, los resultados encontrados indican que los sujetos del grupo control disminuyeron significativamente su puntuación en relación con las actitudes favorables hacia la coeducación tanto en el sumatorio total, como en el sumatorio sociocultural y relacional, pero no en el sumatorio personal (tabla 3).

Tabla 3. Descripción y comparación del grupo control pre-test y post-test

Variable	Pre-test			Post-test			Sig. Comparación
	N	x̄±σ	Sig. Shapiro-Wilk	N	x̄±σ	Sig. Shapiro-Wilk	
Suma total	22	121.41±10.6	0.074	15	113.6±4.49	0.078	**.000**[1]
Suma sociocultural	22	40.41±3.9	0.384	15	36.2±2.65	0.28	**.000**[1]
Suma relacional	22	39.73±4.24	0.284	15	31.2±2.68	0.706	**.000**[1]
Suma personal	22	41.27±6.2	0.17	15	46.2±2.7	0.221	**.001**[1]

[1] Significación de la prueba t para dos muestras relacionadas.

Sin embargo, al estudiar la asociación entre el perfil de los y las profesionales en formación del grupo control hacia la coeducación y el momento de toma de datos, se encuentra que sí existe una dependencia fuerte entre ambas variables (tabla 4). Así, es interesante señalar que mientras que en el pre-test hubo estadísticamente más personas de las esperadas con un perfil coeducativo; en el post-test, la totalidad de la muestra mostró un perfil adaptativo hacia la coeducación, mientras que, estadísticamente, se esperaba que hubiera seis sujetos con perfil coeducativo.

Tabla 4. Tabla de contingencia y medidas de asociación entre el perfil hacia la coeducación del grupo control en función del momento

			Perfil hacia la coeducación		Total
			Adaptativo	Coeducativo	
Momento	Pre	Recuento	7	15	22
		Frecuencia esperada	13.1	8.9	22.0
		Residuo	-6.1	6.1	
		Residuos tipificados	-1.7	2	
	Post	Recuento	15	0	15
		Frecuencia esperada	8.9	6.1	15.0
		Residuo	6.1	-6.1	
		Residuos tipificados	2	-2.5	
Total		Recuento	22	15	37
		Frecuencia esperada	22.0	15.0	37.0

Sig.: 0.000; Valor V de Cramer: 0.682

Por lo tanto, a pesar de que los resultados anteriormente citados indican una mejora en las creencias de la dimensión personal, a nivel general, los resultados encontrados sugieren la posibilidad de que el hecho de no participar en la intervención "Deportigualízate" tenga un efecto negativo en las actitudes hacia la igualdad de las personas del grupo control, puesto que empeoran estadísticamente su perfil hacia la coeducación.

Análisis del grupo experimental: pre-test y post-test

Al estudiar el impacto de la intervención en el caso concreto del grupo experimental, comparando las medias pre-test y post-test, se encuentran diferencias estadísticamente significativas tanto a nivel general (p = .000) como en todas las dimensiones estudiadas: sociocultural (p = .000), relacional (p = .005) y personal (p = .000; tabla 5). Así pues, se puede asegurar que el incremento en las puntuaciones tanto en el sumatorio total, como en los sumatorios sociocultural y personal, son significativos.

Tabla 5. Descripción y comparación del grupo experimental pre-test y post-test

Variable	Pre-test			Post-test			Sig. Comparación
	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	N	$\bar{x}\pm\sigma$	Sig. Shapiro-Wilk	
Suma total	21	127.86±8.01	0.738	24	132.54±7.89	0.197	**.000**[1]
Suma sociocultural	21	40.29±3.64	0.076	24	43±2.52	0.05	**.000**[1]
Suma relacional	21	42.1±4.17	0.668	24	41.71±5.4	0.46	**.005**[1]
Suma personal	21	45.48±3.94	**0.006**	24	47.83±2.66	**0.000**	**.000**[2]

[1] Significación de la prueba t para dos muestras relacionadas.

[2] Significación de la prueba de Wilcoxon y prueba de Signos.

Asimismo, es interesante señalar que al estudiar la asociación entre el perfil hacia la coeducación del grupo experimental y el momento (es decir, pre-test y post-test), no se encuentra dependencia entre ambas variables (p > .05). Por lo tanto, a diferencia de lo que ocurría en el grupo control, los resultados encontrados indican que la intervención ha eliminado la dependencia entre el momento y el perfil hacia la coeducación (tabla 6).

Tabla 6. Tabla de contingencia y medidas de asociación entre el perfil hacia la coeducación del grupo experimental en función del momento

			Perfil hacia la coeducación		Total
			Adaptativo	Coeducativo	
Momento	Pre	Recuento	2	19	21
		Frecuencia esperada	1.4	19.6	21.0
		Residuo	0.6	-0.6	
		Residuos tipificados	0.5	-0.1	
	Post	Recuento	1	23	24
		Frecuencia esperada	1.6	22.4	24.0
		Residuo	-0.6	0.6	
		Residuos tipificados	-0.5	0.1	
Total		Recuento	3	42	45
		Frecuencia esperada	3.0	42.0	45.0

Sig.: 0.472

Discusión y conclusiones

Los resultados obtenidos tras la investigación corroboran que una intervención diseñada e implementada bajo los principios de la pedagogía crítica feminista tiene un efecto positivo en las actitudes hacia la igualdad de género de estudiantes de CAFYD. Así, por un lado, se ha comprobado que no solo las y los profesionales en formación del grupo experimental aumentaron sus actitudes hacia la coeducación y la igualdad de género de forma significativa; sino que, además, las y los profesionales en formación del grupo control las disminuyeron tanto en la escala general, como en la sociocultural y relacional. Además, el grupo control, pasó de presentar un perfil mayoritariamente coeducativo, a un perfil completamente adaptativo.

No obstante, a pesar de que el aumento en la puntuación de la subescala personal del grupo experimental, en comparación con el control, no fuera significativo, en el post-test, la totalidad del alumnado del grupo control presentaba un perfil adaptativo hacia la coeducación (frente a un perfil coeducativo del grupo experimental), lo que indica la necesidad de seguir investigando qué aspectos de la construcción social del género tienen impacto en las y los profesionales de la educación y la actividad física en formación a nivel individual.

Sin embargo, volviendo a la visión general del efecto de la intervención, los resultados positivos refuerzan la importancia de la formación inicial que reciben dichos profesionales, tal y como se señala en diferentes estudios (Cameron & Humbert, 2020; Flintoff & Scraton, 2006; González-Calvo et al., 2021; Ovens et al., 2018).

Además, estos resultados concuerdan con otros estudios realizados en el contexto español implementando intervenciones con perspectiva de género en el contexto del Grado de CAFYD. En este sentido, Camacho-Miñano y Girela-Rejón (2017) demostraron que, tras la impartición de un seminario que tenía por objeto ofrecer formación básica en relación a la introducción de la perspectiva de género en la futura labor profesional del estudiantado, la intervención promovió la toma de conciencia y reflexión, aspecto que permitió que el alumnado aprendiera estrategias acerca de cómo intervenir y aumentara su compromiso hacia la igualdad de género.

En este sentido, los resultados de la intervención "Deportigualízate" coinciden con los hallazgos previamente mencionados puesto que, por un lado, el alumnado del grupo experimental aumentó sus puntuaciones con respecto a la subescala relacional, la cual está relacionada con cómo relacionarse y actuar con el resto de la comunidad educativa. Por otro lado, el incremento de alumnado del grupo experimental con perfil coeducativo parece indicar, a su vez, un mayor compromiso hacia las prácticas equitativas.

Así mismo, los resultados presentados también concuerdan, en cierta medida, con los hallazgos de Fernández y Piedra (2010). En este caso, si bien su intervención no tuvo un efecto significativo al comparar los resultados del pre-test y post-test del grupo experimental, y tampoco del grupo control; su investigación sí demuestra, en línea con los resultados obtenidos en el presente trabajo, que el alumnado que participa en una intervención de estas características aumenta significativamente sus puntuaciones hacia la coeducación.

Por lo tanto, al igual que también demostraron Devís-Devís, Pereira-García, Fuentes-Miguel, et al. (2018), este tipo intervenciones pueden promover la sensibilización del alumnado de CAFYD hacia desigualdades y hacia otras realidades, pudiéndole permitir que transforme su futura práctica profesional, aspecto relacionado con el perfil hacia la coeducación. No obstante, es necesario interpretar dichas conclusiones de forma cautelosa puesto que, a pesar de que las pedagogías críticas feministas puedan proporcionar "el conocimiento y la perspectiva necesarias para patear su [del alumnado] propio habitus" (Philpot, Smith, et al., 2021, 456. Ver Bourdieu (1990) para más detalle sobre el término), sería naif pensar que una sola intervención o acción pueda cambiar las prácticas, valores y pensamientos de todo el alumnado participante.

Sin embargo, también es interesante tomar estos resultados de forma constructiva y positiva, entendiendo que el cambio hacia una sociedad más democrática y justa parte de pequeños cambios (Luguetti et al., 2019), lo que Weick (1984) denomina "pequeñas victorias". Estos hallazgos, además, contribuyen a cubrir, poco a poco, el vacío investigador de propuestas transformadoras en el contexto del Grado de CAFYD con perspectiva feminista, señalado por Lynch y Curtner-Smith (2018).

Así mismo, es preciso tener en cuenta que estos pequeños logros en términos de prácticas críticas que buscan la transformación social en relación a la igualdad y equidad, suelen estar liderados, en el contexto español y según señalan algunas investigaciones, por acciones individuales de profesorado implicado (Serra, Soler, et al., 2018) recayendo así el peso en su compromiso individual. Este aspecto coincide con lo sucedido en esta investigación, en la que la investigadora contó con el apoyo de profesoras implicadas que permitió el desarrollo de este estudio.

Además, investigaciones recientes demuestran que, a pesar de que en el caso concreto de España la legislación vigente señale la necesidad de que la perspectiva de género esté presente en los discursos curriculares y las prácticas docentes universitarias, esto no es una realidad (Garay et al., 2018; Serra, Soler, et al., 2018) Sin embargo, programas universitarios equivalentes a CAFYD en otros contextos, como el Australiano, donde hay una clara alineación curricular entre las leyes nacionales, las filosofías de las facultades, y el activismo del propio profesorado, han demostrado ser un potente generador de cambio (Ovens et al., 2018).

Así, siguiendo a Devís-Devís, Pereira-García, Fuentes-Miguel, et al. (2018), somos conscientes de que un cambio más profundo en los pensamientos, actitudes y perfiles hacia la igualdad de género de las y los futuros profesionales de la educación y la actividad física, precisa un mayor compromiso por parte de todas las partes implicadas. Por lo tanto, para poder fomentar la, tan necesaria, visión crítica en los y las futuras profesionales (Lynch & Curtner-Smith, 2018; Philpot, Gerdin, et al., 2021), son precisas nuevas investigaciones y propuestas curriculares que permitan abordar y desafiar las desigualdades sociales, específicamente en el contexto de la formación inicial de profesionales de la actividad y la educación física.

Limitaciones y líneas de futuro

Tal y como se ha adelantado en el apartado anterior, una de las mayores limitaciones del presente estudio está relacionado con la escasa duración de la intervención curricular. En este sentido, es necesario entender los resultados de forma cautelosa. Además, el hecho de que el estudio se haya llevado a cabo en un contexto concreto y con un tamaño reducido de muestra, conlleva limitaciones metodológicas que no permiten generalizar los resultados.

En la misma línea, como ya ha sido indicado, el grupo experimental y el grupo control, a pesar de haber tenido la misma formación en el grado, en el momento del estudio se encontraban cursando materias optativas diferentes. Este aspecto puede haber condicionado el perfil del alumnado y, por lo tanto, se considera una limitación.

Teniendo en cuenta estas consideraciones, sería interesante llevar a cabo "Deportigualízate" en otros contextos, con una muestra mayor, e incluyendo a alumnado diverso, con el fin de estudiar en mayor profundidad el efecto de la pedagogía crítica feminista en las actitudes hacia la igualdad.

Finalmente, al tratarse de una experiencia transformadora y crítica, los resultados generados cualitativamente ayudarán a comprender mejor la dimensión del problema de estudio abordado. Por lo tanto, el hecho de presentar únicamente los datos cuantitativos del estudio puede considerarse una limitación.

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Anthropometric parameters, glycemia level and chronotype of adults from Popayan-Colombia

Parámetros antropométricos, nivel de glicemia y cronotipo de adultos de Popayán-Colombia

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Abstract

The university adult population shows health difficulties related to their glucose level and variations in the sleep-wake relationship, which an early diagnosis will allow preventive actions, for which we seek to identify the association of anthropometric parameters, blood glucose level and chronotype of adults from the city of Popayán-Colombia; Through a correlational descriptive study with 182 university adults between 36 and 68 years old, evaluating anthropometric parameters, determining the chronotype with the Horne-Ostberg questionnaire and measuring capillary glycemia. In the same way, normality analysis and verification of the correlation were performed using the Pearson statistic coefficient ($p < 0.05$). As results, normality of the anthropometric parameters was found, with indication of pre-diabetics, and an intermediate chronotype, the correlation analysis showed moderate associations of the glycemia levels with the anthropometric parameters, but low association with the chronotype. It was possible to conclude that the women presented alterations in blood glucose levels as with the Body Adiposity Index, with intermediate chronotype registration.

Keywords: Anthropometry, glycemia, chronotype, adults.

Resumen

La población adulta universitaria evidencia dificultades de salud relacionadas con su nivel de glucosa y variaciones en la relación sueño-vigilia, lo que un diagnóstico temprano permitirá realizar acciones preventivas, para lo cual se buscó identificar la asociación de parámetros antropométricos, nivel de glicemia y cronotipo de adultos de la ciudad de Popayán-Colombia; a través de un estudio descriptivo correlacional con 182 adultos universitarios entre 36 a 68 años, evaluando parámetros antropométricos, determinación del cronotipo con el cuestionario de Horne-Ostberg y medición de la glicemia capilar. De la misma manera se realizaron análisis de normalidad y verificación de la correlación mediante el coeficiente el estadístico de Pearson ($p < 0.05$). Como resultados se encontró normalidad de los parámetros antropométricos, con indicación de pre-diabéticos, y un cronotipo intermedio, el análisis de correlación mostró asociaciones moderadas de los niveles de glicemia con los parámetros antropométricos, pero baja asociación con el cronotipo. Se pudo concluir que las mujeres presentaron alteraciones en los niveles de glicemia como con el Índice de adiposidad corporal, con registro de cronotipo intermedio.

Palabras clave: Antropometría, glicemia, cronotipo, adultos.

Introduction

The health of the university adult population is influenced by numerous actions related to lifestyles (Sánchez-Ojeda & De Luna-Bertos, 2015). These include a range of components many of which associated with living conditions or individual patterns of behavior (García-Laguna et al., 2012). Food is thus a determining parameter and mediator of the health-disease process, an aspect today considered of vital importance from the field of public health (Valdés-Badilla et al., 2017).

The World Health Organization (WHO) reports that the rate of overweight and obesity has increased worldwide. Indicators from 2016 establish that "more than 1.9 billion adults aged 18 years or older were overweight, of which more than 650 million were obese". In Colombia there is no evidence that things are, otherwise, which allows us to assert that there is a latent risk in terms of health (Ríos-García et al., 2013).

The disorders associated with overweight, and obesity are varied and include different aspects, not only psychological in nature but physical and metabolic (Rodríguez-Flores, M., 2014). It has thus been shown that overweight and obesity are generating alterations in the sleep-wake relationship (Salin-Pascual, 2015), leading to disturbances associated with the response of the body, specifically in the nervous and cardiovascular systems, where the processing of fundamental hormones (insulin, glucagon, growth hormone, leptin) triggers a series of mechanisms that affect health (Gómez-Abellán et al., 2012 and Tan et al., 2017).

The use of anthropometric measurements is important today in establishing the presence of overweight or obesity (Tanaka et al., 2016), but the novelty focuses on the distribution that houses adipose tissue and more in adults (Neefs et al., 2019). The use of new indices therefore allows making further projections on the distribution of body fat and its impact on health, allowing the correlation to be established as to the risk of the population of diseases such as diabetes, since this disease is a pathology of high mortality and more and more is associated with obesity (Han et al., 2017).

Moreover, it shows up as reduced sleep time in adulthood (Kani et al., 2016) due in part to the different responsibilities not only of a work nature, but also related to work, the family and the social sphere. Research has established that the wake-sleep relationship tends to decrease with age (García Naveira et al., 2015), facts linked to a greater risk of increasing the epidemiological incidence of obesity and resistance to insulin (Marcadenti et al., 2017). A shorter sleep duration generates activation of the sympathetic nervous system - adrenocorticoid activity - which rises, leading to an alteration in insulin sensitivity. Furthermore, studies with workers indicate that nocturnal food consumption also leads to an energy imbalance that promotes body weight gain (Nuñez, 2014).

Teachers undoubtedly develop a sedentary lifestyle due to their academic work (Bauman et al., 2012). This leads to a predisposition to overweight and obesity, associated in turn with metabolic diseases, classifying them as an at-risk population (Molano-Tobar et al., 2017), Their dedication is not only restricted to class hours. Their work forces them to allocate time to study, usually corresponding to the evenings or early mornings. This, added to stressful situations, can trigger health problems.

The above suggests that the sleep-wake relationship is of fundamental importance for human health; more so in this population. Hence the need to find out more about this process and how the lack of sleep, or an increase in sleep might contribute to obesity and to insulin resistance (Koren et al., 2015). It was therefore established as an objective to identify the association between anthropometric parameters, glycemia levels and chronotypes of university adults.

Methodology

The study was cross-sectional and used the descriptive-correlational method.

Participants

The sample was intentional with a total of 182 university professionals - 100 women and 82 men - from a Public Higher Education Institution (PHEI) in Popayán, a city in southwestern Colombia. The inclusion criteria corresponded to being adults over 18 years of age, university lecturers with a full-time indefinite contract at the PHEI, who do not show any kind of musculoskeletal or mental illness and decide to take part in the entire fieldwork process.

Instruments and Procedures

The survey used compiled general data such as age, sex, socioeconomic stratum - for Colombia this is related to family income level - and medical personnel supporting the project. Evaluation of the anthropometric and biochemical parameters was carried out. For the anthropometric aspects, the standards of the International Society for the Advancement of Kineanthropometry described by Pérez et al., (2012) were taken into account in measuring height and body weight. To obtain the body mass index it was ensured that the person was in light clothing without shoes, removing all kinds of metal objects or jewelry that could interfere with the results. Body weight was measured on an OMRON bioelectrical impedance balance (model HBF-514C), which passes a 50 kHz current; height was assessed with a Seca portable stadiometer with a range 0-205 cm and precision 1 mm. The indications of the WHO were taken into account for the classification that included the ranges malnutrition, normal, overweight and obesity (Resolution 2465, 2016).

One of the parameters evaluated was circumference of the waist, measured on the largest circumference that passes anteriorly through the navel and laterally through the upper edge of the iliac crests (Martín-Castellanos et al., 2017). From these direct measurements, waist-hip ratio was established, which according to WHO classification determines risk for men, greater than 0.90, and for women, greater than 0.80 (Paternina-de la Ossa et al., 2018). Body adiposity index was also measured (BAI) using the formula (Fedewa et al., 2018):

$$\frac{\text{Circunference of waist}}{\text{Height} \times \sqrt{\text{Height}}}$$

The blood glucose sample was taken after fasting for a minimum of eight hours. A capillary blood sample was drawn taking into account the glucose levels during fasting of ≥ 110 mg/dl, with a glucose meter and EasyGluco test strips, and this was classified according to the standards

of the American Diabetes Association (Real de Asua et al., 2014).

To determine the chronotype, the Horne-Ostberg questionnaire was used. This contains 19 questions (in which an option must be selected) such as "What time would you get up in conditions of absolute freedom to organize your day?", "What time would you go to bed in conditions of absolute freedom to organize your day?" and "Once you wake up, how alert do you feel during the first half hour?". At the end, the resulting points are totaled and result in a classification according to the ranges: 59 - 86 morning-type or morning lark, 42 - 58 intermediate-type and 16 - 41 evening-type or night owl (Valladares et al., 2016).

Data analysis

The Statistical Package for Social Science® software, version 24 (SPSS; Chicago, IL, USA) was used for statistical analysis. The Kolgomorov-Smirnov statistic was used to identify the normality of the sample. Basic statistical methods were applied. Continuous values were expressed as mean (±) standard deviation and proportions in percentages. Analysis of variance (ANOVA) was performed to study chronotype differences, while correlational analyzes were done using the Pearson correlation coefficient considering a level of statistical significance of $p < 0.05$.

Ethical considerations

The study was approved by the ethics committee of the PHEI and conducted in compliance with the ethical-legal standards set forth in the Helsinki Declaration for studies conducted with humans, such as resolution 8439 of 1993 of the Ministry of Health and Social Protection of Colombia. All participants gave and signed their informed consent prior to the explanation of the objectives and management of the confidentiality of the data of the participants in the study, according to resolution 1581 of 2012 in Colombia.

Results

Population characteristics

The sample corresponded to 182 adult teachers of a PHEI, comprising 100 women (54.89%) and 82 men (45.1%), with a mean age of 51.15 ± 5.21 years. As regards the sociocultural part, it was found that the adults live to a great extent in socioeconomic stratum 4 (47.8%), followed by 3 with 36.5%. On observing marital status, it could be seen that most were in a free union relationship (33.5%) or married (26.4%).

In relation to marital status and sex, it was found that of the women, the majority were married (n = 33), while for the men, a high percentage lived in a free union (n = 36).

Anthropometric Characteristics

It was possible to establish, as shown in Table 1, the descriptions of each variable, showing some general measures with a tendency to normality. Additionally, most variables showed a statistical significance of relevance for the study.

Table 1. Anthropometric characteristics of the adult university population

Anthropometry	Mean ± DE	Range	P<0.05
Body weight (Kg)	66.09±10.95	46 - 97	P = 0.891
Body size (mt)	1.63±0.08	1.43 - 1.91	P = 0.000
BMI (kg/mt2)	24.85±3.69	17.3 - 41.7	P = 0.05
Waist circumference (cm)	77.45±10.35	51 - 106	P = 0.000
Hip circumference (cm)	94.83±9.06	65 - 140	P = 0.000
Waist hip ratio	0.81±0.075	0.64 - 1.05	P = 0.000
Body adiposity index	19.37±5.71	6.50 - 38.60	P = 0.782

The previous variables subjected to an analysis in relation to sex made it possible to determine that the BMI that prevailed corresponded to normality in 57.1% and overweight was found in the general population in a percentage of 32.4%. Distribution according to sex is shown in Table 2.

Table 2. Distribution of BMI according to sex in the adult university population

SEX		Frequency	Percentage	Valid percentage	Accumulated percentage
FEMININE	Normal	51	51.0	51.0	51.0
	Overweight	35	35.0	35.0	86.0
	Obesity-I	12	12.0	12.0	98.0
	Obesity-2	2	2.0	2.0	100.0
	Total	100	100.0	100.0	
MALE	Normal	53	64.6	64.6	64.6
	Overweight	24	29.3	29.3	93.9
	Obesity-I	5	6.1	6.1	100.0
	Total	82	100.0	100.0	

For circumference of waist, 93.9% of the men were found to have low risk parameters and the rest in substantially increased risk (4.9%). Women, meanwhile, although found in greatest concentration in the low risk bracket (55%), some were found to fall into the substantially increased risk category (27%) as well as the increased risk one (18%).

On evaluation of the waist-hip ratio, it was possible to determine that men were not at risk (89%), while 54% of women did show risk.

Body adiposity index (BAI) was another indicator for body composition taken into account, revealing that the population was located between the standards of low for women (n = 61) and healthy for men (n = 71).

Regarding blood glucose, the population had a mean of 103.60 ± 14.79 mg/dl, with 48.4% being considered as prediabetic and 44.5% normal according to the classification of the American Diabetes Association (ADA). Regarding association with sex, these presented more normal ranges in men (n = 45) while in women only 37 fell in the normal range. In contrast, it was established that the prediabetes bracket contained 53 women and only 35 men, moreover, revealing in the population that the ranges of 10 of the women established them as diabetic, but only two men.

It was established that university adults had a chronotype according to the proposed scale of intermediate type (65.4%). The other parameter that scored well was moderate morning-type (29.7%), where the average of the sample corresponded to 55.41 ± 7.40. The relationship with sex showed that women tend to be more intermediate-type (n = 70) - in other words they adapt easily to morning or night - while men had values between intermediate-type (n = 49) and moderate morning-type (n = 26).

Relationships with moderate and low indicators were identified as shown in Table 3. These revealed that glycemia is a variable associated with the anthropometric measurements proposed for this study.

Table 3. Result of the Pearson correlation of the crossing of the study variables

Variables	R-value	P-value	Correlation
Glycemia/BAI	0.583	0.000	Moderate
Blood glucose/Waist	0.500	0.000	Moderate
Glycemia/Hip	0.493	0.000	Moderate
Glycemia/BMI	0.490	0.000	Moderate
ICC/Gender	0.426	0.000	Moderate
BAI/Gender	- 0.313	0.000	Short
Chronotype/ Glycemia	0.237	0.001	Short
BAI/aGE	0.212	0.004	Short
Chronotype / Gender	- 0.550	0.005	Moderate

Discussion

The study identified that university adults show conditions related to the middle class, which for Colombia indicates that they live in houses with public services and a certain comfort that allows them to develop as people and individuals. This is related to studies such as that of Querales. et al., (2012), indicating that the lower socioeconomic strata are linked with low quality and short sleep duration. This is because many of the people located in these low strata need not only one job, but several, and the working day stretches through the whole weekend, contrary to the adults in this study, who work only during the week, an observation that merits future research on aspects of work.

The data showed that most university adults are in common-law or married relationships, consistent with national and international studies (Fhon et al., 2016) stating that after middle age, the population has formed bonds and established a family or couple. Prevalence of cohabitation as a couple was also established. Studies mention that having a partner somehow reinforces confidence and tranquility, reflecting in the gain of some anthropometric measurements such as the incidence of sedentary lifestyle (Laclaustra et al., 2014). This too might constitute a perspective of future research.

As regards anthropometric parameters, the population in general were normal for BMI, but when relating this to sex, women showed diverse variations in the BMI items. This is verified by the national survey of health generated in 2010 by the National Administrative Department of Statistics (DANE, from the Spanish acronym) in Colombia (Bravo et al., 2013), showing that women tend to be overweight and obese (Alencar et al., 2016), reaffirming what was mentioned in other studies carried out with Latin American women (Blümel et al., 2015), which indicate this prevalence and allow association with this study.

The presence of adiposity in the waist and hip, with the relationship that occurs with the BMI, allows us to indicate the close association with cardiovascular risk, showing that on increasing the measurements in the waist and hip areas, a risk is established for women over men, finding similarity with the study by Urquidez-Romero et al., (2016), indicating that these events predict the progression of future chronic diseases and their direct association with metabolic syndrome.

In this study it was clearly demonstrated that women showed higher indicators in the waist-hip ratio, in agreement with the study by Alvim et al., (2014), which establishes that this is a better predictor than BMI, associating it with type 2 diabetes mellitus. As could be seen, the association of these parameters (waist-hip) showed moderate correlations with glycemia in the university adults, allowing a positive evaluation of the risk of the population and being able to establish the health risk for women. In this same sense, Silva et al., (2014) suggest that an increase in abdominal fat is associated with insulin resistance, high blood pressure and other cardiovascular pathologies, making it an economical and easy method to perform to determine the obesity epidemic and the distribution of abdominal fat.

The BAI is a relatively new indicator for evidence of adiposity. In the study it was discovered that the population in this item was in low i.e. healthy conditions. According to the data, its association with the circumference of the waist and the hip could be demonstrated, a fact that gives an additional possibility - to observe the distribution of body fat and its association with diseases such as hypertension, diabetes and cardiovascular diseases (Taing et al., 2016); this was confirmed by Chen et al., (2018) indicating high

sensitivity when compared to kidney diseases as well as cardiovascular and cerebrovascular risk. One of the existing concerns today on the part of obesity relates to the diseases derived from it, such as insulin resistance, hypertension, or cardiovascular diseases. For this study it was estimated that the adult university population showed a classification of prediabetes and normality, which is consistent with Latin American studies that state the increasing probability of the disease (Lizarazu-Diazgranados et al., 2013), conditioning it more in workers, due to their work rhythms, diet and physical activity.

The moderate correlation found in this study with waist and hip circumference allows us to determine that adipose tissue affects insulin production, causing the adipocyte to become a gland that produces hormones such as leptin, tumor necrosis factor and resistin, among others (Evans et al., 2016), which determine the presence of diabetes. Complementing with studies by Reuter et al., (2013), they specify the prevalence of glycemia alterations in the female gender, which is associated with the physiological changes of sex and the activation of adipose tissue differentiation pathways and the production of inflammatory cells, such as macrophages, that increase the possibility of harboring more adipose tissue in the waist and hip areas (Ortiz et al., 2017).

The above forms the foundation of the relationship of human beings with the biological clock, which mediates the activation or inhibition of different hormones. The study revealed that university adults have a tendency towards intermediate-type, contrary to the research by Valladares et al., (2016), who found a prevalence of evening-type; just as it did not show a correlation according to sex, although this was able to be associated in this study.

Analyzing the population of women, a higher prevalence was found for the intermediate type. This can be explained from the point of view that women, having responsibilities at home and at work, have generated adaptations in their sleeping and eating schedules, causing alterations in the dynamics of daily life (Souza et al., 2012). This further results in changes in the distribution of the meal time and in the time dedicated to it, preventing the absorption of food, changes such as the alteration in hormonal production for the optimal development of the circadian rhythm (Moreno et al., 2015).

The previous correlation found between glycemia and chronotype differs from those put forward by Gómez-Abellán et al., (2012) who specify that alterations in sleep time "show an alteration in glucose tolerance and a decreased insulin response resulting in increased plasma glucose".

One of the limitations of the study is the cross-sectional type of the research, which does not reveal the cause and effect of adiposity as regards the circadian rhythm. Although it does allow establishing new measurements in relation to adiposity, it is necessary to implement equipment that allows the real differentiation and distribution of body fat. In light of this, other research could be directed to the type and time of feeding with metabolic and hormonal aspects of the circadian rhythm.

Conclusions

The adult university population was found to have a strong correlation between adiposity and the glycemia parameters, determining that overweight and obesity in this population could be a risk factor in the future. Similarly, a low association was observed between the blood glucose levels with chronotype, which leads to the search for new paths and other methodologies for their study.

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Parámetros antropométricos, nivel de glicemia y cronotipo de adultos de Popayán-Colombia

Anthropometric parameters, glycemia level and chronotype of adults from Popayan-Colombia

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Resumen

La población adulta universitaria evidencia dificultades de salud relacionadas con su nivel de glucosa y variaciones en la relación sueño-vigilia, lo que un diagnóstico temprano permitirá realizar acciones preventivas, para lo cual, se buscó identificar la asociación de parámetros antropométricos, nivel de glicemia y cronotipo de adultos de la ciudad de Popayán-Colombia; a través de un estudio descriptivo correlacional con 182 adultos universitarios entre 36 a 68 años, evaluando parámetros antropométricos, determinación del cronotipo con el cuestionario de Horne-Ostberg y medición de la glicemia capilar. De la misma manera se realizaron análisis de normalidad y verificación de la correlación, mediante el coeficiente estadístico de Pearson (p. < 0.05). Como resultados se encontró normalidad de los parámetros antropométricos, con indicación de pre-diabéticos, y un cronotipo intermedio, el análisis de correlación mostró asociaciones moderadas de los niveles de glicemia con los parámetros antropométricos, pero baja asociación con el cronotipo. Se pudo concluir que las mujeres presentaron alteraciones en los niveles de glicemia como con el Índice de adiposidad corporal, con registro de cronotipo intermedio.

Palabras clave: Antropometría, glicemia, cronotipo, adultos.

Abstract

The adult university population shows health difficulties related to their glucose level and variations in the sleep-wake relationship, so an early diagnosis will allow preventive actions, for which we sought to identify the association of anthropometric parameters, blood glucose level and chronotype of adults from the city of Popayán-Colombia; through a descriptive correlational study with 182 university adults between 36 and 68 years old, evaluating anthropometric parameters, determining the chronotype with the Horne-Ostberg questionnaire and measuring capillary glycemia. In the same way, normality analyzes, and verification of the correlation were carried out using the Pearson statistical coefficient (p <0.05). As results, normality of the anthropometric parameters was found, indicating pre-diabetics, and an intermediate chronotype. The correlation analysis showed moderate associations of blood glucose levels with the anthropometric parameters, but low association with the chronotype. It was concluded that women presented alterations in glycemia levels as with the Body Adiposity Index, with an intermediate chronotype record.

Keywords: Anthropometry, glycemia, chronotype, adults.

Introducción

La salud de la población adulta universitaria está influenciada por numerosas acciones relacionadas con los estilos de vida (Sánchez-Ojeda & De Luna-Bertos, 2015), los cuales comprenden una gama de componentes dentro de los cuales se encuentran asociados a las condiciones de vida y patrones individuales de conducta (García-Laguna et al., 2012), es así como la alimentación es un parámetro determinante y mediador del proceso salud-enfermedad, aspecto que hoy en día se considera de vital importancia desde el ámbito de la salud pública (Valdés-Badilla et al., 2017).

La Organización Mundial de la Salud (OMS), evidencia que la tasa de sobrepeso y obesidad se ha incrementado a nivel mundial, encontrando indicadores de 2016 donde establecen que "más de 1900 millones de adultos de 18 años o más tenían sobrepeso, de los cuales más de 650 millones eran obesos", en Colombia no se evidencia ninguna excepción, lo que permite asegurar que existe un riesgo latente en cuanto a la salud (Ríos-García et al., 2013).

Los trastornos que se asocian con el sobrepeso y la obesidad, son variados y albergan diferentes aspectos, no solo de índole psicológico sino también a nivel físico y metabólico (Rodríguez-Flores, M., 2014), es así, como se ha demostrado que el sobrepeso y la obesidad están generando alteraciones en la relación sueño vigilia (Salin-Pascual, 2015), lo cual, conlleva a perturbaciones asociadas a la respuesta del organismo, específicamente en el sistema nervioso y el cardiovascular, donde el procesamiento de hormonas fundamentales (insulina, glucagón, hormona del crecimiento, leptina), desencadena una serie de mecanismos que afectan la salud (Gómez-Abellán et al., 2012 y Tan et al., 2017).

La utilización de las medidas antropométricas, son de importancia hoy en día para establecer la presencia de sobrepeso u obesidad (Tanaka et al., 2016), pero la novedad se centra en la distribución que alberga el tejido adiposo y más en personas adultas (Neefs et al., 2019), por ello, la utilización de nuevos índices permite proyectar aún más la distribución de la grasa corporal y su incidencia en la salud, permitiendo establecer la correlación como riesgo de la población a enfermedades como la diabetes, puesto que esta enfermedad es una patología de alta mortalidad y que tiene una creciente asociación con la obesidad (Han et al., 2017).

Por otra parte, se presenta como el tiempo de sueño en la edad adulta se ve disminuido (Kani et al., 2016), y es debido en parte por las diferentes responsabilidades que se tiene no solo de índole laboral, sino también relacionado con el ámbito familiar y social, investigaciones han permitido establecer que la relación vigilia-sueño tiende a disminuir con la edad (García Naveira et al., 2015), hechos que vinculan un mayor riesgo para incrementar la incidencia epidemiológica de la obesidad y la resistencia a la insulina (Marcadenti et al., 2017), ya que, al tener menor duración del sueño, se genera activación del sistema nervioso simpático, la actividad adreno-corticoide, la cual se eleva y ello conduce a una alteración en la sensibilidad a la insulina, a la vez estudios con trabajadores indican que el consumo nocturno de alimentos también conlleva a un desequilibrio energético que promueve el aumento de peso corporal (Nuñez, 2014).

Es indudable, que los docentes por su labor académica, desarrollan estilo de vida sedentarios (Bauman et al., 2012), lo cual conlleva a predisposición al sobrepeso como a la obesidad, y ello se asocia a enfermedades metabólicas que los cataloga como una población de riesgo (Molano-Tobar et al., 2017), pues su dedicación no solo se restringe al horario de clase, sino que su labor los obliga a destinar tiempo al estudio, que usualmente corresponde a la noche o madrugada, y sumado a situaciones estresantes, desencadenan problemas de salud.

Lo anterior, denota que la relación sueño-vigilia son de fundamental importancia para la salud humana y más en esta población, de ello la necesidad de indagar acerca de dicho proceso y como la falta o aumento de sueño contribuyen a la obesidad y a la resistencia a la insulina (Koren et al., 2015), desde ello se estableció como objetivo, identificar la asociación entre los parámetros antropométricos, los niveles de glicemia y cronotipo de adultos universitarios.

Metodología

El estudio fue de tipo transversal de carácter descriptivo correlacional

Participantes

La muestra fue intencional con un total de 182 profesionales universitarios de una Institución de Educación Superior Pública (IESP) en la ciudad de Popayán Colombia, distribuidos en 100 mujeres y 82 hombres. Los criterios de inclusión correspondieron a que fueran adultos mayores de 18 años, docentes universitarios con contrato indefinido de tiempo completo en la IESP, no presentaran ninguna clase de enfermedades de índole osteomuscular o mental y decidieran participar en todo el proceso de trabajo de campo.

Instrumentos y Procedimientos

Se utilizó una encuesta que compilo datos generales como la edad, sexo, estrato socioeconómico (para Colombia está relacionado con el nivel de ingresos familiares) y el personal médico de apoyo al proyecto, se realizó la evaluación de los parámetros antropométricos y bioquímicos, para los aspectos antropométricos, se tuvieron en cuenta los estándares de la Sociedad Internacional para el Avance de la Kineantropometría, descritos por Pérez et al., (2012), con los que se realizó la medición de talla y peso corporal; para la obtención del índice de masa corporal, se tuvo en cuenta que la persona se encontrara con ropa ligera sin calzado quitando todo tipo de objetos metálicos o joyas que pudieran interferir en los resultados. El peso corporal se midió en una balanza de impedancia bioeléctrica marca OMRON (modelo HBF-514C), que hace pasar una corriente de 50 kHz; la talla se evaluó con un estadiómetro portátil marca Seca con rango 0-205 cm de 1 mm de precisión. Se tuvo en cuenta las indicaciones de la OMS para la clasificación que comprendió los rangos de desnutrición, normal, sobrepeso y obesidad (Resolución 2465, 2016).

Uno de los parámetros evaluados fue el perímetro de cintura, la cual fue medida en la mayor circunferencia que pasa anteriormente por el ombligo y lateralmente por el borde superior de las crestas iliacas (Martín-Castellanos et al., 2017) y a partir de estas mediciones directas se estableció la relación cintura cadera, la cual según la clasificación de la OMS determina riesgo para hombres superior a 0.90 y para mujeres superior a 0.80 (Paternina-de la Ossa et al., 2018), como también el índice de adiposidad corporal (IAC) a través de la fórmula (Fedewa et al., 2018):

$$\frac{\text{Perímetro de Cadera}}{\text{Altura x } \sqrt{\text{Altura}}} - 18$$

La muestra de glicemia se tomó después de al menos ocho horas de ayuno, se extrajo una muestra de sangre capilar teniendo en cuenta los niveles de glucosa en ayunas de ≥ 110 mg/dl, con un glucómetro y tiras reactivas marca EasyGluco y se clasificó según los estándares de la Asociación Americana de Diabetes (Real de Asua et al., 2014).

Para determinar el cronotipo se utilizó el cuestionario Horne-Ostberg, que contiene 19 preguntas donde debe elegir una opción, como "¿a qué hora te levantarías en condiciones de absoluta libertad para organizar tu jornada?", "¿a qué hora te acostarías en condiciones de absoluta libertad para organizar tu jornada?" y "una vez que te has levantado, ¿cuán alerta te sientes durante la primera media hora?"; al terminar se suman los resultados y de acuerdo a los rangos: 59 - 86 madrugador o vespertino, 42 - 58 intermedio y 16 - 41 trasnochador o vespertino, se clasifica (Valladares et al., 2016).

Análisis de datos

Para el análisis estadístico se utilizó el programa Statistical Pack Age for Social Science® software, versión 24 (SPSS; Chicago, IL, USA), para identificar la normalidad de la muestra se utilizó el estadístico de Kolgomoriv-Smirnov. Se aplicaron métodos estadísticos básicos, los valores continuos se expresaron como media, (±) desviación estándar y las proporciones en porcentaje, se realizó análisis de varianza (ANOVA) para estudiar las diferencias de cronotipo; análisis correlacionales mediante el coeficiente de correlación de Pearson considerando un nivel de significancia estadística de $p < 0.05$

Consideraciones Éticas

El estudio fue aprobado por el comité de ética de la IESP y se dirigió respetando las normas ético-legales planteadas en la declaración de Helsinki para estudios realizados con humanos, como la resolución 8439 de 1993 del Ministerio de Salud y Protección Social de Colombia. Todos los participantes firmaron el consentimiento informado previo a la explicación de los objetivos y manejo de la confidencialidad de los datos de los participantes en el estudio, según la resolución 1581 de 2012 en Colombia.

Resultados

Características Poblacionales

La muestra correspondió a 182 docentes adultos de una IESP, distribuidos en 100 mujeres (54.89%) y 82 hombres (45.1%), con una edad media de 51.15 ±5.21 años. Con relación a la parte sociocultural se encontró que los adultos se albergan en mayor proporción en el estrato socioeconómico 4 (47.8%), seguido del 3 con 36.5%, al observar el estado civil se evidencio que en su mayoría tenían una relación de unión libre (33,5%) o eran casados (26,4%).

Con relación al estado civil y al sexo se encontró que las mujeres en su mayoría se encuentran casadas (n = 33), mientras que los hombres en un alto porcentaje viven en unión libre (n = 36).

Se pudo establecer, como se muestra en la tabla 1, las descripciones de cada variable, mostrando unas medidas generales con tendencia a la normalidad, adicionalmente, es interesante observar que la mayoría de las variables manifestaron una significancia estadística de relevancia para el estudio.

Tabla 1. Características antropométricas de la población adulta universitaria

Antropometría	Media ± DE	Rango	P<0.05
Masa corporal (Kg)	66.09±10.95	46 - 97	P = 0.891
Talla (m)	1.63±0.08	1.43 - 1.91	P = 0.000
IMC (kg/mt2)	24.85±3.69	17.3 - 41.7	P = 0.05
Circunferencia de la cintura (cm)	77.45±10.35	51 - 106	P = 0.000
Circunferencia de la cadera (cm)	94.83±9.06	65 - 140	P = 0.000
Ratio cintura-cadera	0.81±0.075	0.64 - 1.05	P = 0.000
Índice de adiposidad corporal	19.37±5.71	6.50 - 38.60	P = 0.782

Las anteriores variables sometidas a un análisis con relación al sexo, permitió determinar que el IMC que prevaleció corresponde a la normalidad en el 57.1% y el sobrepeso se presentó en la población en general en un porcentaje de 32.4%, la distribución de acuerdo con el sexo se observa en la Tabla 2.

Tabla 2. Distribución del IMC de acuerdo al sexo en la población de adultos universitarios

SEXO		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
FEMENINO	Normal	51	51.0	51.0	51.0
	Sobrepeso	35	35.0	35.0	86.0
	Obesidad-I	12	12.0	12.0	98.0
	Obesidad-2	2	2.0	2.0	100.0
	Total	100	100.0	100.0	
MASCULINO	Normal	53	64.6	64.6	64.6
	Sobrepeso	24	29.3	29.3	93.9
	Obesidad-I	5	6.1	6.1	100.0
	Total	82	100.0	100.0	

Para el perímetro de cintura, se observó que el 93.9% de los hombres presentaron parámetros de bajo riesgo y el resto estuvo distribuido en riesgo sustancialmente aumentado (4.9%); mientras que las mujeres, aunque si presentaron una mayor conglomeración en bajo riesgo (55.0%), se evidencia distribución en el ítem de riesgo sustancialmente aumentado (27%) como para el de riesgo aumentado con 18 mujeres.

En la evaluación de la relación de cintura cadera se pudo determinar que los hombres no presentaron riesgo (89.0%), mientras que el 54% de las mujeres manifestaron riesgo.

Se tuvo en cuenta otro indicador para la composición corporal, como fue el índice de adiposidad corporal (*IAC*), permitiendo encontrar que la población se ubicaba entre los estándares de bajo para las mujeres (n = 61) y saludable para los hombres (n = 71).

Respecto a la glicemia en sangre, se evidenció que la población se encontró con una media de 103.60 ± 14.79 mg/dl, considerándose de acuerdo con la clasificación de la Asociación Americana de Diabetes (*ADA*) como prediabéticos el 48.4%, seguido de normalidad en 81 adultos (44.5%). Referente a la asociación con el sexo presentaron rangos de normalidad más en hombres (n = 45) mientras que las mujeres solo 37 manifestaron esta condición; al contrario, se estableció en el ítem prediabetes que albergo a 53 de las mujeres y solo 35 hombres, mostrando en la población que 10 de las mujeres presentaron rangos que las establecen como diabéticas y solo 2 en los hombres.

Se logró establecer que los adultos universitarios presentaron un cronotipo según la escala propuesta de intermedio (65.4%), y el otro parámetro que representa mayor porcentaje es matutino moderado (29.7%), donde el promedio de la muestra correspondió a 55.41 ± 7.40. La relación con el sexo mostro que las mujeres tienden a presentar más un cronotipo intermedio (n = 70) ósea que se adaptan fácilmente a lo matutino o nocturno, mientras que los hombres presentaron valores distribuidos entre cronotipo intermedio (n = 49) seguido de cronotipo matutino moderado (n = 26).

Se identificó relaciones con indicadores moderados y bajos como se observa en la tabla 3, permitiendo identificar que la glicemia es una variable que se asocia con las mediciones antropométricas, propuestas para este estudio.

Tabla 3. Resultados de la correlación de Pearson del cruce de las variables del estudio

Variables	R-value	P-value	Correlación
Glicemia/IAC	0.583	0.000	Moderada
Glucosa sanguínea/Cintura	0.500	0.000	Moderada
Glicemia/Cadera	0.493	0.000	Moderada
Glicemia/IMC	0.490	0.000	Moderada
ICC/Género	0.426	0.000	Moderada
IAC/Género	- 0.313	0.000	Baja
Cronotipo/ Glicemia	0.237	0.001	Baja
IAC/aGE	0.212	0.004	Baja
Cronotipo / Género	- 0.550	0.005	Moderada

Discusión

El estudio permitió identificar que los adultos universitarios presentan condiciones relacionadas con la clase media, lo que indica para Colombia que las viviendas cuentan con servicios públicos y cierta comodidad que les permite desarrollarse como personas e individuos, lo que se relaciona con estudios como el de Querales et al., (2012), donde indica que en los estratos socioeconómicos más bajos se asocian con una baja calidad y duración de sueño, esto debido a que muchas de las personas ubicadas en estos estratos bajos deben tener no solo un trabajo, sino varios y su jornada laboral se asume hasta todo el fin de semana, contrario a los adultos de este estudio que su jornada laboral se realiza solo en la semana, lo que merece a futuro en profundizar sobre los aspectos laborales.

Los datos permitieron identificar que los adultos universitarios en su mayoría presentan una relación de unión libre o casados, lo que concuerda con estudios nacionales e internacionales (Fhon et al., 2016), al decir que después de la mediana edad, la población tiene a generar vínculos y establecimiento de una familia o pareja; de la misma manera se estableció una prevalencia de convivencia en pareja, lo cual algunos estudios mencionan que el tener una pareja refuerza de alguna manera la

confianza y la tranquilidad, reflejándose en la ganancia de algunas medidas antropométricas como la incidencia de sedentarismo (Laclaustra et al., 2014), lo cual podría ser una perspectiva de investigación a futuro.

Con relación a los parámetros antropométricos, se evidenció que la población en general presentó normalidad para el IMC, pero al relacionar el sexo se logró determinar que las mujeres son las que presentan variaciones diversas en los ítems del IMC, lo que constata con la encuesta nacional de salud generada en 2010 por el departamento Administrativo Nacional de Estadísticas (DANE) en Colombia (Bravo et al., 2013), evidenciando que las mujeres tienden al sobrepeso y la obesidad (Alencar et al., 2016), reafirmando lo mencionado, en otros estudios realizados con mujeres latinoamericanas (Blümel et al., 2015), que indican dicha prevalencia y permiten asociar con este estudio.

La presencia de adiposidad en cintura y cadera, con la relación que se presenta con el IMC, permite indicar la estrecha asociación con el riesgo cardiovascular, evidenciando que al incrementar las medidas en las áreas de la cintura y la cadera sé estable un riesgo para las mujeres sobre los hombres, hallando similitud con el estudio de Urquidez-Romero et al., (2016), al indicar que dichos eventos, predicen a la progresión de enfermedades crónicas futuras y su asociación directa con el síndrome metabólico.

Sin duda, en este estudio se pudo demostrar que las mujeres presentaron mayores indicadores en la relación de cintura cadera, concordando con el estudio de Alvim et al., (2014), el cual establece que es un mejor predictor que el IMC, al asociarlo con diabetes mellitus tipo 2 y como se pudo observar, la asociación de estos parámetros (cintura-cadera) demostraron correlaciones moderadas con la glicemia en los adultos universitarios, permitiendo evaluar positivamente el riesgo de la población y poder establecer el riesgo en salud que presentan las mujeres, en este mismo sentido Silva et al., (2014), sugieren que un incremento de grasa abdominal, se asocia a la resistencia a la insulina, hipertensión arterial como otras patologías cardiovasculares, siendo así un método económico y fácil de realizar para determinar la epidemia de la obesidad y la distribución de la grasa abdominal.

El IAC, es un indicador relativamente nuevo para la evidencia de adiposidad, en el estudio se descubrió que la población en este ítem estaba en condiciones bajas o saludables y de acuerdo a los datos obtenido, se logró evidenciar su asociación con el perímetro de cintura como de cadera, hecho que da una posibilidad adicional, para observar la distribución de la grasa corporal y su asociación con enfermedades como la hipertensión, diabetes y enfermedades cardiovasculares (Taing et al., 2016); esto fue constatado por Chen et al., (2018) indicando la alta sensibilidad al compararlo con enfermedades renales como con el riesgo cardiovascular y cerebrovascular.

Una de las preocupaciones existentes hoy en día por parte de la obesidad, son las enfermedades derivadas de ella, como la resistencia a la insulina, hipertensión o enfermedades cardiovasculares, para este estudio se estimó que la población adulta universitaria presentó, una clasificación de prediabetes y normalidad, lo que concuerda con los estudios latinoamericanos que enuncian la creciente probabilidad de la enfermedad (Lizarazu-Diazgranados et al., 2013), condicionándose más en trabajadores, por sus ritmos de trabajo, alimentación y actividad física.

La moderada correlación encontrada en este estudio con el perímetro de cintura y cadera, permite determinar que el tejido adiposo afecta la producción de insulina, propiciando que el adipocito se convierta en una glándula productora de hormonas tales como la leptina, factor de necrosis tumoral y resistina entre otras (Evans et al., 2016), que determinan la presencia de diabetes; complementando con estudios de Reuter et al., (2013), precisan la prevalencia de las alteraciones de la glicemia en el género femenino, que se asocia a los cambios fisiológicos propios del sexo y a la activación de vías de diferenciación del tejido adiposo y la producción de células inflamatorias, como macrófagos que incrementan la posibilidad de albergar más tejido adiposo en las áreas de la cintura como cadera (Ortiz et al., 2017).

Lo anterior, fundamenta la relación que los seres humanos presentan con el reloj biológico, el cual media la activación o inhibición de las diferentes hormonas, en el estudio se pudo evidenciar, que los adultos universitarios presentan una tendencia hacia un cronotipo intermedio, contrario a la investigación de Valladares et al., (2016), quienes encontraron una prevalencia de cronotipo trasnochador, como también, no evidenciaron correlación según el sexo, pero si se pudo asociar en este estudio.

Al analizar a la población de mujeres, se encontró mayor prevalencia por el cronotipo intermedio, lo cual puede ser justificado, desde el punto de vista que la mujer por tener responsabilidades del hogar como del trabajo, ha generado adaptaciones en sus horarios de sueño y alimentación, ocasionando alteraciones en las dinámicas de la vida cotidiana (Souza et al., 2012); hecho que también genera modificaciones en la distribución de sus horarios de comidas y en el tiempo dedicado a ello, ocasionando que no se presente una absorción de los alimentos, como la alteración en la producción hormonal para el óptimo desarrollo del ritmo circadiano (Moreno et al., 2015).

La anterior correlación entre la glicemia y el cronotipo, encontrada difiere a los presentados por Gómez-Abellán et al., (2012), donde, precisa que las alteraciones en el tiempo de sueño "muestran una alteración en la tolerancia a la glucosa y una disminución de la respuesta de la insulina que tiene como consecuencia un aumento de la glucosa plasmática".

Una de las limitaciones del estudio, es el tipo de investigación transversal, que no permite evidenciar la causa y efecto de la adiposidad con el ritmo circadiano, aunque permite establecer nuevas mediciones con relación a la adiposidad, se hace necesario la implementación de equipos que permitan la diferenciación y distribución real de la grasa corporal, en este sentido, otras investigaciones podrían encaminarse al tipo y tiempo de alimentación con aspectos metabólicos y hormonales del ritmo circadiano.

Conclusiones

La población adulta universitaria presentó una fuerte correlación entre la adiposidad y los parámetros de glicemia, logrando determinar que el sobrepeso y la obesidad en esta población, podrían ser un factor de riesgo a futuro, de la misma, manera se observó una asociación baja entre los niveles de glicemia con el cronotipo, lo cual conlleva a buscar nuevos caminos y otras metodologías para su estudio.

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Most frequent tests in the literature for the evaluation of physical qualities in elite level Paralympic wheelchair basketball: a systematic review

Test más frecuentes en la literatura para la evaluación de las cualidades físicas en el baloncesto en silla de ruedas nivel élite: Una revisión sistemática

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Abstract

The objective was to identify the most recurrent tests in literature which are used for the evaluation of physical qualities in wheelchair basketball elite level. For this, a systematic review was carried out in PubMed, Web of Science, Scopus and ScienceDirect, involving the use of keywords athletes, wheelchair basketball and test and performance. The search strategy carried out yielded a total of 270 results where, after eliminating duplicates and applying the previously established inclusion and exclusion criteria, 39 documents were included for detailed review based on qualitative synthesis. According to the collected literature, most tests included 20m sprint as a majority, followed by 5m sprint test and dynamometer, which indicates that the most evaluated physical qualities were speed, strength, agility, and anaerobic power. According to the aforementioned, it is concluded that the tests used are tools of easy access, for the most part, since large-scale sports implements are not necessary (excluding the Wingate test, which requires a crank ergometer). They are also pertinent and valid for the evaluation of physical qualities in elite level BSR athletes.

Keywords: Adapted sports, Training, Sports Preparation, Performance, Athletes.

Resumen

El objetivo fue identificar los test más recurrentes en la literatura, utilizados para la evaluación de las cualidades físicas en el BSR nivel élite. Para ello se llevó a cabo Revisión Sistemática en PubMed, Web of Science, Scopus y ScienceDirect, combinando las siguientes palabras clave Athletes y "Wheelchair basketball" y Test y Performance. La estrategia de búsqueda realizada arrojó un total de 270 resultados donde posterior a la eliminación de duplicados y aplicando los criterios de inclusión y exclusión previamente establecidos, llegaron a ser incluidos 39 documentos para su revisión detallada de síntesis cualitativa. Los test más utilizados según la literatura recabada, señalan en primer lugar al Sprint 20m, seguido del Sprint 5m y dinamómetro, lo cual indica que las cualidades físicas más evaluadas son; velocidad, fuerza, agilidad y potencia anaeróbica. De acuerdo a lo mencionado anteriormente, se concluye que los test utilizados son herramientas de fácil acceso, en su mayoría, pues no son necesario implementos deportivos de gran envergadura, (excluyendo el test de Wingate el cual requiere un ergómetro de manivela). Además, son pertinentes y válidos para la evaluación de las cualidades físicas en atletas de BSR nivel elite.

Palabras clave: Deporte adaptado, Entrenamiento, Preparación Deportiva, Rendimiento, Atletas.

Introduction

Wheelchair basketball (WB) is one of the most well-known and attractive sports modalities in the paralympic movement (Luarte et al., 2022; Solera et al., 2021), emerging for the first time around the year 1946 in the US after the Second World War, being practiced by wounded soldiers who, for the most part, were former players without disabilities who wanted to carry on, in one way or another, practicing this sport (International Paralympic Commmittee, 2019).

This modality is regulated by the International Wheelchair Basketball Federation (IWBF) and establishes rules of play similar to the conventional sport, although with adaptations, among them, the wheelchair and sports classification. The latter is a mandatory requirement for athletes to participate in official competitions and consists of grouping athletes according to the functionality of their disability (IWBF, 2021b). According to the functionality presented, each athlete will be incorporated into a sport class ranging from 1.0 to 4.5, considering that, the lower their sport class, the greater the motor compromise presented by the athlete (Cavedon et al., 2018; dos Santos et al., 2017; IWBF, 2021b; Luarte et al., 2022). Therefore, no team may field athletes whose combined total of the five players on the court adds up to more than 14 points (IWBF, 2021b).

WB is an intermittent sport that demands athletes to possess adequate levels of strength in its various manifestations; speed and agility, aerobic and anaerobic endurance to perform high intensity actions with short recovery time intervals (Iturricastillo et al., 2016; Seron et al., 2019). In addition, technique is essential in the performance of athletes, since game situations entail having ball control and wheelchair handling in the actions proper and determinant of the modality, such as; pushing the chair, dribbling, turning, passing, throwing to the hoop and tilting the chair on a wheel (IWBF, 2021a; Soylu et al., 2020).

The wide variety of individual physical disabilities on a team makes physiological responses different for each player and considering the wheelchair which is a primordial part as the integration of the player with their chair allows for propulsion and sport movements that impact their performance (Goosey-Tolfrey & Leicht, 2013). The considerations of all these variables make a great challenge for researchers. With respect to the evaluations in WB, we have two relevant considerations which are the player and the wheelchair, since both form a single unit that gives an answer according to the athlete's sport form and the conditions of his wheelchair, in addition it should be considered that the performance not only depends on the physical condition of the athletes, but also on the skills, experiences and technical competencies of the sport (Goosey-Tolfrey & Leicht, 2013).

For athletes, complete performance evaluations should be considered that include aerobic, anaerobic and sport-specific abilities that allow the evaluation of individual parameters and the level of achievement in an indoor environment with the application of field tests (Vanlandewijck et al., 1999), in addition to specific laboratory tests such as the Wingate test with arm crank ergometers to evaluate maximal and average anaerobic power and fatigue index (Bartosz & Molik et al., 2010).

Evaluations in sport, are fundamental tools that allow knowing the physical condition of the athlete, the effects that one has with the practice of the activity and is the means by which coaches obtain objective parameters to make decisions and to be able to define the most appropriate type of training (González-Rico & Ramírez-Lechuga, 2018).

These evaluations are fundamental for the sports preparation of athletes considering the complexity of the systems that compose it; that is, competition system, training system and complementary factors (Gomes, 2009). Physical evaluations are closely related to the training system, which is related to the development and improvement of athletes considering the principles of modality specificity, individuality, overload, continuity, volume and intensity (Gomes, 2009 cited in Campos Campos et al., 2021; Fernández et al., 2021).

Therefore, the objective of this research is to identify the most recurrent tests in the literature, used for the evaluation of physical qualities in WB elite level.

Methods

Protocol

A systematic literature review was performed according to the guidelines set forth in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Statement (Moher et al., 2009; Page et al., 2021).

Data sources and search

A literature search was conducted between April and May 2021 in four electronic databases: PubMed, Web of Science (WOS), Scopus and ScienceDirect. Keywords in English were used in the searching process: Athletes, Wheelchair Basketball, Testing and Performance were entered. Key search terms were included and combined using the "AND", "OR" operator: [Athletes AND "Wheelchair basketball" AND Test AND Performance].

Eligibility Criteria

Eligibility criteria were determined according to the PICOS approach, which contemplates in its acronym; population (P), intervention (I), comparator (control) (C), outcome (O) and study design(s) (S), This strategy is used for the construction of research question and eligibility criteria (da Costa Santos et al., 2007).

Accordingly, studies were considered if (1) the sample consisted of elite athletes, (2) WB practitioners, (3) if the results of the studies dealt with the evaluation of physical qualities and (4) were published in English, Spanish and/or Portuguese.

Studies that corresponded to (1) thesis studies, (2) book chapters, (3) articles without full text and (4) case studies were excluded.

Selection of studies

First, all the articles obtained after the searching process from the databases were classified and registered in the Mendeley® program, in which duplicates were eliminated and those that did not meet the inclusion criterion of year of publication were excluded. Subsequently, the articles were reviewed by title and/or abstract, where one or more of the key terms were present. Finally, only articles that met all the inclusion criteria were considered. These studies were finally analyzed during the review process.

Process of data collection

The data collection process is based on the PRISMA flowchart. That is, three main filters were applied during the data collection process detailed in the previous point. The Mendeley® program was used to compile the information

from all the selected databases and the results were recorded using an Excel® spreadsheet.

In the first instance, with the articles that were selected on the basis of the title and summary, the information was recorded with respect to: title and variable of the physical quality that it evaluates.

Then, the articles were read completely and those that met the inclusion criteria, an additional Excel spreadsheet was created, where the following information was identified: year of publication, title, authors, objective of the research, methodology, results, and conclusions.

Finally, based on the above information, two tables were prepared, firstly, with the characteristics of the studies: author, year, title, and objective. Secondly, with the aspects: author, year, methodology, results, and conclusions.

Results

Selection of studies

The initial search in the databases yielded a total of 270 articles, where 199 studies were registered after the elimination of duplicates. These articles were read by title and/or abstract in search of information relevant to our research topic, with 43 studies being selected for full reading. Finally, a total of 39 articles met the eligibility criteria and were selected for this systematic review.

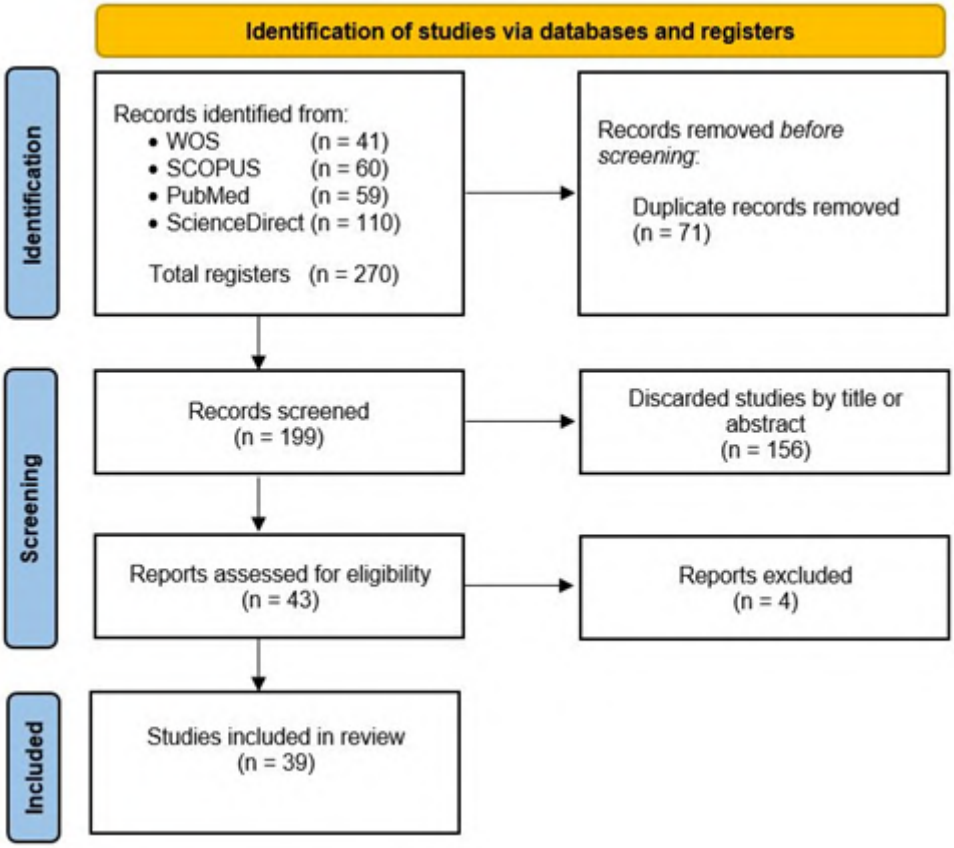

Figure 1. *PRISMA flowchart*
Page et al. (2021)

Process of data collection

Table 1 shows the identification in the original language of all the articles included in the systematic review, where the largest number of articles were between 2015 and 2020.

Table 1. Identification of selected studies

Author(s)	Year	Title
Mason et al.	2012	The Effect of Wheel Size on Mobility Performance in Wheelchair Athletes
de Groot et al.	2012	Validity and reliability of tests determining performance-related components of wheelchair basketball
Montesano et al.	2013	Improvement of the motor performance difference in athletes of wheelchair Basketball
Molik et al.	2013	Relationships between anaerobic performance, field tests, and functional level of elite female wheelchair basketball athletes
Leicht et al.	2014	Blood lactate and ventilatory thresholds in wheelchair athletes with tetraplegia and paraplegia
Ozmen et al.	2014	Explosive strength training improves speed and agility in wheelchair basketball athletes
Yanci et al.	2015	Sprint, agility, strength and endurance capacity in wheelchair basketball players
Granados et al.	2015	Anthropometry and performance in wheelchair basketball
Iturricastillo et al.	2015	Changes in Body Composition and Physical Performance in Wheelchair Basketball Players During a Competitive Season
Weissland et al.	2015	Comparison between 30-15 intermittent fitness test and multistage field test on physiological responses in wheelchair basketball players
Cavedon et al.	2015	Physique and Performance of Young Wheelchair Basketball Players in Relation with Classification.
Weissland, Faupin, Borel, Berthoin, et al.	2015	Effects of Modified Multistage Field Test on Performance and Physiological Responses in Wheelchair Basketball Players
Astier et al.	2016	Perceived exertion responses and performance of two mode of propulsion in the multistage field test with wheelchair basketball players
Pereira et al.	2016	Respiratory muscle strength and aerobic performance of wheelchair basketball players
Ferro et al.	2016	Sprint performance of elite wheelchair basketball players: Applicability of a laser system for describing the velocity curve
Vaquera et al.	2016	Validity and Test-Retest Reliability of the TIVRE-Basket Test for the Determination of Aerobic Power in Elite Male Basketball Players
Saltan & Ankarali	2017	The Role of Trunk Stabilization in Functional-Classification Levels in Wheelchair Basketball
Ferreira et al.	2017	Morphological characteristics, muscle strength, and anaerobic power performance of wheelchair basketball players
Ferro et al.	2017	Nutritional Habits and Performance in Male Elite Wheelchair Basketball Players During a Precompetitive Period
Skucas & Pokvytyte	2017	Short-term moderate intensive high volume training program provides aerobic endurance benefit in wheelchair basketball players
Molik et al.	2017	Comparison of Aerobic Performance Testing Protocols in Elite Male Wheelchair Basketball Players
de Witte et al.	2018	Development, construct validity and test–retest reliability of a field-based wheelchair mobility performance test for wheelchair basketball

Author(s)	Year	Title
Iturricastillo et al.	2017	Neuromuscular Responses and Physiological Changes During Small-Sided Games in Wheelchair Basketball.
Cavedon et al.	2018	Anthropometry, body composition, and performance in sport-specific field test in female wheelchair basketball players
Yüksel & Sevindi	2018	Examination of Performance Levels of Wheelchair Basketball Players Playing in Different Leagues
de Witte, Sjaarda, et al.	2018	Sensitivity to change of the field-based Wheelchair Mobility Performance Test in wheelchair basketball.
Veeger et al.	2019	Improving mobility performance in wheelchair basketball
Iturricastillo et al.	2019	Velocity and Power-Load Association of Bench-Press Exercise in Wheelchair Basketball Players and their Relationships With Field-Test Performance
Tachibana et al.	2019	Influence of Functional Classification on Skill Tests in Elite Female Wheelchair Basketball Athletes
Marszałek et al.	2019	Laboratory and non-laboratory assessment of anaerobic performance of elite male wheelchair basketball athletes
Otto et al.	2019	Physiological responses at the anaerobic threshold and at peak performance during arm crank ergometer diagnostics compared to wheelchair propulsion on a treadmill in elite wheelchair basketball players
Marszalek et al.	2019	Test-retest reliability of the newly developed field-based tests focuses on short time efforts with maximal intensity for wheelchair basketball players
Antonelli et al.	2020	Effects of inspiratory muscle training with progressive loading on respiratory muscle function and sports performance in high-performance wheelchair basketball athletes: A randomized clinical trial
Weber et al.	2020	Adaptation of Anaerobic Field-Based Tests for Wheelchair Basketball Athletes
De Witte et al.	2020	Effects of seat height, wheelchair mass and additional grip on a field-based wheelchair basketball mobility performance test
Loturco et al.	2020	Relationship between power output and speed-related performance in Brazilian wheelchair basketball players
Villacieros et al.	2020	Relationship between Sprint Velocity and Peak Moment at Shoulder and Elbow in Elite Wheelchair Basketball Players
Zacharakis	2020	The effect of upper limb characteristics on palm strength, anaerobic power, and technical skills of wheelchair basketball players of varying classification
Soylu et al.	2020	The Relationship Between Athletic Performance and Physiological Characteristics in Wheelchair Basketball Athletes

Source: Own elaboration.

On the other hand, Table 2 shows a summary of the selected articles that evaluated some physical quality by means of physical tests.

Table 2. Summary of selected studies

Author(s)	Sample	Methods	Variable	Test
Astier et al. (2016)	8 athletes	Performance evaluation in synchronous and asynchronous mode (wheelchair propulsion) in multi-stage incremental field test (MFT). The number of exercise levels performed, maximal aerobic speed, rating of perceived exertion, and arm frequency were measured.	Maximal aerobic speed	Multistage Field Test (MFT)
Otto et al. (2019)	8 athletes	Physiological responses at anaerobic threshold and maximal performance in two tests were evaluated.	Oxygen uptake (VO2), heart rate (HR), energy expenditure (EE), and lactate concentration (LA)	Ergometer – Treadmill.
Cavedon, Zancanaro & Milanese (2015)	52 athletes (45 men 7 women)	Evaluation of performance in sport-specific field tests.	Speed - Explosive Force	Speed: Sprint 5m - Sprint 20m w/ball - Suicides. Explosive force: Maximum pass.
Loturco et al. (2020)	11 athletes	Verify the relationship between power output and speed-related performance.	Speed - Power	Power: Bench press, shoulder press and pull exercise on prone bench.
Villacieros et al. (2020)	12 athletes	Evaluation of the speed based on the movement of the shoulder and elbow in the propulsion.	Speed	Sprint 5m - Sprint 10m with ball and Sprint 15m with passing and braking.
Pereira et al. (2016)	19 athletes	Training sessions including stretching and resistance exercises, muscular resistance focused on the muscles of the arm, shoulder and trunk.	Respiratory Muscle Strength - Aerobic Performance	Respiratory muscle strength: analog manometer. Aerobic performance: 12-minute test in a 25x15 meter rectangle.
De Witte et al. (2018)	16 athletes	Assessment of athlete performance based on wheelchair mobility.	Mobility performance	Wheelchair Mobility Performance (WMP)
Skucas & Pokvytyte (2017)	8 athletes	Subjects participated in a two-week intervention program of mainly two types of training: wheelchair basketball and wheelchair driving resistance training.	Aerobic resistance	Ergonómetro
Ferro, Villacieros & Pérez-Tejero (2016)	12 athletes	Speed measurement through a laser system to describe the speed curve.	Speed	Sprint 20m
Yanci et al. (2015)	16 athletes	The reliability and reproducibility of an agility test and a recovery test were determined. On the other hand, the physical characteristics measured by field tests were evaluated.	Agility - Aerobic resistance - Speed - Strength	Agility: Test T. Aerobic resistance: Yo-Yo 10m. Speed: Sprint 5m and 20m with and without the ball. Strength: dynamometer and maximum pass (basketball).
Zacharakis (2020)	14 athletes	The athletes performed 8 tests of wheelchair propulsion and technical skills. Finally, their anaerobic power was evaluated.	Speed - Skill - Anaerobic Power	Speed: Sprint 5m and 20m. Ability: Dribbling, Lay-up, Passing. Anaerobic power: Ergometer.
Mason, Van der Woude, Lenton & Goosey-Tolfrey (2012)	13 athletes	They used different types of wheel sizes (0.59m, 0.61m and 0.65m) to verify mobility performance in field tests.	Speed - Mobility - Agility	Speed: Sprint 20m. Mobility: Linear acceleration and brake. Agility: Linear speed with Slalom.
Soylu et al. (2020)	26 athletes (24 men 2 women)	All BSR athletes examined underwent anthropometric measurements and took laboratory tests and three field tests in two sessions separated by 6 weeks.	Strength - Aerobic capacity - Anaerobic capacity.	Isokinetic shoulder strength: Isokinetic dynamometer. Grip strength: Manual dynamometer. Aerobic capacity: ramp protocol using a treadmill. Anaerobic capacity: Wingate test.

Author(s)	Sample	Methods	Variable	Test
Saltan & Ankarali (2017)	113 athletes	Athletes underwent a modified wheelchair skills test to assess trunk stabilization at functional classification levels.	Skills	Modified Wheelchair Skills Test (WST) (version 4.1)
Iturricastillo et al. (2019)	9 athletes	Athletes performed power loading exercises in bench press to verify the relationship with performance in field tests.	Speed - Power Strength - Skill	Speed: Sprint 20m. Ability: 505 change of direction ability test (505 CODA), Repeated Sprint Ability Test (RSA). Power strength: Bench press isoinertial test.
Molik et al. (2013)	23 athletes (women)	Field tests and the 30-second Wingate anaerobic test were evaluated. Measures of maximal power output (PP), time to maximal power (tPP), mean power output (MP), and a fatigue index (FI) were used to assess AnP. A test battery was applied that evaluated seven wheelchair basketball skills.	Anaerobic power - Grip strength - Explosive strength - Accuracy - Speed - Agility	Anaerobic power: Wingate. Grip strength: Dynamometer. Explosive force: Maximum pass. Accuracy: Shots from different sectors of the field. Speed: Sprint 5m, 20m. Agility: Slalom with and without the ball.
Granados et al. (2015)	8 male athletes	The tests were performed in 2 different sessions separated by at least 2 days. The speed test consisted of 3 maximum sprints of 20 m (39), with a rest period of 120 seconds between each repetition.	Speed – Agility – Strength - Resistance	Speed: Sprint (5 and 20m) with and without the ball. Agility: T test and ball pick up test. Strength: Dynamometer, maximum pass and medicine ball throw (5kg). Resistance: Yo-Yo test 10 m.
Cavedon et al. (2018)	13 female athletes	Physical performance through field tests.	Speed, Skill	Speed: Sprint (5 and 20m) with and without the ball; Ability: Accurate pass; tray test.
Leicht et al. (2014)	19 athletes (2 women)	Athletes were tested on the motorized treadmill, beginning a 5- to 10-minute warm-up at speeds slower than the initial gXt speed, followed by a 10-minute passive recovery to ensure participants started the gXt from a resting state. gXt boot speed varied between 1.2 and 2.0 ms.	Resistance	Test on a motorized treadmill with a constant 1.0% incline.
Ferreira et al. (2017)	11 athletes	To provide a descriptive analysis of the morphological structure, muscle strength, and anaerobic power performance of the upper limbs of wheelchair basketball athletes.	Muscular strength -Anaerobic power	Muscle strength: right and left hand dynamometers (kg), medicine ball throw (m); Anaerobic power: Wingate test (W)
Iturricastillo et al. (2015)	8 athletes	Three accelerations were performed over 5 and 20 m in a straight line with and without the ball, with a rest period of 2 min between sprints. The T test was performed three repetitions with 3 min of rest between them. For the pick-up test, three repetitions were performed with rest periods of 3 min between them. The ball pick-up test consisted of picking up four basketballs from the ground twice with the left hand and twice with the right hand.	Speed - Agility - Pickup - Ultimate Strength - Resistance	Speed: Sprint (5 and 20 m) with and without the ball; Agility: T test and ball pick up test; Maximum strength: dynamometer and maximum pass, medicine ball throw (5kg). Resistance: Yoyo Test of 10 m.
Weissland et al. (2015)	18 athletes	The incremental continuous test MFT includes rotating around an octagon (15 × 15 m) at an initial speed of 6 km h - 1 for 1 min. Sde increases, the speed by 0.37 km. · h - 1 every minute until exhaustion. The 30-15 SI T consisted of 40-m shuttle runs for 30 s with 15 s of passive recovery. The initial speed was set at 6 km h - 1 (instead of 8 km h - 1 in the original protocol) for the first 30 s trial and was increased by 0.5 km h - 1 every 45 s.	Aerobic fitness and maximum sprint speed	Multistage Continuous Field Test (MFT) and 30-15 Intermittent Field Test (30-15 IFT).

Author(s)	Sample	Methods	Variable	Test
Molik et al. (2017)	12 athletes	For the WCT test the sports wheelchair was connected to the metal frame for safety. The speed and slope of the treadmill were increased simultaneously. The test started at 3.2 km/h 0% WCT. The speed and incline of the treadmill were increased every two minutes (0-2 min: 3.2 km/h, 0%; 2-4 min: 4.8 km/h, 1.0%; 4-6 min: 6.4 km/h, 1.5%, 6-8 min: 8 km/h, 2.0%, 8-10 min: 9.6 km/h, 2.5%, 10-12 min: 11.2 km/h, 3.0%).	Aerobic performance	Wheelchair treadmill (WCT) and crank ergometer stress test (ACE).
Antonelli et al. (2020)	17 athletes	Respiratory muscle strength is assessed using a manovacuometer, an evaluation of sports performance performed using the YoYo resistance test and intermittent recovery.	Respiratory muscle strength (MIP and MEP), aerobic PP by wheelchair yoyo test.	Intermittent Resistance Test Yoyo adapted test (10m). Respiratory muscle force manovacuometer.
Weissland, Faupin, Borel, Berthoin, et al. (2015)	16 BSR athletes (2 women)	On two separate days, all subjects performed a multistage incremental field test (MFT) and a modified MFT (MFT-8). The MFT consisted of turning around an octagonal course. For both trials, the initial rate of turn was 6 km·h −1 during the first 1-minute stage and then the rate of turn was increased by 0.37 km·h −1 every minute until exhaustion. With the same progressive speed, the MFT-8 consisted of rotating two octagons 2 meters apart to describe an 8.	Maximal aerobic speed	Octagonal incremental test MFT and modified MFT-8.
Witte et al. (2020)	21 athletes	Field-based wheelchair mobility performance (WMP) test. The participants performed the WMP test six times in their own wheelchair, of which five times with different configurations. Each WMP trial took about 6.5 minutes and was followed by a 15- to 30-minute rest period to allow for recovery. All WMP tests were videotaped from the side of the field with two video cameras.	Mobility performance	Wheelchair Mobility Performance (WMP)
Yüksel et al. (2018)	21 athletes	Specific field tests of the BSR	Agility - Speed - Aerobic resistance - Shoulder Flexibility - Skill	Balance: Modified functional scope test. A modified sit-up test and modified push-ups were implemented. Shoulder Flexibility: Back Scratch Test; Speed: Sprint 20m; Agility: slalom with and without the ball; Endurance: Endurance run 6 min; Ability: Pass by accuracy; pass by distance; zone shot.
Montesano et al. (2013)	20 athletes	Improve the percentage of shots and passes by strengthening the upper extremities through specific exercises and the use of competition balls, medicine balls and elastic bands.	Passing and shooting effectiveness	Pass registration exercises approved with one hand (5 stations) and another exercise of percentage of approval of the shot were used.
Veeger et al. (2019)	70 athletes (16 women)	The wheelchair mobility performance test (WMP test) was demonstrated with a video and a camera is used to record the performance. All lengths and angles of the athlete, wheelchair, and athlete-wheelchair interface were determined using Kinovea.	Mobility performance	Wheelchair Mobility Performance (WMP)

Author(s)	Sample	Methods	Variable	Test
Tachibana et al. (2019)	26 female athletes	Before 10 minutes of the tests, the athletes could warm up freely. The order of execution of the tasks was not specified and they were instructed to do the tests at maximum intensity, in addition to allowing them to have rest times between tests (2 min).	Speed - Agility - Resistance	Speed: Sprint 20m; Agility: T test and octagonal ball test, Endurance: Yo-Yo Test 10 m
Iturricastillo et al. (2017)	13 athletes	A battery of tests (ability to change direction, sprints, and sled towing) were performed to study neuromuscular responses. For the sled tow test, subjects performed the same 20 m wheelchair speed test, but in this case, the players pulled a resistance of 10% of their body mass. In the case of speed, two 20-meter sprints are performed.	Speed – Agility.	Agility: T test. Speed: 20m sprint. Sled towing: Subjects performed the same 20-m wheelchair speed test, but in this case, the players pulled a resistance of 10% of their body mass.
Ferro et al. (2017)	11 athletes	The players performed two sets of 20m sprints. The test began with a 15-min warm-up, and a 5-min rest was given between the two series. Players waited at the starting line with their front wheels on the line and the trunk behind. They could independently perform preparatory driving movements and pull away when ready. For the measurement, a type 1 laser sensor was used.	Speed	Sprint 20 m
Ozmen et al. (2014)	10 male athletes	The speed was determined by a speed test. The players had two attempts to cover the distance as quickly as possible in a 2-minute period. Sprint duration was measured using photocell gates at the beginning and end of the line. Agility was assessed using the Illinois wheelchair agility test. Four cones marked the beginning, the end and the two turning points. Another four cones were placed in the center at the same distance. Each cone in the center was spaced 3.3 m apart. Duration was measured by photocells located from start to finish with the best result of two recorded attempts.	Speed - Agility	Speed: Sprint 20m. Agility: Illinois

Source: Own elaboration.

Finally, Table 3 shows the 6 selected articles that were exclusively dedicated to validity and reliability of tests in wheelchair basketball, referring to several physical variables.

Table 3. Items identified from validation and/or reliability of a test

Author and year	Sample	Method	Variable	Test
Marszalek et al. (2019)	9 BSR athletes	The athletes performed 11 field tests focused on short-time effort at maximum intensity. These tests were performed twice (pre and post test) to verify the reliability of these tests.	Speed - Power - Strength - Agility	Speed: Sprint 10m, 20m, 30-second test and Sprint 10x5m. Power: Sprint 3m, 5m, Maximum Pass and Medicine Ball Throw 3kg. Grip strength: Dynamometer. Agility: Agility drill test.
De Groot et al. (2012)	19 BSR athletes	A battery of 10 tests was designed that the athletes had to perform twice to determine reliability. The validity of the tests was evaluated by relating the scores to the players' rating and the standard of competition, the coach's rating and the player's rating.	Speed - Power - Explosive Force - Agility - Skill	Ability: Precision passes, Lay-up, Free kick, Point shots. Speed: Sprint 5m, 20m, Suicides. Explosive force: Maximum pass (basketball). Agility: Slalom, Pick up balls.
Vaquera et al. (2016)	36 BSR athletes	The athletes performed a test-retest of the TIVRE-Basket test to determine aerobic power	Aerobic power	Test TIVRE-Basket
Weber et al. (2020)	11 BSR athletes	Estimation of anaerobic power through field tests. In addition, double-handed grip strength (HGS) and the medicine ball chest pass test were assessed.	Anaerobic Power – Strength - Muscular Power	Anaerobic Power: Wingate; Sprint 15m and 20m, Grip strength: dynamometer; Muscular power: medicine ball chest pass (3kg)
Marszałek et al. (2019)	61 BSR athletes	The participants were divided into two functional categories A (classes from 1.0 to 2.5; n = 29) and B (classes from 3.0 to 4.5; n = 32) according to the IWBF rules. Laboratory and field tests were carried out.	Anaerobic Performance - Speed – Skill - Agility - Strength	Anaerobic test: Wingate (ergometer). Speed: 3m sprint, 5m sprint, 10m sprint, 20m sprint, 30s sprint trial. Strength: medicine ball throw (3kg), bilateral grip, 3-6-9m mock test, Agility: agility mock test.
De Witte, Sjaarda et al. (2018)	46 BSR athletes	Wheelchair activities were assessed by systematic observation of video images of matches. Four games were recorded at the national game level and five games at the international game level. To make a translation of the match data to the test design, the result was organized in three main categories: separate activities, combined activities and ball possession activities.	Mobility performance	Wheelchair Mobility Performance (WMP)

Source: Own elaboration.

Discussion

The objective of this systematic review was to identify the most recurrent tests in the literature, used for the evaluation of physical qualities in elite level WB. A total of 39 articles related to the objective were selected.

The main findings indicate that the most used tests and instruments were: 20m sprint, with presence in 18 studies, followed by 5m sprint, used in 11 studies, dynamometer, present in 8 studies, maximum basketball pass, with presence in 7 studies, medicine ball throw, used in 6 studies, T-test, with presence in 5 studies and Wingate, used in 5 studies. This indicates that the most evaluated physical qualities are: speed, strength, agility and anaerobic power.

Table 4. Most used test according to the literature investigated

Test	Variable	Number of appearances	Studies
Sprint 20m	Speed	18	(Cavedon et al., 2015; Ferro et al., 2016; Yanci et al., 2015; Zacharakis, 2020; Iturricastillo et al., 2019; Molik et al., 2013; Granados et al., 2015; Cavedon et al., 2018; Iturricastillo et al., 2015; Yüskel et al., 2018; Tachibana et al., 2019; Iturricastillo et al., 2017; Ferro et al., 2017; Ozmen et al., 2014; Marszalek et al., 2019; De Groot et al., 2012; Weber et al., 2020; Marszalek et al., 2019)
Sprint 5m	Speed	11	(Cavedon et al., 2015; Villacieros et al., 2020; Yanci et al., 2015; Zacharakis et al., 2020; Molik et al., 2013; Granados et al., 2015; Cavedon et al., 2018; Iturricastillo et al., 2015; Marszalek et al., 2019; De Groot et al., 2012; Marszalek et al., 2019)
Dynamometer	Grip strength	8	(Yanci et al., 2015; Soylu et al., 2020; Molik et al., 2013; Granados et al., 2015; Ferreira et al., 2017; Iturricastillo et al., 2015; Marszalek et al., 2019; Weber et al., 2020)
Max pass	Explosive force	7	(Cavedon et al., 2015; Yanci et al., 2015; Molik et al., 2013; Granados et al., 2015; Iturricastillo et al., 2015; Marszalek et al., 2019; De Groot et al., 2012)
Medicine ball throw	Explosive force	6	(Granados et al., 2015; Ferreira et al., 2017; Iturricastillo et al., 2015; Marszalek et al., 2019; Weber et al., 2020; Marszalek et al., 2019)
T-Test	Agility	5	(Yanci et al., 2015; Granados et al., 2015; Iturricastillo et al., 2015; Tachibana et al., 2019; Iturricastillo et al., 2017)
Wingate	Anaerobic power	5	(Soylu et al., 2020; Molik et al., 2013; Ferreira et al., 2017; Weber et al., 2020; Marszalek et al., 2019)

Source: Own elaboration.

The 20-meter sprint test has been used to assess the speed of WB athletes in numerous studies. This test is of simple applicability and apart from obtaining speed data, it also provides certain results about factors related to performance and pushing efficiency (Brown, 2013). The protocol consists of locating, generally, a cone in the start and finish zone (20 meters in a straight line), where with a device (photocells and/or manual stopwatch) the time used is measured. Athletes must align the large wheel of their wheelchair parallel to the start line (Molik et al., 2013). Athletes have two attempts to execute the test and the best time is recorded. Authors (Cavedon et al., 2015; Cavedon et al., 2018; Granados et al., 2015; Iturricastillo et al., 2015; Yanci et al., 2014) have used this test with and without ball, finding an increase in the time used when using the ball, that is, when performing the Sprint 20m test without ball, the range of time used is between 5.16 and 5.7 seconds, but when performing the test using the ball, the range of time is between 5.76 and 9.2 seconds. On the other hand, authors (Bergamini et al., 2015) indicate the importance of an adequate propulsion symmetry as an indicator value related to sports performance and possible injuries using the 20m Sprint test with inertia measurement units. Similarly, Ferro et al. (2021) demonstrated that there

is a relationship between the speed of movement of the players and the acceleration generated from the players' wrists.

The 5-meter sprint test was the second most applied test in WB athletes. This consists of the athlete starting from a stationary position and with the front of the wheel behind the starting line, the athlete must move forward as fast as possible for 5 meters. The time it takes to travel the five meters is considered, for this generally, in the studies photocells are used for the assessment, however, it is also common to use stopwatch, in this regard, authors (Cavedon et al., 2015; Cavedon, Zancano & Milanese, 2018; De groot et al., 2012) indicate that this started when the front wheels crossed the starting line and stopped when the front wheels crossed the finish line. In terms of attempts, there are studies in which athletes perform two repetitions (Molik et al., 2013; Marszalek et al., 2019) and research applying three (De groot, 2012; Granados et al., 2018; Iturricastillo, Granados & Yanci, 2015; Yanci et al., 2018). It is important to consider the dominant wrist acceleration in the test as an indicator of higher acceleration, so states Ferro et al. (2021), where it is shown that there is a significant relationship between the average acceleration of the dominant wrist and the average speed of the wheelchair player, being this relationship stronger at the beginning (0-3 m).

To measure the grip strength, the hand dynamometer is used, where the athlete from his wheelchair, holds with one hand the instrument that will be located fully extended to the side of the wheel, and without this touching it. According to Yanci et al (2015), the protocol indicates that three maximum isometric contractions are performed for 5 seconds, with a rest period of one minute, where the highest value is considered to determine the maximum grip strength. In the case of the studies by Ferreira et al. (2017) and Weber et al. (2020), they apply two attempts with one minute of rest. Authors (Oliveira et al., 2017) state that the dynamometer is a valid tool to evaluate wheelchair propulsion. It is important to consider that sports performance values in WB athletes will be related to the different classification scores (Soylu et al., 2020).

On the other hand, one of the most widely used tests to measure explosive strength in athletes was the Maximum Basketball Pass. This test consists of placing the athlete with the front wheel behind the baseline and performing an overhead pass with both arms as far as possible from a stationary position, while one of the researchers holds the wheelchair still (Granados et al., 2015; Iturricastillo et al., 2015). Athletes have a maximum of 5 attempts where the average distance between the 5 throws is taken. It is a test of easy application and helps to have parameters referred to explosive strength in athletes. The reference values considering high and low classes oscillate between 7.8 and 13.8 meters.

The medicine ball throwing test was used in several studies to evaluate explosive strength in WB athletes. The authors mainly used 3 kg (Ferreira et al., 2017; Iturricastillo et al., 2015; Marszałek, Kosmol, Morgulec-Adamowicz, Mróz, Gryko, Klavina, Skucas, Navia & Molik, 2019; Marszalek, Kosmol, Morgulec-Adamowicz, Mróz, Gryko & Molik, 2019; Weber et al., 2020) and 5 kg (Granados et al., 2015;) balls. For this test, the authors point out that the protocol consists of the athlete supporting his back firmly on the back of his chair, holding the medicine ball with both hands and performing a throw from the chest area to the front without removing his back from the back of the chair (Ferreira et al., 2017). To maintain this position, an evaluator holds with a strip of cloth (10 cm) the chest area, trying to maintain a static position of the trunk at all times of the throw. According to the selected studies, for the 3 kg ball throw and considering high and low classes, the values oscillate between 3.09 and 7.08 meters; for the 5 kg medicine ball throw, the values oscillate between 4.86 and 4.89 meters. Authors (Granados et al., 2015) have compared the maximum pass test and medicine ball throw in first and third division teams, finding significant differences between the two with an increase of 33% and 24% respectively in the results of first division teams. The aforementioned authors (Granados et al., 2015) point out that these differences between elite and lower level players have also been observed in other sports such as rugby (Baker, 2002) and handball (Gorostiaga et al., 2005), and indicate that high absolute values of muscle strength and explosiveness might be required for successful performance in high-level BSR.

Another of the most commonly used tests in this systematic review was the T-Test (Granados et al., 2015; Iturricastillo et al., 2015; Iturricastillo et al., 2017; Tachibana et al., 2019; Yanci et al., 2015). In the case of Yanci et al. (2015) and Granados et al. (2015), they built on the protocol of Sassi et al. (2009) by making modifications for the wheelchair to allow it to always be moving forward with forward movements. From this, the studies by Iturricastillo et al. (2015), Tachibana et al. (2019) and Iturricastillo et al. (2018), employ the protocol proposed by Yanci et al. (2015). The test consists of completing a T-shaped circuit composed of four cones, moving as fast as possible, where each participant must perform the test 3 times with at least 3 minutes of rest between repetitions. The values of BSR athletes range from 14.74±1.65s (Granados Domínguez et al., 2016) to 15.3±1.2s (Romarate et al., 2020). In relation to other wheelchair sports and the agility test, there is a study conducted on nine elite tennis players, where the T-test was used, whose results were 12.42±0.99s (Sánchez-Pay et al., 2021). When comparing the data presented above in relation to BSR, it can be inferred that BSR athletes present to be slower compared to tennis players. The opposite happens when compared to a study conducted to 13 wheelchair handball athletes, where it is observed that their results in the agility test were 16.5±1.5s (Borges et al., 2017), therefore, it is appreciated that BSR athletes were more agile than handball athletes.

Finally, there is the Wingate test that evaluates anaerobic power, it is characterized for being a laboratory test since a cycloergometer for upper limbs is used. The participant starts by sitting in his or her wheelchair with the cycloergometer adjusted to the level of the shoulder joint (Molik et al., 2013). According to the protocol, athletes perform a warm-up between 10 and 20 minutes consisting of three to four 5-second sprints and then rest. This test consists of performing a maximum effort for 30 seconds with a load of 5% of body weight (Ferreira et al., 2017), however, Marszalek et al. (2019) performs a load difference according to the type of athlete classification, 4% of body mass for category A participants and 5.5% for category B players. This test delivers measures such as peak power (PP), defined as the maximum 5-second value recorded during the test measured in watts (W), mean power output (MP) as mean power achieved during the 30-second test measured in watts (W), minimum maximum power output (MPP), the highest 5-second maximum power value recorded during the Wingate test measured in watts (W) and power drop (PD) (Soylu et al., 2020). This type of testing has also been employed in other Paralympic modalities, for example, wheelchair rugby (Marcolin et al., 2020), however, its application requires specific implements that may make it difficult to access.

As for the studies that focused on validating tests for the evaluation of some physical quality, six were identified. On the one hand, Marszalek et al. (2019) whose study objective was to evaluate the test-retest reliability of field tests focused on high intensity efforts, their results were that

10 out of 11 field tests are reliable for BSR athletes, since there are no statistically significant differences between test and retest ($p > .05$), in addition, to presenting a strong correlation for each test ($r > 0.7$). On the other hand, as for the study of De Groot et al. (2012), ten tests are carried out of which six showed good reliability (ICC = 0.80 - 0.97, respectively), while the accuracy pass, free throw, tray and specific throws tests, manifested moderate reliability (ICC = 0.26 - 0.67, respectively), likewise, most of the tests showed good to moderate validity ($r > 0.6$).

Among the limitations of the present study, we found a lack of specificity in the writing of results by the literature investigated in terms of high and low classes, which prevented us from being able to establish certain reference values discriminating between types of classes for WB athletes. On the other hand, the lack of studies focused on women's sport made it impossible to classify results according to sex.

Conclusion

The physical variables most evaluated in the literature were speed in first place, followed by strength, agility and anaerobic power. To evaluate the mentioned variables, the authors prefer to use 20m and 5m sprints, dynamometer, maximum pass, medicine ball throw, T-test and Wingate.

Finally, the articles focused on the confirmation of reliability and validity of tests for the measurement of physical variables in WB presented good results, concluding that most of the tests evaluated are reliable and valid to evaluate physical aspects in WB athletes.

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Test más frecuentes en la literatura para la evaluación de las cualidades físicas en el baloncesto en silla de ruedas nivel élite: Una revisión sistemática

Most frequent tests in the literature for the evaluation of physical qualities in elite level Paralympic wheelchair basketball: a systematic review

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Resumen

El objetivo fue identificar los test más recurrentes en la literatura, utilizados para la evaluación de las cualidades físicas en el BSR nivel élite. Para ello se llevó a cabo Revisión Sistemática en PubMed, Web of Science, Scopus y ScienceDirect, combinando las siguientes palabras clave Athletes y "Wheelchair basketball" y Test y Performance. La estrategia de búsqueda realizada arrojó un total de 270 resultados donde posterior a la eliminación de duplicados y aplicando los criterios de inclusión y exclusión previamente establecidos, llegaron a ser incluidos 39 documentos para su revisión detallada de síntesis cualitativa. Los test más utilizados según la literatura recabada, señalan en primer lugar al Sprint 20m, seguido del Sprint 5m y dinamómetro, lo cual indica que las cualidades físicas más evaluadas son; velocidad, fuerza, agilidad y potencia anaeróbica. De acuerdo a lo mencionado anteriormente, se concluye que los test utilizados son herramientas de fácil acceso, en su mayoría, pues no son necesario implementos deportivos de gran envergadura, (excluyendo el test de Wingate el cual requiere un ergómetro de manivela). Además, son pertinentes y válidos para la evaluación de las cualidades físicas en atletas de BSR nivel elite.

Palabras clave: Deporte adaptado, Entrenamiento, Preparación Deportiva, Rendimiento, Atletas.

Abstract

The objective was to identify the most recurrent tests in the literature, used for the evaluation of physical qualities in the BSR elite level. For this, a Systematic Review was carried out in PubMed, Web of Science, Scopus and ScienceDirect, combining the following keywords Athletes and "Wheelchair basketball" and Test and Performance. The search strategy carried out yielded a total of 270 results where, after eliminating duplicates and applying the previously established inclusion and exclusion criteria, 39 documents were included for detailed review of qualitative synthesis. The most used tests according to the collected literature, indicate in the first place the 20m Sprint, followed by the 5m Sprint and dynamometer, which indicates that the most evaluated physical qualities are; speed, strength, agility and anaerobic power. According to the aforementioned, it is concluded that the tests used are tools of easy access, for the most part, since large-scale sports implements are not necessary (excluding the Wingate test, which requires a crank ergometer). They are also pertinent and valid for the evaluation of physical qualities in elite level BSR athletes.

Keywords: Adapted sports, Training, Sports Preparation, Performance, Athletes.

Introducción

El baloncesto en silla de ruedas (BSR) es una de las modalidades deportivas más conocidas y atractivas en el movimiento paralímpico (Luarte et al., 2022; Solera et al., 2021), surgiendo por primera vez alrededor del año 1946 en EE. UU, posterior a la segunda guerra mundial siendo practicado por soldados heridos que, en su mayoría, eran ex jugadores sin discapacidad, los cuales querían seguir, de alguna u otra forma, practicando este deporte (International Paralympic Commmittee, 2019).

Esta modalidad es regulada por la International Wheelchair Basketball Federation (IWBF) y establece reglas de juego similares al deporte convencional, aunque con adaptaciones, entre ellas, la silla de ruedas y la clasificación deportiva. Esta última, es un requisito obligatorio para que los atletas puedan participar en competiciones oficiales y consiste en agrupar a los atletas de acuerdo a la funcionalidad de su discapacidad (IWBF, 2021b). De acuerdo con la funcionalidad presentada, cada atleta será incorporado en una clase deportiva que varía de 1.0 a 4.5, considerando que, cuanto menor es su clase deportiva, mayor es el compromiso motor que presenta el atleta (Cavedon et al., 2018; dos Santos et al., 2017; IWBF, 2021b; Luarte et al., 2022). Por lo tanto, ningún equipo se puede presentar a jugar con atletas que, cuya sumatoria de los cinco jugadores en cancha, sumen más de 14 puntos (IWBF, 2021b).

El BSR es un deporte intermitente que demanda a los atletas poseer adecuados niveles de fuerza en sus distintas manifestaciones; de velocidad y agilidad, resistencia aeróbica y anaeróbica para realizar acciones de alta intensidad con breves intervalos de tiempo para recuperación (Iturricastillo et al., 2016; Seron et al., 2019). Además, la técnica es imprescindible en la performance de los atletas, pues las situaciones de juego conllevan a tener un control de balón y manejo de silla de ruedas en las acciones propias y determinantes de la modalidad, tales como; empujar la silla, driblear, girar, pasar, lanzar al aro e inclinar la silla sobre una rueda (IWBF, 2021a; Soylu et al., 2020).

La gran variedad de discapacidades físicas individuales que hay en un equipo hace que las respuestas fisiológicas sean diferentes en cada jugador y considerando la silla de rueda que es parte primordial ya que la integración del jugador con su silla permite la propulsión y los movimientos del deporte que inciden en su rendimiento (Goosey-Tolfrey & Leicht, 2013). Las consideraciones de todas estas variables hacen un gran desafío para los investigadores. Con respecto a las evaluaciones en el BSR, tenemos dos consideraciones relevantes que son el jugador y la silla de ruedas, ya que ambas conforman una sola unidad que da respuesta de acuerdo a la forma deportiva del atleta y las condiciones de su silla de rueda, además se debe considerar que el rendimiento no solo depende del estado físico de los atletas, sino también en las habilidades, experiencias y las competencias técnicas del deporte (Goosey-Tolfrey & Leicht, 2013).

Para los atletas se debe considerar evaluaciones completas de rendimiento que incluyan las capacidades aeróbicas, anaeróbicas y habilidades específicas del deporte que permitan evaluar los parámetros individuales y el nivel de logro en un ambiente interior con la aplicación de test de campo (Vanlandewijck et al., 1999), sumado a pruebas específicas de laboratorios como el test de Wingate con ergómetros de manivela de brazo para evaluar la potencia anaeróbica máxima, media e índice de fatiga (Bartosz; Molik et al., 2010).

Las evaluaciones en el deporte, son herramientas fundamentales que permiten conocer la condición física del atleta, los efectos que se tiene con la práctica de la actividad y es el medio por el cual los entrenadores obtienen parámetros objetivos para tomar decisiones y poder definir el tipo de entrenamiento más adecuado (González-Rico & Ramírez-Lechuga, 2018).

Estas evaluaciones son fundamentales para la preparación deportiva de los atletas considerando la complejidad de los sistemas que la componen; es decir, sistema de competencia, sistema de entrenamiento y de factores complementarios (Gomes, 2009). Las evaluaciones físicas tienen íntima relación con el sistema de entrenamiento, el cual que se relaciona con el desarrollo y perfeccionamiento de los deportistas considerando los principios de especificidad de la modalidad, individualidad, sobrecarga, continuidad, volumen e intensidad (Gomes, 2009 citado en Campos Campos et al., 2021; Fernández et al., 2021).

Es por eso que, el objetivo de esta investigación es identificar los test más recurrentes en la literatura, utilizados para la evaluación de las cualidades físicas en el BSR nivel élite.

Métodos

Protocolo

Se realizó una revisión de literatura de tipología sistemática de acuerdo a las pautas expuestas en la Declaración PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) (Moher et al., 2009; Page et al., 2021).

Fuentes de datos y búsqueda

Se realizó una búsqueda bibliográfica entre abril y mayo del 2021 en cuatro bases de datos electrónicas: PubMed, Web of Science (WOS), Scopus y ScienceDirect. Se utilizaron las palabras claves en inglés y fueron considerados Atletas, Baloncesto en silla de ruedas, Pruebas y Rendimiento. Los términos clave de búsqueda se incluyeron y combinaron mediante el operador "Y", "O": [Athletes AND "Wheelchair basketball" AND Test AND Performance].

Criterios de elegibilidad

Los criterios de elegibilidad se determinaron según el enfoque PICOS, el cual contempla en sus siglas; tipo de participantes (P), intervenciones (I), comparaciones (C), resultados (O) y diseños de investigación (S), Esta estrategia es utilizada para la construcción de pregunta de investigación y criterios de elegibilidad (da Costa Santos et al., 2007).

De acuerdo con lo anterior, los estudios fueron considerados si (1) la muestra consistía en atletas de élite, (2) practicantes de BSR, (3) si los resultados de los estudios trataban sobre evaluación de las cualidades físicas y (4) estaban publicados en idioma inglés, español y/o portugués.

Se excluyeron estudios que correspondieran a (1) estudios de tesis, (2) capítulos de libros, (3) artículos sin texto completo y (4) estudios de casos.

Selección de estudios

En primera instancia se identifican todos los artículos obtenidos después de haber hecho la búsqueda en las bases de datos para cada variable de estudio, se registran en el programa Mendeley® en el cual se eliminan los duplicados y se excluyen aquellos que no cumplan el criterio de inclusión de año de publicación. Posterior a

ello, se procede a revisar los artículos mediante título y/o resumen, donde se presente uno o más de los términos claves. Finalmente, se consideran sólo los artículos que cumplen con todos los criterios de inclusión. Estos estudios finalmente son analizados durante el proceso de revisión.

Proceso de recolección de datos

El proceso de recopilación de datos se basa en el Flujograma PRISMA. Es decir, se aplicaron tres filtros principales durante el proceso de recolección de datos detallados en el punto anterior. Para recopilar la información de todas las bases de datos escogidas se utilizó el programa Mendeley® y con ayuda de una planilla Excel® se fueron registrando los resultados.

En primera instancia, con los artículos que fueron seleccionados a partir del título y resumen, se registró la información respecto a: título y variable de la cualidad física que evalúa.

Luego, los artículos fueron leídos completamente y aquellos que cumplieran con los criterios de inclusión, se realizó una planilla Excel adicional, en donde se identificó la siguiente información: año de publicación, título, autores, objetivo de la investigación, metodología, resultados y conclusiones.

Finalmente, a partir de la información anterior se elaboraron dos tablas, en primer lugar, con las características de los estudios: autor, año, título y objetivo. En segundo lugar, con los aspectos: autor, año, metodología, resultados y conclusiones.

Resultados

Selección de estudios

La búsqueda inicial en las bases de datos arrojó un total de 270 artículos, donde posterior a la eliminación de duplicados se registraron 199 estudios. Estos artículos fueron leídos mediante título y/o resumen en búsqueda de información relevante a nuestro tema de investigación, siendo seleccionados 43 estudios para su lectura completa. Finalmente, un total de 39 artículos cumplieron con los criterios de elegibilidad, siendo seleccionados para esta revisión sistemática.

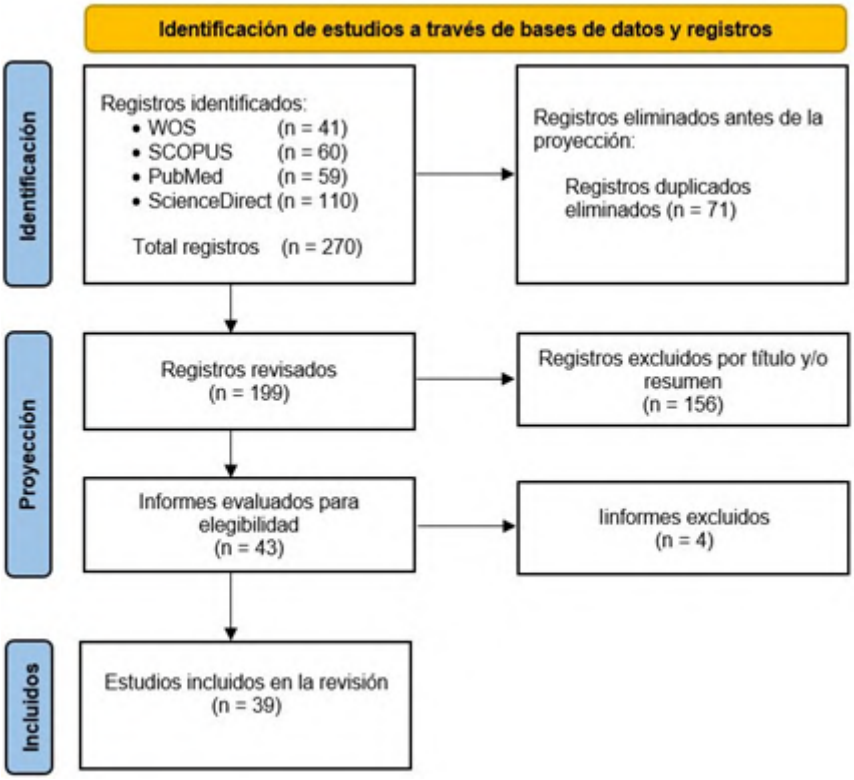

Figura 1. Flujograma PRISMA
Fuente: Page et al. (2021)

Proceso de recolección de datos

En la tabla 1 se presencian la identificación en el idioma original de todos los artículos incluidos en la revisión sistemática, en donde la mayor cantidad de artículos fueron entre los años 2015 y 2020.

Tabla 1. Identificación de los estudios seleccionados

Autor (es)	Año	Título
Mason et al.	2012	The Effect of Wheel Size on Mobility Performance in Wheelchair Athletes
de Groot et al.	2012	Validity and reliability of tests determining performance-related components of wheelchair basketball
Montesano et al.	2013	Improvement of the motor performance difference in athletes of wheelchair Basketball
Molik et al.	2013	Relationships between anaerobic performance, field tests, and functional level of elite female wheelchair basketball athletes
Leicht et al.	2014	Blood lactate and ventilatory thresholds in wheelchair athletes with tetraplegia and paraplegia
Ozmen et al.	2014	Explosive strenght training improves speed and agility in wheelchair basketball athletes
Yanci et al.	2015	Sprint, agility, strength and endurance capacity in wheelchair basketball players
Granados et al.	2015	Anthropometry and performance in wheelchair basketball
Iturricastillo et al.	2015	Changes in Body Composition and Physical Performance in Wheelchair Basketball Players During a Competitive Season
Weissland et al.	2015	Comparison between 30-15 intermittent fitness test and multistage field test on physiological responses in wheelchair basketball players
Cavedon et al.	2015	Physique and Performance of Young Wheelchair Basketball Players in Relation with Classification.
Weissland, Faupin, Borel, Berthoin, et al.	2015	Effects of Modified Multistage Field Test on Performance and Physiological Responses in Wheelchair Basketball Players
Astier et al.	2016	Perceived exertion responses and performance of two mode of propulsion in the multistage field test with wheelchair basketball players
Pereira et al.	2016	Respiratory muscle strength and aerobic performance of wheelchair basketball players
Ferro et al.	2016	Sprint performance of elite wheelchair basketball players: Applicability of a laser system for describing the velocity curve
Vaquera et al.	2016	Validity and Test-Retest Reliability of the TIVRE-Basket Test for the Determination of Aerobic Power in Elite Male Basketball Players
Saltan & Ankarali	2017	The Role of Trunk Stabilization in Functional-Classification Levels in Wheelchair Basketball
Ferreira et al.	2017	Morphological characteristics, muscle strength, and anaerobic power performance of wheelchair basketball players
Ferro et al.	2017	Nutritional Habits and Performance in Male Elite Wheelchair Basketball Players During a Precompetitive Period
Skucas & Pokvytyte	2017	Short-term moderate intensive high volume training program provides aerobic endurance benefit in wheelchair basketball players
Molik et al.	2017	Comparison of Aerobic Performance Testing Protocols in Elite Male Wheelchair Basketball Players

Autor (es)	Año	Título
de Witte et al.	2018	Development, construct validity and test–retest reliability of a field-based wheelchair mobility performance test for wheelchair basketball
Iturricastillo et al.	2017	Neuromuscular Responses and Physiological Changes During Small-Sided Games in Wheelchair Basketball.
Cavedon et al.	2018	Anthropometry, body composition, and performance in sport-specific field test in female wheelchair basketball players
Yüksel & Sevindi	2018	Examination of Performance Levels of Wheelchair Basketball Players Playing in Different Leagues
de Witte, Sjaarda, et al.	2018	Sensitivity to change of the field-based Wheelchair Mobility Performance Test in wheelchair basketball.
Veeger et al.	2019	Improving mobility performance in wheelchair basketball
Iturricastillo et al.	2019	Velocity and Power-Load Association of Bench-Press Exercise in Wheelchair Basketball Players and their Relationships With Field-Test Performance
Tachibana et al.	2019	Influence of Functional Classification on Skill Tests in Elite Female Wheelchair Basketball Athletes
Marszałek et al.	2019	Laboratory and non-laboratory assessment of anaerobic performance of elite male wheelchair basketball athletes
Otto et al.	2019	Physiological responses at the anaerobic threshold and at peak performance during arm crank ergometer diagnostics compared to wheelchair propulsion on a treadmill in elite wheelchair basketball players
Marszalek et al.	2019	Test-retest reliability of the newly developed field-based tests focuses on short time efforts with maximal intensity for wheelchair basketball players
Antonelli et al.	2020	Effects of inspiratory muscle training with progressive loading on respiratory muscle function and sports performance in high-performance wheelchair basketball athletes: A randomized clinical trial
Weber et al.	2020	Adaptation of Anaerobic Field-Based Tests for Wheelchair Basketball Athletes
De Witte et al.	2020	Effects of seat height, wheelchair mass and additional grip on a field-based wheelchair basketball mobility performance test
Loturco et al.	2020	Relationship between power output and speed-related performance in brazilian wheelchair basketball players
Villacieros et al.	2020	Relationship between Sprint Velocity and Peak Moment at Shoulder and Elbow in Elite Wheelchair Basketball Players
Zacharakis	2020	The effect of upper limb characteristics on palm strength, anaerobic power, and technical skills of wheelchair basketball players of varying classification
Soylu et al.	2020	The Relationship Between Athletic Performance and Physiological Characteristics in Wheelchair Basketball Athletes

Fuente: Elaboración propia

Por otra parte, en la tabla 2 se presencia un resumen de los artículos seleccionados que evaluaron alguna cualidad física mediante test físicos.

Tabla 2. Resumen de estudios seleccionados

Autor (año)	Muestra	Métodos	Variable	Test
Astier et al. (2016)	8 atletas	Evaluación del rendimiento en modo sincrónico y asincrónico (propulsión de silla de ruedas) en prueba de campo incremental de varias etapas (MFT). Se midieron el número de niveles de ejercicio realizados, la velocidad aeróbica máxima, la calificación del esfuerzo percibido y la frecuencia del brazo.	Velocidad aeróbica máxima	Multistage Field Test (MFT)
Otto et al. (2019)	8 atletas	Se evaluó las respuestas fisiológicas en el umbral anaeróbico y en el rendimiento máximo en dos pruebas.	Captación de oxígeno (VO2), frecuencia cardíaca (FC), gasto energético (EE) y concentración de lactato (LA)	Ergómetro - Cinta de correr
Cavedon, Zancanaro & Milanese (2015)	52 atletas (45 hombres 7 mujeres)	Evaluación del rendimiento en pruebas de campo específicas del deporte	Velocidad - Fuerza explosiva	Velocidad: Sprint 5m - Sprint 20m c/balón - Suicidios. Fuerza explosiva: Pase máximo.
Loturco et al. (2020)	11 atletas	Verificar la relación entre la potencia de salida y el rendimiento relacionado con la velocidad	Velocidad - Potencia	Potencia: Press de banca, press de hombros y ejercicio de tracción en banco prono.
Villacieros et al. (2020)	12 atletas	Evaluación de la velocidad en función del movimiento de hombro y codo en la propulsión	Velocidad	Sprint 5m - Sprint 10m con balón y Sprint 15m con pase y frenado
Pereira et al. (2016)	19 atletas	Sesiones de entrenamiento incluyendo ejercicios de estiramiento y resistencia, resistencia muscular centrado en la musculatura del brazo, hombro y tronco.	Fuerza de músculos respiratorios - Rendimiento aeróbico	Fuerza de músculos respiratorios: manómetro analógico. Rendimiento aeróbico: prueba de 12 minutos en un rectángulo de 25x15metros.
De Witte et al. (2018)	16 atletas	Evaluación del rendimiento del atleta en función de la movilidad de la silla de ruedas.	Rendimiento de movilidad	Wheelchair Mobility Performance (WMP)
Skucas & Pokvytyte (2017)	8 atletas	Los sujetos participaron en un programa de intervención de dos semanas de principalmente dos tipos de entrenamiento: baloncesto en silla de ruedas y entrenamiento de resistencia de conducción en silla de ruedas.	Resistencia aeróbica	Ergonómetro
Ferro, Villacieros & Pérez-Tejero (2016)	12 atletas	Medición de velocidad a través de un sistema láser para describir la curva de velocidad.	Velocidad	Sprint 20m
Yanci et al. (2015)	16 atletas	Se determinó la confiabilidad y reproducibilidad de una prueba de agilidad y una prueba de recuperación. Por otra parte se evaluaron las características físicas medidas por pruebas de campo.	Agilidad - Resistencia aeróbica - Velocidad - Fuerza	Agilidad: Prueba T. Resistencia aeróbica: Yo-Yo 10m. Velocidad: Sprint 5m y 20m con y sin balón. Fuerza: dinamómetro y pase máximo (balón baloncesto).
Zacharakis (2020)	14 atletas	Los atletas realizaron 8 pruebas de propulsión en silla de ruedas y destrezas técnicas. Por último, se evaluó su potencia anaeróbica.	Velocidad - Habilidad - Potencia anaeróbica	Velocidad: Sprint 5m y 20m. Habilidad: Dribling, Lay-up, Pases. Potencia anaeróbica: Ergómetro.

Autor (año)	Muestra	Métodos	Variable	Test
Mason, Van der Woude, Lenton & Goosey-Tolfrey (2012)	13 atletas	Usaron distintos tipos de tamaños de rueda (0,59m, 0,61m y 0,65m) para verificar el rendimiento de movilidad en pruebas de campo.	Velocidad - Movilidad - Agilidad	Velocidad: Sprint 20m. Movilidad: Aceleración lineal y freno. Agilidad: Velocidad lineal con Slalom.
Soylu et al. (2020)	26 atletas (24 hombres 2 mujeres)	Todos los atletas BSR examinados se sometieron a mediciones antropométricas y tomaron pruebas de laboratorio y tres pruebas de campo en dos sesiones separadas por 6 semanas.	Fuerza - Capacidad aeróbica - Capacidad anaeróbica.	Fuerza isocinética de hombros: Dinamómetro isocinético. Fuerza de agarre: Dinamómetro manual. Capacidad aeróbica: protocolo de rampa utilizando una cinta de correr. Capacidad anaeróbica: Prueba de Wingate.
Saltan & Ankarali (2017)	113 atletas	Los atletas se sometieron a una prueba de habilidades en silla de ruedas modificada para evaluar la estabilización del tronco en los niveles de clasificación funcional	Habilidad	Prueba de habilidades en silla de ruedas (Wheelchair Skills Test - WST) modificada (versión 4.1)
Iturricastillo et al. (2019)	9 atletas	Los atletas realizaron ejercicios de carga potencia en press de banca para verificar la relación con el rendimiento en pruebas de campo	Velocidad - Fuerza potencia - Habilidad	Velocidad: Sprint 20m. Habilidad: 505 change of direction ability test (505 CODA), Repeated Sprint Ability Test (RSA). Fuerza potencia: Test isoinercial de press de banca.
Molik et al. (2013)	23 atletas de (mujeres)	Se evaluaron pruebas de campo y la prueba anaeróbica de Wingate de 30 segundos. Se utilizaron medidas de producción de potencia máxima (PP), tiempo para alcanzar la potencia máxima (tPP), producción de potencia media (MP) y un índice de fatiga (FI) para evaluar AnP. Se aplicó una batería de prueba que evaluó siete habilidades de baloncesto en silla de ruedas	Potencia anaeróbica - Fuerza agarre - Fuerza explosiva - Precisión - Velocidad - Agilidad	Potencia anaeróbica: Wingate. Fuerza agarre: Dinamómetro. Fuerza explosiva: Pase máximo. Precisión: Tiros desde distintos sectores de la cancha. Velocidad: Sprint 5m, 20m. Agilidad: Slalom con y sin balón.
Granados et al. (2015)	8 atletas masculinos	Las pruebas se realizaron en 2 sesiones diferentes separadas por al menos 2 días. La prueba de velocidad constaba de 3 sprints máximos de 20 m (39), con un período de descanso de 120 segundos entre cada repetición.	Velocidad, Agilidad, Fuerza, Resistencia	Velocidad: Sprint (5 y 20m) con y sin balón. Agilidad: Prueba T y prueba de recoger balones. Fuerza: Dinamómetro, pase máximo y lanzamiento balón medicinal (5kg). Resistencia: Yo-Yo test 10 m.
Cavedon et al. (2018)	13 atletas mujeres	Rendimiento físico por medio de pruebas de campo.	Velocidad, Habilidad	Velocidad: Sprint (5 y 20m) con y sin balón; Habilidad: Pase con precisión; prueba de bandeja.
Leicht et al. (2014)	19 atletas (2 mujeres)	Las atletas fueron evaluadas en la cinta motorizada, empezando un calentamiento de 5 a 10 minutos a velocidades más lentas que la velocidad inicial del gXt, seguido de una recuperación pasiva de 10 minutos para asegurar que los participantes comenzaran el gXt desde un estado de reposo. la velocidad de arranque del gXt varió entre 1,2 y 2,0 ms.	Resistencia	Prueba en una cinta de correr motorizada con una pendiente constante del 1,0%.

Autor (año)	Muestra	Métodos	Variable	Test
Ferreira et al. (2017)	11 atletas	Proporcionar un análisis descriptivo de la estructura morfológica, la fuerza muscular y el rendimiento de la potencia anaeróbica de los miembros superiores de los atletas de baloncesto en silla de ruedas.	Fuerza muscular, Potencia anaeróbica	Fuerza muscular: dinamométricas mano derecha e izquierda (kg), lanzamiento de balón medicinal (m); Potencia anaeróbica: test de Wingate (W)
Iturricastillo et al. (2015)	8 atletas	Se realizaron tres aceleraciones sobre 5 y 20 m en línea recta con y sin balón, con un periodo de descanso de 2 min entre sprint. La prueba T se realizaron tres repeticiones con 3 min de descanso entre ellas. Para la prueba de recoger se realizaron tres repeticiones con periodos de descanso de 3 min entre ellas. La prueba de recoger balón consistió en coger cuatro pelotas de baloncesto del suelo dos veces con la mano izquierda y dos veces con la mano derecha	Velocidad, Agilidad, Recoger, Fuerza máxima, Resistencia	Velocidad: Sprint (5 y 20 m) con y sin balón; Agilidad: Prueba T y prueba de recoger balón; Fuerza máxima: dinamómetro y Pase máximo, Lanzamiento balón medicinal (5kg). Resistencia: Yoyo Test de 10 m.
Weissland et al. (2015)	18 atletas	el MFT prueba continua incremental, incluye girar alrededor de un octágono (15 × 15 m) a una velocidad inicial de 6 km · h - 1 durante 1min. Sde aumenta, la velocidad en 0,37 km. · h - 1 cada minuto hasta el agotamiento. El 30-15 SI T consistió en carreras de lanzadera de 40 m durante 30 s con 15 s de recuperación pasiva. La velocidad inicial se estableció a 6 km · h - 1 (en lugar de 8 km · h - 1 en el protocolo original) para la primera prueba de 30 s y se incrementó en 0,5 km · h - 1 cada 45 s	Aptitud aeróbica y Velocidad máxima de sprint	Prueba de campo continua de múltiples etapas (MFT) y prueba de campo intermitente 30-15 (30-15 IFT)
Molik et al. (2017)	12 atletas	Para la prueba WCT la silla de ruedas deportiva estaba conectada al marco de metal por seguridad. La velocidad y la pendiente de la cinta se incrementaron simultáneamente. La prueba comenzó a 3,2 km/ h 0% WCT. La velocidad y la pendiente de la cinta se incrementaron cada dos minutos (0-2 min: 3,2 km/ h, 0%; 2-4 min: 4,8 km/ h, 1,0%; 4-6 min: 6,4 km/ h, 1,5 %; 6-8 min: 8 km/ h, 2,0%; 8-10 min: 9,6 km/ h, 2,5%; 10-12 min: 11,2 km/ h, 3,0%).	Rendimiento Aeróbico	Prueba de esfuerzo en cinta rodante (WCT) y prueba de esfuerzo en ergómetro de manivela (ACE).
Antonelli et al. (2020)	17 atletas	Se evalúa la fuerza muscular respiratoria mediante un manovacuómetro, una evaluación del rendimiento deportivo realizada utilizando la prueba de resistencia YoYo y recuperación intermitente,	Fuerza de los músculos respiratorios (MIP y MEP), PP aeróbica por la prueba de Yoyo para silla de ruedas,	Prueba Resistencia Intermitente Yoyo test adaptado (10m). Fuerza muscular respiratoria manovacuómetro
Weissland, Faupin, Borel, Berthoin, et al. (2015)	16 atletas de BSR (2 mujeres)	En dos días separados, todos los sujetos realizaron una prueba de campo incremental de múltiples etapas (MFT) y una MFT modificada (MFT-8). El MFT consistió en girar alrededor de un curso octogonal. Para ambas pruebas, la velocidad de giro inicial fue de 6 km·h − 1 durante la primera etapa de 1 minuto y luego la velocidad de giro se incrementó en 0.37 km·h − 1 cada minuto hasta el agotamiento. Con la misma velocidad progresiva, el MFT-8 consistía en girar dos octágonos distantes a 2 metros para describir un 8.	Velocidad aeróbica máxima	Prueba incremental octagonal MFT y MFT-8 modificada.

Autor (año)	Muestra	Métodos	Variable	Test
Witte et al. (2020)	21 atletas	Prueba de rendimiento de movilidad en silla de ruedas (WMP) basada en el campo. Los participantes realizaron la prueba WMP seis veces en su propia silla de ruedas, de las cuales cinco veces con diferentes configuraciones. Cada prueba de WMP tomó alrededor de 6.5 minutos y fue seguida por un período de descanso de 15 a 30 minutos para permitir la recuperación. Todas las pruebas de WMP se grabaron en video desde el costado del campo con dos cámaras de video.	Rendimiento de movilidad	Wheelchair Mobility Performance (WMP)
Yüksel et al. (2018)	21 atletas	Pruebas de campo específicas del BSR	Agilidad - Velocidad - Resistencia Aeróbica - Flexibilidad de Hombro – Habilidad	Equilibrio: Prueba de alcance funcional modificada. Se implementó una prueba de abdominales modificada y flexiones modificadas. Flexibilidad del hombro: prueba Back Scratch; Velocidad: Sprint 20 m; Agilidad: slalom con y sin balón; Resistencia: carrera de resistencia 6 min; Habilidad: Pase por precisión; pase por distancia; tiro de zona.
Montesano et al. (2013)	20 atletas	Mejorar el porcentaje de tiros y pases fortaleciendo las extremidades superiores mediante ejercicios específicos y el uso de balones de competición, balones medicinales y banda elástica.	Efectividad de pases y lanzamientos	Se utilizó ejercicios de registro de pases aprobado con una mano (5 estaciones) y otro ejercicio de porcentaje de aprobación del lanzamiento
Veeger et al. (2019)	70 atletas (16 mujeres)	La prueba de rendimiento de movilidad en silla de ruedas (prueba WMP) se demostró con un video y se utiliza cámara para grabar el rendimiento. Todas las longitudes y ángulos del atleta, la silla de ruedas y la interfaz entre atleta y silla de ruedas se determinaron utilizando Kinovea.	Rendimiento de movilidad	Wheelchair Mobility Performance (WMP)
Tachibana et al. (2019)	26 atletas mujeres	Antes de 10 minutos de las pruebas, las atletas podían calentar libremente. No se especificó el orden de ejecución de las tareas y se les indicó que hicieran las pruebas a máxima intensidad, además, de permitirles tener tiempos de descansos entres pruebas (2 min).	Velocidad, Agilidad, Resistencia	Velocidad: Sprint 20 m; Agilidad: Prueba T y prueba octagonal con balón, Resistencia: Yo-Yo Test 10 m
Iturricastillo et al. (2017)	13 atletas	Se realizó una batería de prueba (capacidad de cambio de dirección, sprints y remolque de trineo) para estudiar las respuestas neuromusculares. Para la prueba remolque trineo, los sujetos realizaron la misma prueba de velocidad en silla de ruedas de 20 m, pero en este caso, los jugadores tiraron de una resistencia del 10% de su masa corporal. En el caso de la velocidad, se realizan 2 sprint de 20 metros.	Velocidad, Agilidad	Agilidad: Prueba T. Velocidad: sprint de 20 m. Remolque de trineo: los sujetos realizaron la misma prueba de velocidad en silla de ruedas de 20 m, pero en este caso, los jugadores tiraron de una resistencia del 10% de su masa corporal.

Autor (año)	Muestra	Métodos	Variable	Test
Ferro et al. (2017)	11 atletas	Los jugadores realizaron dos series de pruebas de velocidad de 20 m. La prueba se inició con un calentamiento de 15 min, y entre las dos series se dio un descanso de 5 min. Los jugadores esperaban en la línea de salida con las ruedas delanteras en la línea y el maletero detrás. Podían realizar de forma independiente movimientos de conducción preparatorios y arrancar cuando estuvieran preparados. Para la medición se utilizó un sensor láser tipo 1.	Velocidad	Sprint 20 m
Ozmen et al. (2014)	10 atletas masculinos	La velocidad se determinó mediante una prueba de velocidad. Los jugadores tuvieron dos intentos para cubrir la distancia lo más rápido posible en un período de 2 minutos. La duración del sprint se midió utilizando puertas de fotocélulas al principio y final de la línea. La agilidad se evaluó mediante la prueba de agilidad de Illinois en silla de ruedas. Cuatro conos marcaron el inicio, el final y los dos puntos de inflexión. Otros cuatro conos se colocaron en el centro a la misma distancia. Cada cono en el centro estaba espaciado 3.3 m. La duración se midió mediante fotocélulas ubicadas de principio a fin con el mejor resultado de dos intentos registrados.	Velocidad, agilidad	Prueba sprint 20m. Agilidad: Illinois

Fuente: Elaboración propia

Finalmente, en la tabla 3 se presencian los 6 artículos seleccionados que se dedicaron exclusivamente a validez y fiabilidad de test en el baloncesto en silla de ruedas, referente a diversas variables físicas.

Tabla 3. Artículos identificados a partir de validación y/o confiabilidad de una prueba

Autor y Año	Muestra	Método	Variable	Test
Marszalek et al. (2019)	9 atletas de BSR	Los atletas realizaron 11 pruebas de campo centradas en esfuerzo de tiempo corto a máxima intensidad. Estas pruebas se realizaron dos veces (pre y post test) para verificar la fiabilidad de estas pruebas.	Velocidad - Potencia - Fuerza - Agilidad	Velocidad: Sprint 10m, 20m, prueba de 30 segundos y Sprint 10x5m. Potencia: Sprint 3m, 5m, Pase máximo y Lanzamiento de balón medicinal 3kg. Fuerza de agarre: Dinamómetro. Agilidad: Agility drill test.
De Groot et al. (2012)	19 atletas de BSR	Se diseñó una batería de 10 pruebas que los atletas debieron realizar dos veces para determinar confiabilidad. La validez de las pruebas se evaluó relacionando los puntajes con la clasificación de los jugadores y el estándar de competencia, la calificación del entrenador y del jugador.	Velocidad - Potencia - Fuerza explosiva - Agilidad - Habilidad	Habilidad: Pases de precisión, Lay-up, Tiro libre, Lanzamientos puntuales. Velocidad: Sprint 5m, 20m, Suicidios. Fuerza explosiva: Pase máximo (balón de baloncesto). Agilidad: Slalom, Recoger balones.
Vaquera et al. (2016)	36 atletas de BSR	Los atletas realizaron un test-retest de la prueba TIVRE-Basket para determinar la potencia aeróbica	Potencia aeróbica	Test TIVRE-Basket
Weber et al. (2020)	11 atletas de BSR	Estimación de la potencia anaeróbica mediante pruebas de campo. Además, se evaluaron la fuerza de agarre de ambas manos (HGS) y la prueba de pase de pecho con balón medicinal.	Potencia Anaeróbica, Fuerza, Potencia Muscular	Potencia Anaeróbica: Wingate; Sprint 15m y 20m, Fuerza de agarre: dinamómetro; Potencia Muscular: pase pecho balón medicinal (3kg)
Marszałek et al. (2019)	61 atletas de BSR	Los participantes se dividieron en dos categorías funcionales A (clases de 1.0 a 2.5; n = 29) y B (clases de 3.0 a 4.5; n = 32) de acuerdo con las reglas de la IWBF. Se realizó prueba de laboratorio y de campo.	Rendimiento anaeróbico - Velocidad - Habilidad Agilidad - Fuerza	Prueba anaeróbica: Wingate (ergómetro). Velocidad: sprint de 3 m, sprint de 5 m, sprint de 10 m, sprint de 20 m, prueba de sprint de 30 s. Fuerza: lanzamiento balón medicinal (3 kg), empuñadura bilateral, prueba de simulacro de 3-6-9m, Agilidad: prueba de simulacro de agilidad.
De Witte, Sjaarda et al. (2018)	46 atletas de BSR	Las actividades en silla de ruedas se evaluaron mediante la observación sistemática de imágenes de video de partidos. Se grabaron cuatro partidos a nivel de juego nacional y cinco partidos a nivel de juego internacional. Para hacer una traducción de los datos del partido al diseño de la prueba, el resultado se organizó en tres categorías principales: actividades separadas, actividades combinadas y actividades con posesión de balón	Rendimiento de movilidad	Wheelchair Mobility Performance (WMP)

Fuente: Elaboración propia

Discusión

El objetivo de esta revisión sistemática fue identificar los test más recurrentes en la literatura, utilizados para la evaluación de las cualidades físicas en el BSR nivel élite. Se seleccionaron un total de 39 artículos relacionados al objetivo.

Los principales hallazgos indican que los test e instrumentos más utilizados fueron: Sprint 20m, con presencia en 18 estudios, seguido del Sprint 5m, utilizado en 11 estudios, dinamómetro, presente en 8 estudios, Pase máximo de balón de baloncesto, con presencia en 7 estudios, Lanzamiento de balón medicinal, utilizado en 6 estudios, Prueba T, con presencia en 5 estudios y Wingate, siendo utilizado en 5 estudios. Esto indica que

las cualidades físicas más evaluadas son; velocidad, fuerza, agilidad y potencia anaeróbica.

Tabla 4. Test más utilizados según la literatura investigada

Test	Variable	Cantidad apariciones	Estudios
Sprint 20m	Velocidad	18	(Cavedon et al., 2015; Ferro et al., 2016; Yanci et al., 2015; Zacharakis, 2020; Iturricastillo et al., 2019; Molik et al., 2013; Granados et al., 2015; Cavedon et al., 2018; Iturricastillo et al., 2015; Yüskel et al., 2018; Tachibana et al., 2019; Iturricastillo et al., 2017; Ferro et al., 2017; Ozmen et al., 2014; Marszalek et al., 2019; De Groot et al., 2012; Weber et al., 2020; Marszalek et al., 2019)
Sprint 5m	Velocidad	11	(Cavedon et al., 2015; Villacieros et al., 2020; Yanci et al., 2015; Zacharakis et al., 2020; Molik et al., 2013; Granados et al., 2015; Cavedon et al., 2018; Iturricastillo et al., 2015; Marszalek et al., 2019; De Groot et al., 2012; Marszalek et al., 2019)
Dinamómetro	Fuerza agarre	8	(Yanci et al., 2015; Soylu et al., 2020; Molik et al., 2013; Granados et al., 2015; Ferreira et al., 2017; Iturricastillo et al., 2015; Marszalek et al., 2019; Weber et al., 2020)
Pase máximo	Fuerza explosiva	7	(Cavedon et al., 2015; Yanci et al., 2015; Molik et al., 2013; Granados et al., 2015; Iturricastillo et al., 2015; Marszalek et al., 2019; De Groot et al., 2012)
Lanzamiento balón medicinal	Fuerza explosiva	6	(Granados et al., 2015; Ferreira et al., 2017; Iturricastillo et al., 2015; Marszalek et al., 2019; Weber et al., 2020; Marszalek et al., 2019)
Prueba T	Agilidad	5	(Yanci et al., 2015; Granados et al., 2015; Iturricastillo et al., 2015; Tachibana et al., 2019; Iturricastillo et al., 2017)
Wingate	Potencia anaeróbica	5	(Soylu et al., 2020; Molik et al., 2013; Ferreira et al., 2017; Weber et al., 2020; Marszalek et al., 2019)

Fuente: Elaboración propia

La prueba de sprint 20 metros ha sido empleada para evaluar la velocidad de atletas de BSR en numerosos estudios. Esta prueba es de simple aplicabilidad y aparte de obtener datos de velocidad, también proporciona ciertos resultados acerca de factores relacionados con el rendimiento y eficiencia de empuje (Brown, 2013). El protocolo consiste en ubicar, generalmente, un cono en la zona de inicio y final (20 metros en línea recta), en donde con un dispositivo (fotocélulas y/o cronómetro manual) se mide el tiempo empleado. Los atletas deben alinear la rueda grande de su silla de ruedas paralela a la línea de salida (Molik et al., 2013). Los atletas tienen dos intentos para ejecutar la prueba y se registra el mejor tiempo. Autores (Cavedon et al., 2015; Cavedon et al., 2018; Granados et al., 2015; Iturricastillo et al., 2015; Yanci et al., 2014) han utilizado esta prueba con y sin balón, encontrando un aumento en el tiempo empleado al utilizar el balón, es decir, al momento de realizar la prueba de Sprint 20m sin balón, el rango de tiempo empleado es entre 5,16 y 5,7 segundos, pero al momento de ejecutar la prueba utilizando el balón, el rango de tiempo es entre 5,76 y 9,2 segundos. Por otra parte, autores (Bergamini et al., 2015) indican la importancia de una simetría de propulsión adecuada como valor indicador relacionado con el rendimiento deportivo y posibles lesiones utilizando la prueba de Sprint 20m con unidades de medida de inercia. Igualmente, Ferro et al. (2021) demostraron que existe una relación entre la velocidad de movimiento de los jugadores y la aceleración generada de las muñecas de los jugadores.

La prueba de sprint de 5 metros, fue el segundo test más aplicado en atletas de BSR. Esta consiste en que el atleta inicia desde una posición estacionaria y con el frente de la rueda por detrás de la línea de partida, este debe desplazarse hacia adelante lo más rápido posible durante 5 metros. Se considera el tiempo que tarda en recorrer los cinco metros, para ello generalmente, en los estudios se emplea fotocélulas para la valoración, no obstante, también es común que se utilice cronómetro, al respecto, autores (Cavedon et al., 2015; Cavedon, Zancano & Milanese, 2018; De groot et al., 2012) indican que este se iniciaba cuando las ruedas delanteras cruzaban la línea de salida y se detenía

cuando las ruedas delanteras cruzaron la línea de meta. En cuanto a los intentos, hay estudios en que los atletas realizan dos repeticiones (Molik et al., 2013; Marszalek et al., 2019) e investigaciones que aplican tres (De groot, 2012; Granados et al., 2018; Iturricastillo, Granados & Yanci, 2015; Yanci et al., 2018). Es importante considerar la aceleración de muñeca dominante en la prueba como un indicador de mayor aceleración, así lo afirma Ferro et al. (2021), donde se demuestra que existe una relación significativa entre la aceleración media de la muñeca dominante y la velocidad media del jugador en silla de ruedas, siendo esta relación más fuerte al inicio (0-3 m).

Para medir la fuerza de agarre, se utiliza el dinamómetro de mano, donde el atleta desde su silla de ruedas, sostiene con una mano el instrumento que se ubicará completamente extendido al costado de la rueda, y sin que este la toque. Según Yanci et al (2015), el protocolo indica que se realizan tres contracciones isométricas máximas durante 5 segundos, con un período de descanso de un minuto, donde el valor más alto se considera para determinar la fuerza máxima de agarre. En el caso de los estudios de Ferreira et al. (2017) y Weber et al. (2020), aplican dos intentos con un minuto de descanso. Autores (Oliveira et al., 2017) establecen que el dinamómetro es una herramienta válida para evaluar la propulsión de la silla de ruedas. Es importante considerar que los valores de rendimiento deportivo en atletas de BSR estarán relacionados a los diferentes puntajes de clasificación (Soylu et al., 2020).

Por otra parte, una de las pruebas más utilizadas para medir la fuerza explosiva en atletas fue el Pase máximo de balón de baloncesto. Esta prueba consiste en ubicar al atleta con la rueda delantera detrás de la línea de fondo y realizar un pase por sobre la cabeza con los dos brazos lo más lejos posible desde una posición estacionaria, mientras uno de los investigadores sostiene la silla de ruedas quieta (Granados et al., 2015; Iturricastillo et al., 2015). Los atletas tienen un máximo de 5 intentos donde se toma la distancia media entre los 5 lanzamientos. Es una prueba de fácil aplicación y ayuda a tener parámetros referidos a la fuerza explosiva en los atletas. Los valores de referencia considerando clases altas y clases bajas oscilan entre 7,8 y 13,8 metros.

La prueba de Lanzamiento balón medicinal fue utilizado en diversos estudios para evaluar fuerza explosiva en atletas de BSR. Los autores utilizaron principalmente balones de 3 kg (Ferreira et al., 2017; Iturricastillo et al., 2015; Marszałek, Kosmol, Morgulec-Adamowicz, Mróz, Gryko, Klavina, Skucas, Navia & Molik, 2019; Marszalek, Kosmol, Morgulec-Adamowicz, Mróz, Gryko & Molik, 2019; Weber et al., 2020) y 5 kg (Granados et al., 2015;). Para esta prueba los autores señalan que el protocolo consiste en que el atleta debe apoyar su espalda firmemente en el respaldo de su silla, sosteniendo el balón medicinal con ambas manos y realizando un lanzamiento desde la zona del pecho hacia el frente sin quitar la espalda del respaldo de la silla (Ferreira et al., 2017). Para mantener esa posición, un evaluador sostiene con una tira de tela (10 cm) la zona del pecho, procurando mantener una posición estática del tronco en todo momento del lanzamiento. Según los estudios seleccionados, para el lanzamiento del balón de 3 kg y considerando clases altas y bajas, los valores oscilan entre 3,09 y 7,08 metros; para el lanzamiento del balón medicinal de 5 kg, los valores oscilan entre 4,86 y 4,89 metros. Autores (Granados et al., 2015) han comparado la prueba de pase máximo y lanzamiento de balón medicinal en equipos de primera y tercera división, encontrando diferencias significativas entre ambos con un aumento del 33% y 24% respectivamente en los resultados de equipos de primera división. Los autores mencionados (Granados et al., 2015) señalan que estas diferencias entre jugadores de élite y de menor nivel también se han observado en otros deportes como el rugby (Baker, 2002) y el balonmano (Gorostiaga et al., 2005), e indican que se podrían requerir altos valores absolutos de fuerza y explosividad muscular para un rendimiento exitoso en BSR de alto nivel.

Otra de las pruebas más utilizadas en esta revisión sistemática fue la Prueba T (Granados et al., 2015; Iturricastillo et al., 2015; Iturricastillo et al., 2017; Tachibana et al., 2019; Yanci et al., 2015). En el caso de Yanci et al. (2015) y Granados et al. (2015), se basaron en el protocolo de Sassi et al. (2009) haciendo modificaciones para la silla de ruedas que le permita siempre ir avanzando con movimientos hacia adelante. A partir de ello, los estudios de Iturricastillo et al. (2015), Tachibana et al. (2019) e Iturricastillo et al. (2018), emplean el protocolo propuesto por Yanci et al. (2015). La prueba consiste en completar un circuito en forma de T compuesto por cuatro conos, desplazándose lo más rápido posible, en donde cada participante debe realizar la prueba 3 veces con al menos 3 minutos de descanso entre repetición. Los valores de los atletas de BSR oscilan entre 14,74±1,65s (Granados Domínguez et al., 2016) y 15,3±1,2s (Romarate et al., 2020). Con relación a otros deportes en silla de ruedas y la prueba de agilidad, se encuentra un estudio realizado a nueve tenistas de élite, donde se empleó la prueba T, cuyos resultados fueron 12,42±0,99s (Sánchez-Pay et al., 2021). Al comparar los datos presentados anteriormente con relación al BSR, se puede inferir que los atletas de BSR presentan ser más lentos frente a los tenistas. Lo contrario sucede al compararlo con un estudio realizado a 13 atletas de handball en silla de ruedas, donde se observa que sus resultados en la prueba de agilidad fueron de 16,5±1,5s (Borges et al., 2017), por ende, se aprecia que los atletas de BSR fueron más ágiles que los de handball.

Por último, se encuentra la prueba Wingate que evalúa la potencia anaeróbica, se caracteriza por ser una prueba de laboratorio ya que se utiliza un cicloergómetro para miembros superiores. El participante inicia sentando en su silla de ruedas con el cicloergómetro ajustado al nivel de la articulación del hombro (Molik et al., 2013). Según el protocolo, los atletas realizan un calentamiento entre los 10 y 20 minutos cual consiste en tres a cuatro sprint de 5 segundos y posteriormente descansan. Este test consiste en realizar un esfuerzo máximo durante 30 segundos con una carga de 5% del peso corporal (Ferreira et al., 2017), sin embargo, Marszalek et al. (2019) realiza una diferencia de carga según el tipo de clasificación del atleta, 4% de la masa corporal para los participantes de la categoría A y 5,5% para los jugadores de la categoría B. Esta prueba entrega medidas como potencia máxima (PP), definido como el valor máximo de 5 segundos registrado durante la prueba medido en vatios (W), potencia de salida media (MP) como potencia media logrado durante la prueba de 30 segundos medido en vatios (W), salida de potencia máxima mínima (MPP), la más alta de 5 segundos valor máximo de potencia registrado durante el Wingate prueba medida en vatios (W) y caída de potencia (PD) (Soylu et al., 2020). Este tipo de pruebas también ha sido empleada en otras modalidades paralímpicas, por ejemplo, el rugby en silla de ruedas (Marcolin et al., 2020), no obstante, su aplicación requiere implementos específicos que pueden dificultar su acceso.

En cuanto a los estudios que se enfocaron en validar pruebas para la evaluación de alguna cualidad física, se identificaron seis. Por un lado, Marszalek et al. (2019) cuyo objetivo de estudio fue evaluar la confiabilidad test-retest de las pruebas de campo enfocadas en esfuerzos de alta intensidad, sus resultados fueron que 10 de cada 11 pruebas de campo son confiables para atletas de BSR, ya que no existen estadísticamente diferencias significativas entre el test y re-test (p > .05), además, de presentar una

fuerte correlación para cada prueba (r > 0.7). Por otro lado, en cuanto al estudio de De Groot et al. (2012), se lleva a cabo diez prueba de las cuales seis demostraron una buena confiabilidad (*ICC* = 0.80 – 0.97, respectivamente), mientras que los test de pase por precisión, lanzamiento libre, bandeja y lanzamientos específicos, manifestaron una fiabilidad moderada (*ICC* = 0.26 – 0.67, respectivamente), de igual forma, la mayoría de las pruebas mostraron de buena a moderada validez (r > 0.6).

Dentro de las limitaciones del presente estudio, encontramos una falta de especificidad en la redacción de resultados por parte de la literatura investigada en función de clases altas y bajas lo que impidió poder establecer ciertos valores referenciales discriminando entre tipos de clases para atletas de BSR. Por otra parte, la falta de estudios enfocados al deporte femenino hizo imposible una clasificación de resultados en función del sexo.

Conclusión

Las variables físicas más evaluadas en la literatura investigada, fueron la velocidad en primer lugar, seguido de fuerza, agilidad y potencia anaeróbica. Para evaluar las variables mencionadas, los autores se inclinan preferentemente por Sprint 20m y 5m, Dinamómetro, Pase máximo, Lanzamiento de balón medicinal, Prueba T y Wingate.

Finalmente, los artículos enfocados a la confirmación de fiabilidad y validez de pruebas para la medición de variables físicas en BSR presentaron buenos resultados, concluyendo que la mayoría de las pruebas evaluadas son fiables y válidas para evaluar aspectos físicos en atletas de BSR.

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Improvements and perception following a physical-exercise intervention specific for chronic/palliative older adults

Mejoras y valoración tras un programa de ejercicio específico para adultos mayores crónicos/paliativos

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Abstract

After analysing the impact of a cognitively oriented multicomponent home-based exercise training program on independence, perceived health status, and lower limb strength in a group of multimorbid and/or palliative older patients (MPO-P), we studied the associations between improvements following training and the participants and health personnel's opinion of the program. 13 MPO-P, (80.15+4.20 years) completed four months of training progressing in autonomy (from two supervised sessions and one autonomous weekly -60min session-, to two autonomous and one supervised). This was followed by four autonomous (detraining) weeks with a recommendation to continue the exercises. Volume and intensity were increased by introducing more global exercises, with a greater neuromuscular load and double tasks, and a shorter resting interval. No exercise was repeated during the session (EFAM-UV©). Independence (Barthel) and perceived health (physical SF-36, with no changes in the mental domain), were improved after supervised training, with a tendency to improve in strength (sitting and standing for 30-s) and perceived health (total SF-36). This effect was maintained after the autonomous detraining phase, with a very favourable final perception by both patients and health personnel, as indicated in questionnaires. The gain in independence correlated negatively with the users' perception, but this requirement ensured the improvement. There was no association between perceived health and the evaluation of the program.

Keywords: Autonomy, detraining, health perception, multi-component training, strength.

Resumen

Tras analizar el impacto de un programa de entrenamiento domiciliario multicomponente, con orientación cognitiva, sobre independencia, percepción subjetiva de salud, y fuerza del miembro inferior en un grupo de adultos mayores crónicos multimórbidos y/o paliativos (MCM-Ps), se estudiaron las asociaciones entre las mejoras obtenidas y la valoración del programa de participantes y personal sanitario. 13 MCM-Ps (80.15+4.20 años) completaron cuatro meses de entrenamiento progresando en autonomía (de dos sesiones supervisadas y una autónoma semanalmente -60 min/sesión-, a dos autónomas y una supervisada). Le siguieron cuatro semanas autónomas (desentrenamiento) con recomendación de ejercicio. El volumen y la intensidad se aumentaron introduciendo más ejercicios integrales, con mayor carga neuromuscular y doble tarea, y menor tiempo de descanso entre ellos, sin repetirlos en la sesión (EFAM-UV©). Independencia (Barthel) y salud percibida (SF-36 físico, sin cambios en dominio mental) mejoraron tras el entrenamiento supervisado, con tendencia a la mejora de fuerza (sentarse y levantarse 30-s) y la salud percibida (SF-36total). El efecto permaneció tras la fase autónoma/desentrenamiento, con una percepción final muy favorable de pacientes y personal sanitario-determinada mediante cuestionarios-. La ganancia en independencia correlacionó negativamente con la valoración del usuario, pero esta exigencia aseguró su mejora. No hubo asociación entre salud percibida y valoración del programa.

Palabras clave: Entrenamiento multicomponente, desentrenamiento, percepción de salud, autonomía, fuerza.

Introduction

Scientific evidence has revealed that isolation and lack of exercise lead to weakness and dependence (Roppolo et al., 2015). After an adverse event, a prolonged period of involuntary isolation or certain chronic illnesses the risk of becoming completely fragile rises steeply (Ong et al., 2016; Pilotto et al., 2020). Although we do not generally expect to find extreme fragility in those under 85 (Clark, 2019), the presence of one or more of these factors (including lack of exercise, a sedentary lifestyle, hyper-medication or frequent hospital admissions) can aggravate declining health and explain the ever increasing number of people who reach this state. These premature symptoms are associated with those of advanced age, with a high degree of fragility and dependence, comorbidity and the risk of death. We also find in this group an increased number of the so-called palliative patients.

In the last 20 years, physical exercise has been shown to improve people of all ages, regardless of their mobility levels and illnesses suffered (Bull et al., 2020), and the evidence has also mounted of its benefits for pre-fragile and fragile persons (Kidd et al., 2019; Rebelo-Marques et al., 2018). Demanding, high-volume and high-intensity exercises also seem to be most effective for increasing strength and muscle mass in fragile persons (Beckwée et al., 2019). Sessions combining flexibility, aerobics and physical effort have been shown to improve the physical condition, cognitive performance, quality of life (QoL) and functionality in those who are both elderly and fragile (Langlois et al., 2013; Rezaei-Shahsavarloo et al., 2020). In fact, interventions based on multi-component training (e.g., Mobility, strength and balance combined with cardiovascular and breathing exercises) are becoming increasingly recognized, thanks to their capacity for improving both physical and mental/cognitive abilities (Beckwée et al., 2019; Bray et al., 2020; Matos Duarte & Berlanga, 2020; Pardo et al., 2021; Poyatos & Orenes, 2018).

Physical exercise and a training program can thus be seen as a type of medicine for the fragile (Nagai et al., 2018), those in their eighties, even 100-year-olds (Miller et al., 2020) and people in bad health or with reduced mobility (Laddu et al., 2021). Physical training at home is therefore now recommended to promote or facilitate the practice of physical exercise by the aged and fragile unable to go outside their homes, those who are institutionalised (Thomas et al., 2019), or who live in environments without the proper conditions for the practice of physical activity (Annear et al., 2014). The advantages of this type of program include the ability to adapt the sessions to individual needs and they show promising results in those who have recently suffered falls (Hill et al., 2015; Liu-Ambrose et al., 2019). They have also been found to reduce anxiety and stress levels, improve mental health, reduce dyspnea and incapacity, with the associated benefit of a better quality of life (Loh et al., 2019). These home training sessions are usually based on working with single individuals with a single objective (e.g. to improve their strength, balance or aerobics) (Liu-Ambrose et al., 2019).

In this context, in spite of the evidence that supports the use of multi-component training programs, these programs have a more holistic vision of improving the elderly's QoL, although as far as we know home interventions for chronic or palliative patients have not been multi-component, nor have they included a cognitive and entertaining orientation to maintain physical condition by improving both neuromuscular and cardiovascular factors far removed from the aim of rehabilitation. The challenge of carrying out these programs and treatments while guaranteeing the participants' safety is also considered. The Home Hospitalisation Unit (HHU), responsible for chronic and/or palliative patients, is thus seen as the best medicalised unit to supervise these multi-component programs and help to get over two of the main barriers to their exercising: the difficulty they have to get around and a fear of a lack of control (Rodrigues et al., 2017).

Home-based training programs make up an alternative to the fragility-dependence binomial and give them a multi-component orientation that also focuses on the cognitive and game aspects to motivate chronic elderly patients with multiple pathologies to exercise. However, few studies have been published in this topic and neither have the subjects' opinions on this strategy been taken into account. Also, since informing the users on improvements to their physical and mental health has recently been shown to give them an incentive to exercise (Hager et al., 2019; Rodrigues et al., 2017), including participants' opinion and appraisals in these programs can help to strengthen their effects and imbue a perception of their necessity in both the medical staff and users.

In order to achieve results for the successful application of home training programs for the elderly chronic/palliative patients, the present study had several objectives: 1) to determine the effects of multi-component training with important effects on their cognitive faculties as regards their QoL, independence and lower limb strength; 2) evaluate their degree of satisfaction and perception of the need for such exercises in both clinical staff and patients; and 3) determine the relationship between this perception and the possible benefits of the intervention.

Our main initial hypothesis was that both staff and patients should positively value this strategy to achieve health improvements.

Material and Methods

Participants

The pilot study was on 13 elderly chronic multimorbid and/or palliative patients (MPO-P) either admitted to or discharged from the Home Hospitalisation Unit (HHU) of the Alicante General Hospital. After medical approval and derivation, the patients were gradually admitted to the training program. After informing them and their families on the characteristics of the study, those who decided to join the training program signed written consent forms.

All the patients who complied with the following criteria were included: medical approval to participate, included in the HHU program, over 65 and available for the entire training period. Those excluded were the ones who did not match these criteria, or who were taking part in another physical training or rehabilitation program, those suffering a cognitive impairment that disabled them from taking part, or who could not complete the entire program and/or the periodical tests.

Participation was entirely voluntary, and the subjects were free to abandon the intervention at any time with no negative repercussions. The study was given the previous approval of Valencia University's Ethical Committee (H14014428868708), in accordance with the Declaration of Helsinki.

Training Program

The training program was divided into phases according to the EFAM-UV© recommendations (Blasco-Lafarga et al., 2020; Blasco-Lafarga et al., 2016), adapted to the hospital context and the participants' characteristics (Blasco-Lafarga

et al., 2019; Blasco-Lafarga et al., 2021; Sanchis-Soler et al., 2021). It was opted to include indirect training of participants and carers to foment autonomy and the practice of physical exercise, so that training autonomy was introduced gradually by combining supervised and autonomous sessions. Three evaluations were carried out during the 4-month intervention (Ev.: preliminary; Ev.: after 36 sessions, 24 supervised and 12 autonomous; Ev.: after 12 sessions, 4 supervised and 8 autonomous), followed by an evaluation after one month of complete autonomy or detraining (Ev.).

In accordance with the EFAM-UV© Method (Blasco-Lafarga et al., 2020; Monteagudo et al., 2020), the 4 months' training were divided into three mesocycles (M): M1-Introductory o Familiarisation, M2-Neuromuscular & Cognitive Development, and M3-Neuromuscular Stabilisation & Improvement of Motor Plasticity. Two transition microcyles were introduced in each mesocycle for patients that required reinforcement of the goals set for the mesocycle.

The training sessions had a general cognitive neuromotor functional objective (see Figure 1), for which gait and postural re-education tasks – the central core of the session – were combined with manipulative and cognitive skills. The demands of strength and motor control – balance and coordination – were gradually increased since the subjects were very weak and lacking in physical abilities. The cardiovascular demands were increased when they showed a certain amount of mastery of the task.

Following the EFAM-UV© method, based on dual-tasking and unilateral proposals, the sessions gradually became more demanding by increasing the Volume, Intensity and Complexity. For the first of these, the volume was increased by 2 or 3 reps before the introduction of harder loads / new proposals, aiming to do between 6 to 10 intense reps; new exercises were then introduced while the recovery times were slowly reduced as far as possible. For the second and third, respectively, the duration of joint contraction and/or amplitude was increased in work with dumbbells and elastic bands, together with stamina in assisted/ resisted exercises and cognitive-coordinative complexity. Shortening the rest times made the sessions more dense and thus more intense.

As can be seen in Figure 1, the postural control requirement was used as the variable to modify and/or increase the neuromuscular demands. The strengthening tasks were begun in a sitting position and progressed from bilateral support to tandem and semi-tandem positions also while sitting. The exercise was then repeated in a dynamic position for the subjects who were able to do so. The exercises were not generally repeated in a single session but were modified to involve the muscle groups selected in different patterns. The work was progressively intensified in the three mesocycles, passing from neuromuscular exercises (large muscle groups; motor coordination, joint, amplitude and balance) to cognitively more demanding tasks in the final part of the program (taking decisions, associating or remembering while moving). In short, the EFAM method is based on the progressive involvement of different muscle groups in increasingly complex situations (see Blasco-Lafarga et al. (2021) for further details.

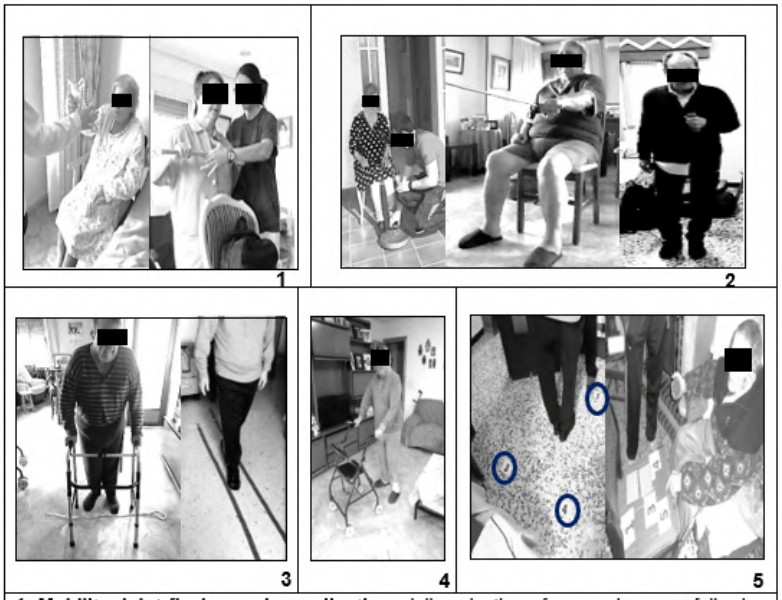

Figure 1. Characteristics of tasks carried out

Sessions were controlled daily by monitoring blood pressure, oxygen saturation and subjective pain perception after each block of exercises (EVA scale) and fatigue (modified 1-10 Borg scale) with at least 3 registers of each variable per session. The exercises were intensified to stay within the subjects' individual capacities or safety ranges to allow the trainer to adapt the daily sessions to safely increase the effort required.

To conclude, the patients' needs, habits and hobbies were also considered (e.g. board games, cards and other pastimes) in the design of the session, which also included cognitive and fine psychomotor tasks to maintain stimulation throughout the 60 m.

Instruments

To determine the participants' characteristics, and health status, information was collected on their sociodemographic and general health conditions, including: oxygen saturation (SO.) by a WristOx. pulse oximeter (Model 3150, Nonin Medical, Inc., Amsterdam, The Netherlands), blood pressure by an automatic OMRON M3 (IM-HEM-7131-E) tensiometer (Omron Healthcare Co., Ltd. Binh Duong, Vietnam), blood sugar by an Accu-Chek Aviva monitor. Roche Diabetes Care Spain, S.L., Sant Cugat del Vallès, Barcelona), and body mass index by a Tanita model BC 545 N body impedance scale (TANITA Corporation, Amsterdam, The Netherlands), while cognitive capacity was measured by Mini-Mental State Examination (MMSE) in the initial evaluation.

The pre-post assessment included evaluating the degree of independence in everyday activities by means of the Spanish version of the Barthel Index (Cid-Ruzafa & Damián-Moreno, 1997). This scale analyses the degree of independence (help and time required) in 10 activities (maximum score 100 points), using the criteria proposed by Shah et al. (1989): from 0 to 20 points - complete dependence, 21 to 60 - severe dependence, 61 to 90 - moderate dependence, and 91 to 99 - little dependence.

The health-related QoL was evaluated by Questionnaire SF-36, which determines a person's level of physical, mental and overall welfare. We used the Spanish version adapted by Alonso (1995), with a 4-week recall period. The questionnaire contains 36 items and can evaluate health and perceived QoL on 8 scales (Physical Function, Physical role, Body pain, General Health, Vitality, Social Function, Emotional state and Mental health) grouped into 3 categories (perception of mental health (SF_36m), perception of physical health (SF-36f) (Zeggwagh et al., 2020) and total health perception (SF-36t). The possible scores range between 0 and 100 (Vilagut et al., 2005).

The 30-s Chair Stand Test (30s-CST) was used to check lower-limb strength, as proposed by Rikli and Jones 30-s (1999). This was selected since most of the participants could not stand up from the chair more than 3 times, and variants such as the time taken to stand up and sit down 5 times would hardly reflect any improvement following the intervention.

Finally, we compiled special questionnaires for patients and clinical staff to give their opinion and/or assessment of the physical exercise intervention. The one for the patients covered their degree of satisfaction and perceived need for training program. It was composed of 13 questions with 4 possible answers on a Likert scale (0 = never, 1 = seldom, 2 = sometimes, 3 = almost always and 4 = always). The clinical staff awarded points to the program in their questionnaire on a scale of 0-10, answering 12 closed questions, also on a scale Likert scale (0 = never, 1 = seldom, 2 =sometimes, 3 = almost always and 4 = always) plus 2 open questions. This questionnaire provided the clinical staff's opinions on the training program and also on the opinions expressed to them by the patients.

The sessions were monitored and guided by a WristOx2 Model 3150 pulse oximeter and an automatic OMROM M3 tensiometer (IM-HEM-7131-E), which were periodically used to monitor the patients' progress and safety levels during the intervention. This control was additionally supported by information from the perceived effort score (Borg 1-10) and the visual analogue pain scale (EVA) throughout the session.

Statistical analysis

The Statistical Package for the Social Sciences software (SPSS Version 26) was used for the statistical analysis. After checking the sample normality (Shapiro -Wilk $n<30$), to determine the changes brought about by the training a repeated measures analysis was performed followed by a Bonferroni test for (Ev_1-Ev_3), a Student's T-test for related samples (Ev_1-Ev_4) for QoL health-related perception, and a Friedman test followed by a Wilcoxon test for level of independence of the lower limb.

To collect the participants and clinical staff's perceptions, questionnaires were subjected to a descriptive or frequency analysis. In addition, to find the relationship between the participants rating and the changes generated by the intervention ($\Delta_{1\text{-}4}$) on SF-36 and IB, a Pearson's bivariate correlation was carried out to determine the association with the SF-36 and a Spearman's correlation for IB.

Significance was set at $p < .05$, also considering the $p < .1$ tendencies due to the sample size (Rosner, 2015). The Cohen's D effect size was calculated for all the variables that underwent a significant change or a tendency to significance. The results were interpreted according to the ranges proposed by Fritz et al. (2012), considering 0.2 as small, 0.5 as medium and 0.8 as large.

Results

The final sample of the pilot study was composed of 13 patients with an average age of 80.15 years. As can be seen in Table 1, they were dependent elderly adults (84.62% needed a caregiver), with moderate desaturation and high levels of blood glucose. As regards body composition, the 8 participants that could be measured by bio-impedance had high IMC and a percentage of fat that indicated being overweight.

On assessing the effect of the training program on the level of independence (Table 2) significant improvements were found in all the outcomes in relation to the initial evaluation, with a medium effect size: $v_{1\text{-}2}$ ($p = .011$; $d = 0.47$); $Ev_{1\text{-}3}$ ($p = .022$; $d = 0.45$). Improved health related QoL was also found in the physical dimension (Table 2), with a trend to significance in the SF-36 total outcome (SF-36t). Specifically, the improvements in the SF-36f referred to $Ev_{1\text{-}2}$ ($p = .031$; $d = 0.84$). In relation to the lower-limb strength, a significant tendency was only obtained in evaluations 2 and 3 with respect to the initial assessments: $Ev_{1\text{-}2}$ ($p = .058$; $d = 0.62$); $Ev_{1\text{-}3}$ ($p = .085$; $d = 0.53$).

Secondly, the 1-month post-training assessment (overall intervention assessment) showed that after the autonomous month, the significant improvements were maintained in spite of possible detraining. In fact, although not significantly, the results were better than those of the third evaluation in all variables except for IB. When

compared to the start of the intervention, significant differences were obtained in IB (p = .045; d = 0.37), Sf3-6f (p = .003; d = 1.09) and SF-36t (p = .025; d = 0.72) (Table 2).

Table 1. Descriptives: mean, standard deviation, coeffi cient of variation

Variables	***M±DE***	***CV***
Age (years)	80.15 ± 4.20	5.24%
Sao_2 (%)	92.31 ± 5.99	6.49%
Glucose (mg/dl)	156.00 ± 77.77	49.85%
TAS (mmHg)	131.69 ± 13.20	10.02%
TAD (mmHg)	70.77 ± 9.91	14.00%
Weight (kg) (n=9)	70.98 ± 13.77	19.40%
Height (cm) (n=12)	154.25 ± 13.33	8.64%
BMI (n=8)	30.98 ± 5.08	16.40%
Muscle Mass (kg) (n=8)	40.40 ± 8.83	21.86%
Fat (kg) (n=8)	41.49 ± 7.59	18.29%
MMSE (30-0)	24.08 ± 3.77	15.66%
	Frequency	**Percentage**
Gender		
Male	6	46.15%
Female	7	53.85%
Education		
None	6	46.15%
Some	7	53.85%
Caregiver		
Relative	11	84.62%
Formal	1	7.69%
No carer	1	7.69%
Walking capacity		
Yes	9	69.23%
No	4	30.77%

M: mean ; SD:standard deviation ; CV: coefficient of variation ; Sao2: Oxygen saturation ; TAS. Systolic blood pressure ; TAD: Diastolic blood pressure ; BMI: Body mass index ; mmHg : mm of mercury ; kg: kilograms ; cm: centímetres ; MMSE: Mini-Mental State Examination.

High scores were obtained for the participants' satisfaction with the course (44 out of a possible 52), which indicates a very positive evaluation. Bearing in mind the total possible answers, for items 1, 2, 8, 11, 12 and 13, regarding satisfaction and perception of the need for this type of program, 78.20% of the total assessments were the maximum score (*"always"*). For the items related to the benefits of the program, (5, 6, 7, 9 and 10) 72.30% of the scores were *"always" or "almost always"* on the Likert scale.

In relation to the suitability of the program (items 3 and 4), 76.92% of the answers were again the maximum score. Table 3 gives details of the percentages assigned to each question by the participants. Table 4 gives details of the scores awarded by the clinical staff, considering their total answers to items 1, 2 and 12, (degree of satisfaction and overall score for the program and trainer), for which 80% of the answers were the maximum score.

Secondly, regarding the benefits to the patients (items 3, 4, 5 and 6), 65% of the answers were the maximum score and 25% were the second highest (*"almost always"*). Regarding the staff's perception of the patients' satisfaction (items 7, 8, 9, 10 y 11), 92% gave the training program the maximum score and the doctors and nurses in general gave it a mean score of 9.8 points out of 10. All of these indicated a need to include this type of interventions in the HHU service based on the different perceptions and commentaries offered by the patients. To emphasise: the improved perception of health related QoL; making the caregivers' burden lighter and the fact that they looked forward to being able to carry out their daily activities again.

The relationship was also analysed between the program evaluation and those variables with significantly positive changes throughout the intervention (Δ1-4IB and Δ1-4Sf-36). As can be seen in Table 5, the perception of the health related QoL did not have a significant correlation with the program rating. On the other hand, the change in the degree of independence did have a relationship with this rating, although negative.

Table 2. Effects of intervention

Phases	Supervised training (Ev_{1-3})				Autonomy (Ev_{1-4})
Weekly sessions	Ev_1	Ev_2 *2S+1A*	Ev_3 *1S+2A*	p_{1-3}	Ev_4
Barthel	32.69 ± 32.70	**48.08 ± 32.37[1]**	**46.15 ± 27.05[1]**	.026*	44.23 ± 30.13[1]
Sf-36m	36.54 ± 23.30	46.00 ± 26.05	44.38 ± 24.96	.216	44.92 ± 23.82
Sf-36f	20.38 ± 15.44	**34.54 ± 18.08[1]**	33.85 ± 22.32	.024*	39.31 ± 18.99[1]
Sf-36t	29.15 ± 19.09	41.77 ± 21.55	40.31 ± 22.69	.072†	43.54 ± 20.72[1]
30s-CST	2.15 ± 3.13	**3.54 ± 3.02[A]**	**3.15 ± 3.29[A]**	.109	3.19 ± 2.96

Ev1: Preliminary program evaluation ; Ev2: Evaluation after 36 training sessions (24 supervised and 12 autonomous); Ev3: Evaluation after 12 sessions (4 supervised and 8 autónomous); Ev4: Evaluation after 1 month of autonomy; p1-3: Friedman's test (IB and 30s_CST) and ANOVA (Sf_36). Sf_36m: Sf_36 mental; Sf_36f: Sf_36 physical; Sf_36t: Sf_36 total; 30s_CST: 30 s standing and sitting. *Significance p<.05; † tendency to significance p<.1. 1 significant differences vs. Initial evaluation (Ev1); A tendency to significance vs. Initial evaluation (Ev1).

Table 3. Frequencies (expressed as a percentage) of the evaluation of the patients' satisfaction questionnaire towards the training program (n = 13)

Question	Never	Seldom	Sometimes	Almost always	Always
1. In general I am satisfied with the exercise program carried out.			7.7%	7.7%	84.6%
2. I am happy with the treatment received.					100%
8. I looked forward to the sessions.	7.7%		7.7%	23.1%	61.5%
11. I think this type of program is important to improve my health.				23.1%	76.9%
12. I would recommend other elderly people to take part in the course.				7.7%	92.3%
13. I think these 4-5 months were enough to improve my physical condition.	15.4%		15.4%	15.4%	53.8%
5. I'm aware of an improvement in my physical condition.		7.7%	23.1%	38.5%	30.8%
6. My mood has improved.	7.7%	15.4%	15.4%	23.1%	38.5%
7. I find myself more alert and with a better mental capacity.		7.7%	30.8%	30.8%	30.8%
9. I feel better on the days when I have a training session.	7.7%		7.7%	30.8%	53.8%
10. I always feel better after physical exercise.			15.4%	38.5%	46.2%
3. The exercises were tailored to my capacity and possibilities.	7.7%			38.5%	53.8%
4. I had all the necessary material for my workouts, whether supervised or autonomous sessions.					100%

Table 4. Frequencies expressed as a percentage of the questionnaire on doctors and nurses' satisfaction with the training program (n = 5)

Question	Never	Seldom	S0metimes	Almost always	Always
1.Are you satisfied with the training program in general?					100%
2.Do you think the program achieves its goals?				20%	80%
12.In spite of the short duration, do you consider that the program could help to reduce the health service burden?			40%		60%
3.Do you think this type of program is important and beneficial to HHU patients?					100%
4.Do you think this type of program benefits and improves the patients' physical condition?				20%	80%
5. Do you think this type of program improves the patients' cognitive abilities?			20%	40%	40%
6. Do you think this type of program leads to psycho-social improvements in the patients?			20%	40%	40%
7. At the end of the program, would you say that the patient has improved significantly?			20%	20%	60%
8. Do you think the patients are happy with the trainer's behaviour?					100%
9. Do you think the patients are happy with their exercise program?					100%
10. Have the patients made favourable comments on the program?					100%
11. Have the patients made any negative comments on the program?	100%				

Discussion

To improve the prescription of home-based training programs for elderly hospitalized or HHU chronic multi-morbid and/ or palliative patients, the effect of a multi-component program with a cognitive orientation (EFAM-UV©) was first analysed on their levels of independence, perception of health-related QoL and lower-limb strength. Secondly, we evaluated the participants' satisfaction and perception of the need for such a physical exercise program, as well as the clinical staff's evaluation of its benefits. Finally, we analysed the relationship between the participants' rating and the possible improvements due to the program.

The initial diagnosis showed the participants' severe degree of dependence, low QoL and lower-limb strength (Rikli & Jones, 1999; Shah et al., 1989; Vilagut et al., 2005). In spite of this, and as the first finding, the training program significantly improved their independence in all the stages of the exercise program, and the perception of health after the most intensely supervised stage. These improvements were maintained after the month of autonomous training. In the latter period there was also a significant improvement in their perception of total health.

As regards lower-limb strength, the mean values were higher in all the evaluations after the initial one, although they only showed a tendency to significance in the second and third. These changes could have been responsible for the improved independence and health perception in relation to QoL Previous studies had already shown how a good home-based training program can improve the physical condition of frail older people (Boongird et al., 2017; Martel et al., 2018). In line with our results, this type of intervention has been shown to be successful in improving independence, functionality, mobility and QoL in elderly fragile persons (Clegg et al., 2012).

The perceived mental health did not show any significant improvement, although the scores in the evaluations were all higher than the initial score. These insignificant changes could have been due to the longer time needed to achieve improvements in mental/cognitive health (Blasco-Lafarga et al., 2020). Related to this, the delay in appreciating improvements in the perception of physical health supports the importance of including lasting supervised interventions, since a longer time is required to produce a visible improvement in the state of health (Blasco-Lafarga et al., 2020). The progressive slowdown in improvements during the semi-supervised phase (Ev3) and detraining (Ev4) in independence and strength, confirms these needs (supervision and longer lasting interventions), since ending the exercise training means that in most cases the benefits are lost (Blasco-Lafarga et al., 2021; Sanchis-Soler et al., 2021). These losses during detraining are in agreement with the findings of other studies; (Vogler et al. 2012), in a study on a sample of aged fragile adults (average age 79) found that after a 12-week home training intervention, 12 weeks later the improvements achieved in balance and risk of falls had disappeared (Cadore et al.. 2014) carried out an 8-week multi-component training program with demented elderly patients and found that their physical and cognitive conditions, and dependence, had deteriorated after 12 and 24-weeks of detraining.

This deterioration of the results after the periods with detraining and less supervision could be partly explained by the difficulty of convincing elderly patients to stick to the training program. Factors such as incomplete understanding or even being unaware of their benefits,

Table 5. Bivariate correlation between the rating in the satisfaction questionnaire and the improvements in autonomy and QoL related to perception of health

	Satisfaction with the program	
	p	Correlation
$\Delta_{1\text{-}4}$Barthel	**.039**	-.577*
$\Delta_{1\text{-}4}$Sf-36f	.180	-.396
$\Delta_{1\text{-}4}$Sf-36t	.377	-.267

Pearson's for Sf36 and Spearman's for Barthel's Index. Ev4: final evaluation; Δ1-3 : delta (degree of change from initial evaluation to evaluation 3. Change caused by training); Δ1-4: delta (degree of change from initial evaluation to evaluation 4. Change caused by the intervention); Sf-36m: Sf-36 mental; Sf-36f: Sf-36 physical; Sf-36t: Sf-36 total. *Significance $p<.05$.

fear of falls on being alone and /or lack of interest or strength at these ages are possible barriers to fragile elderly persons practicing regular physical activity (Rodrigues et al., 2017). To this can be added many other types of barriers , such as the difficulty of introducing this type of exercise training programs earlier on the health care system (Annear et al., 2014; Thomas et al., 2019). As far as we understand, identifying these barriers could help to include more training programs in the hospital context and ensure the compliance of the patients. It would thus be important to evaluate both the users and doctors' perceptions.

The second finding was that the questionnaires indicated that both users and doctors considered the intervention to be highly positive. Different authors have recently begun to carry out studies in this direction. For example, Evensen et al. (2017) found that 93% of elderly adults confessed to an interest in doing physical exercises during their stay in hospital, although 27% claimed they did not know anything about the available activities and 33% did not know anything about the physical training options after being discharged. As we have already mentioned, fear of falls, lack of interest or transport or considering oneself to be too old for a physical training program could be seen as barriers to these persons practicing physical activity (Rodrigues et al., 2017). Conversely, it is important to point out that allowing patients to choose their exercises, and the fact of feeling less pain and fatigue after training, are enticements to train (Hager et al., 2019; Rodrigues et al., 2017). We did not strictly assess these items in our study, but the improved perception of health related QoL and the rating of better physical condition following exercise training would be helpful and aligned with this idea . What does seem to be clear from our data is that having all the material to hand , tailoring the sessions , clear instructions and the consideration shown by the trainer are very important points for the satisfaction and completion of the program in these populations.

The third and final finding of our study was that the persons that begin with the lowest levels are reluctant to make a greater effort, especially in the exercises that demand the biggest exertion, and may even have a lower opinion of the program than those who are fitter, even if they make better progress. It is thus important to emphasise the need to keep the intensity and/or demands high to achieve the highest improvement (Bull et al., 2020). Early interventions make it possible to carry out more intense training for longer periods, which would help to improve performance and/or the changes achieved (Cadore et al., 2014). In any case, the patients were considered to value the program positively and also their assessments

agreed with the (even more positive) opinions of the clinical staff. A balance must also be made between demanding and motivating the participants, which is not at all easy in these populations.

All the improvements obtained in relation to the initial evaluation were in general maintained, in spite of the sessions becoming gradually more autonomous, even after detraining, indicating that the program continued to be effective and maintained the patients' positive physical evolution. Indeed, their improved mental and physical health perception continued to increase after the autonomous period, confirming the impact on their welfare after these multi-component, cognitive and entertaining home training programs, also in MPO-P patients. Besides, both the significance and medium-high effect size indicate the need, capacity and benefits of exercising on independence in everyday activities and their repercussion on the health perception of MPO-Ps. For this reason, due to the high cost of caring for the chronically ill (Krůtilová et al., 2021), including home physical exercise programs coordinated by HHUs could help to reduce these costs and improve the independence of debilitated elderly persons, reducing both medication costs and frequent hospital admissions (Garrett et al., 2011). There thus is a need for early long-lasting interventions, since greater commitment to and control of the patients (Gelaw et al., 2020) combined with early physical training interventions, or at the first indications of pre-fragility or being out of condition, will thus help to optimise the training, obtain greater benefits, encourage adhesion to the practice of physical exercise and thus maintain the improvement acquired.

Limitations

As this was a pilot study, it was carried out on a relatively small patient sample, lacked a control group, and the questionnaires were not previously validated. Apart from their validation, as an important contribution of having experienced this program, it is recommended to enrich future programs on qualitative methods to obtain an in-depth understanding of their benefits for these patients. Also, it is difficult to distinguish between autonomy and detraining. Defective health and physical condition, even after completing one of these programs, makes it difficult to consider that the patients are capable of being responsible for their own exercises, while it appears that a longer-lasting intervention is required in all cases.

Conclusions

A multi-component training program (EFAM-UV©) adapted to the HHU home context improves elderly patients' degree of independence and health-related QoL perception. Even though the improvements start to decline after stopping the supervised sessions, the values still remain above those of the initial evaluation after a month of autonomous training. Both the patients and clinical staff consider that this type of program would be a good strategy against the fragility-dependence binomial in the health system. The negative association of the assessment of the program with the improvement in autonomy could be explained by the greater effort required in the less independent population to carry out physical exercises.

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Mejoras y valoración tras un programa de ejercicio específico para adultos mayores crónicos/paliativos

Improvements and perception following a physical-exercise intervention specific for chronic/palliative older adults

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Resumen

Tras analizar el impacto de un programa de entrenamiento domiciliario multicomponente, con orientación cognitiva, sobre independencia, percepción subjetiva de salud, y fuerza del miembro inferior en un grupo de adultos mayores crónicos multimórbidos y/o paliativos (MCM-Ps), se estudiaron las asociaciones entre las mejoras obtenidas y la valoración del programa de participantes y personal sanitario. 13 MCM-Ps (80.15+4.20 años) completaron cuatro meses de entrenamiento progresando en autonomía (de dos sesiones supervisadas y una autónoma semanalmente -60 min/sesión-, a dos autónomas y una supervisada). Le siguieron cuatro semanas autónomas (desentrenamiento) con recomendación de ejercicio. El volumen y la intensidad se aumentaron introduciendo más ejercicios integrales, con mayor carga neuromuscular y doble tarea, y menor tiempo de descanso entre ellos, sin repetirlos en la sesión (EFAM-UV©). Independencia (Barthel) y salud percibida (SF-36 físico, sin cambios en dominio mental) mejoraron tras el entrenamiento supervisado, con tendencia a la mejora de fuerza (sentarse y levantarse 30-s) y la salud percibida (SF-36total). El efecto permaneció tras la fase autónoma/desentrenamiento, con una percepción final muy favorable de pacientes y personal sanitario-determinada mediante cuestionarios-. La ganancia en independencia correlacionó negativamente con la valoración del usuario, pero esta exigencia aseguró su mejora. No hubo asociación entre salud percibida y valoración del programa.

Palabras clave: Entrenamiento multicomponente, desentrenamiento, percepción de salud, autonomía, fuerza.

Abstract

After analysing the impact of a cognitively oriented multicomponent home-based exercise training program on independence, perceived health status, and lower limb strength, in a group of multimorbid and/or palliative older patients (MPO-Ps), we studied the associations between improvements following training and the participants and health personnel opinion of the program. 13 MPO-Ps, (80.15+4.20 years) completed four months of training progressing in autonomy (from two supervised sessions and one autonomous weekly -60min/session-, to two autonomous and one supervised). It was followed by four autonomous (detraining) weeks with exercise recommendation. Volume and intensity were increased by introducing more global exercises, with greater neuromuscular load and double task, and less resting time between them, no exercise was repeating along the session (EFAM-UV©). Independence (Barthel) and perceived health (physical SF-36, with no changes in the mental domain), were improved after supervised training, with a trend to improve strength (sit and stand 30-s) and perceived health (total SF-36). The effect was maintained after the autonomous detraining phase, with a very favourable final perception of patients and health personnel, determined through questionnaires. The gain in independence correlated negatively with the user's perception, but this requirement ensured the improvement. There was no association between perceived-health and the evaluation of the program.

Keywords: multicomponent training, detraining, health perception, autonomy, strength.

Introducción

La evidencia científica constata que el inmovilismo y la soledad son importantes potenciadores del ciclo de la fragilidad/dependencia (Roppolo et al., 2015). Así, tras un evento adverso, un periodo prolongado de soledad no deseada, o la cronificación de ciertas enfermedades, el riesgo de alcanzar cotas de fragilidad limitantes se dispara (Ong et al., 2016; Pilotto et al., 2020). De forma general no esperamos encontrar niveles altos de fragilidad hasta superados los 80-85 años (Clark, 2019), pero la presencia de uno o varios de estos factores (entre otros, inmovilismo/sedentarismo, soledad, cronicidad, hiper medicación o hiper frecuentación hospitalaria) podría potenciar el declive de la salud y explicar el aumento de personas cada vez más jóvenes en estados de pre-fragilidad y patología. Esta anticipación del ciclo conlleva la entrada en las etapas de edad más avanzadas con un alto grado de fragilidad y dependencia, con el consiguiente aumento de comorbilidad y riesgo de muerte. En el extremo de este continuo encontramos también un aumento de los llamados pacientes paliativos.

En este sentido, en las últimas décadas el ejercicio físico ha confirmado sus mejoras en personas con independencia de su edad, nivel de movilidad y patología (Bull et al., 2020), aumentando también la evidencia que da soporte a los beneficios del ejercicio físico en personas pre-frágiles y frágiles (Kidd et al., 2019; Rebelo-Marques et al., 2018). En concreto, el ejercicio de fuerza a alta intensidad y volumen parece ser más efectivo para las ganancias de fuerza y masa muscular también en personas frágiles (Beckwée et al., 2019). Por otro lado, sesiones en las que se combina trabajo de flexibilidad, aeróbico y fuerza han demostrado mejoras sobre la condición física, rendimiento cognitivo, calidad de vida y funcionalidad en personas mayores frágiles (Langlois et al., 2013; Rezaei-Shahsavarloo et al., 2020). De hecho, cada vez son más reconocidas las intervenciones basadas en un entrenamiento multicomponente (por ejemplo, movilidad, fuerza y equilibrio combinados con entrenamiento cardiovascular y de respiración), dada su capacidad para producir mejoras tanto en la vertiente física como en la mental/cognitiva (Beckwée et al., 2019; Bray et al., 2020; Matos Duarte & Berlanga, 2020; Pardo et al., 2021; Poyatos & Orenes, 2018).

Así pues, el ejercicio físico y los programas de entrenamiento se postulan como medicina para personas frágiles (Nagai et al., 2018), nonagenarios, incluso centenarios (Miller et al., 2020), y otras poblaciones con una salud deficiente o con movilidad reducida (Laddu et al., 2021). Por ello, recientemente se recomienda el entrenamiento físico domiciliario con el objetivo de promocionar o facilitar la práctica de actividad física por parte de estas personas mayores frágiles, incapaces de asistir a un centro específico, institucionalizadas (Thomas et al., 2019) o residentes en entornos urbanísticos con diseños o condicionantes inapropiados para la práctica de actividad física (Annear et al., 2014) . Entre las ventajas destacables de este tipo de programas, encontramos la facilidad para adaptar e individualizar las sesiones, con resultados prometedores sobre la funcionalidad e historial de caídas (Hill et al., 2015; Liu-Ambrose et al., 2019). También encontramos disminución de la ansiedad y el estrés, y mejoras en el estado de ánimo, o la reducción de la disnea y la discapacidad, con la consecuente mejora de la calidad de vida de estos mayores enfermos y frágiles (Loh et al., 2019). Estas sesiones de entrenamiento domiciliario, por lo general, se basan en trabajos con un solo componente u objetivo central (fuerza, equilibrio o aeróbico) (Liu-Ambrose et al., 2019).

En este contexto, por un lado, a pesar de que la evidencia avala el uso de los programas de entrenamiento multicomponente, con una visión más holística en la mejora sobre la funcionalidad y calidad de vida de los adultos mayores, hasta donde sabemos las intervenciones domiciliarias para pacientes crónicos y paliativos no han trabajado desde esta óptica multicomponente; ni incluyendo una orientación cognitiva y jugada, para tratar de mantener la condición física incidiendo conjuntamente sobre mejoras neuromusculares, pero también sobre aspectos como la función ejecutiva y la capacidad cardiovascular, lejos de la perspectiva rehabilitadora. Se plantea además el reto de cómo llevar a la práctica estos programas y tratamientos garantizando la seguridad de los participantes. Por otro lado, la Unidad de Hospitalización a Domicilio (UHD), encargada especialmente de los pacientes crónicos y/o paliativos, se presenta como una unidad medicalizada óptima para incluir y supervisar estos programas multimodales, contribuyendo a solucionar dos de las principales barreras para la práctica de ejercicio físico para estos pacientes: la dificultad de desplazamiento y el miedo a la falta de control (Rodrigues et al., 2017).

Con ello, los programas de entrenamiento domiciliario constituyen una alternativa al binomio fragilidad-dependencia, y la orientación multi-componente con orientación cognitiva y más jugada puede motivar hacia el ejercicio al adulto mayor crónico pluripatológico y/o paliativo. Sin embargo, la literatura al respecto es escasa, y tampoco se conoce la opinión de usuarios y personal sanitario sobre esta estrategia. Además, dado que en los últimos años se ha constatado que informar a los usuarios sobre la mejora de su salud física y mental supone un aliciente para que practiquen ejercicio físico (Hager et al., 2019; Rodrigues et al., 2017), incluir valoraciones tras estos programas puede ayudar a potenciar su efecto y la percepción de su necesidad por parte de ambas partes (usuarios y personal sanitario).

Por todo ello, para aportar resultados que nos permitan aproximarnos con éxito hacia la prescripción de programas de entrenamiento domiciliario para personas muy mayores y frágiles, el presente estudio tiene como objetivos: (1) determinar los efectos de un programa de entrenamiento multicomponente con alta implicación cognitiva sobre la percepción de calidad de vida, estado de independencia y fuerza del miembro inferior en pacientes mayores crónicos y/o paliativos, (2) valorar el grado de satisfacción y percepción de necesidad hacía estos programas de ejercicio físico (por parte de pacientes y personal sanitario) y (3) conocer la relación existente entre esta valoración y las posibles mejoras provocadas por la intervención.

Como principal hipótesis de partida, tanto usuarios como personal sanitario valorará positivamente la estrategia, alcanzando mejoras sobre su salud.

Material y Método

Participantes

Se incluyeron en este estudio piloto 13 pacientes mayores crónicos multimórbidos y/o paliativos (MCM-Ps), ingresados o dados de alta por la Unidad de Hospitalización a Domicilio (UHD) del Hospital General Universitario de Alicante. Tras la aprobación y derivación médica, los pacientes fueron ingresando por goteo en el programa de entrenamiento. Después de informar a pacientes y familiares sobre las características y condiciones del estudio, aquellos/as que decidieron ser incluidos en el programa de entrenamiento firmaron el consentimiento de participación.

Se incluyeron en el estudio todos aquellos pacientes que cumplían con las siguientes características: contaban con la aprobación médica para participar, estaban incluidos en el programa de atención médica de la UHD, eran mayores de 65 años y tenían disponibilidad para su seguimiento a lo largo del todo el programa. Se excluyeron aquellas personas que no aceptaron las condiciones de participación o que estuvieran participando en algún otro programa de entrenamiento físico o de rehabilitación, que no pudieron seguir con el programa por incapacidad cognitiva o por no poder completar el entrenamiento y/o las evaluaciones pautadas.

La participación en el estudio fue totalmente voluntaria, pudiendo retirarse en cualquier momento y sin que ello tuviera repercusiones negativas para el paciente. Este estudio fue aprobado previamente por el Comité de Ética de la Universidad de Valencia (H14014428868708), según la Declaración de Helsinki.

Programa de entrenamiento

La periodización del programa de entrenamiento se hizo siguiendo las directrices de la metodología EFAM-UV© (Blasco-Lafarga et al., 2020; Blasco-Lafarga et al., 2016), adaptándola al contexto hospitalario y a las características individuales de cada uno de los participantes (Blasco-Lafarga et al., 2019; Blasco-Lafarga et al., 2021; Sanchis-Soler et al., 2021). En este estudio se optó por incluir una formación indirecta de los participantes y cuidadores/familiares, con el objetivo de fomentar la autonomía y adherencia a la práctica de ejercicio físico. Para ello se fue aumentando de forma progresiva la autonomía del entrenamiento, combinando sesiones dirigidas (SD) con sesiones autónomas (SA), controladas y pautadas, en ambos casos por el entrenador. Se realizaron tres evaluaciones repartidas a lo largo de los cuatro meses de entrenamiento (Ev_1: previa al programa; Ev_2: tras 36 sesiones, 24 dirigidas y 12 autónomas; Ev_3: tras 12 sesiones, 4 dirigidas y 8 autónomas), seguido de una evaluación tras un mes de autonomía total o desentrenamiento (Ev_4).

De acuerdo con la metodología EFAM-UV© (Blasco-Lafarga et al., 2020; Monteagudo et al., 2020), los cuatro meses de entrenamiento se organizaron en tres mesociclos (M) de entrenamiento: M1-Introductorio o Familiarización, M2-Desarrollo Neuromuscular y Cognitivo y M3-Estabilización Neuromuscular y Mejora de la Plasticidad Motora. Además, se establecieron dos microciclos de transición entre cada uno de los mesociclos para todos aquellos pacientes que necesitaran afianzar los objetivos planteados a alcanzar durante el mesociclo de procedencia.

Las sesiones de entrenamiento llevadas a cabo tuvieron un objetivo general de trabajo neuromotor cognitivo con orientación funcional (figura 1). Para ello se combinaron tareas de educación del paso y control postural -eje central de la sesión-, con habilidades manipulativas y propiamente cognitivas. Las demandas de fuerza y control motor -equilibrio y coordinación- se incrementaron desde el principio y de forma progresiva, dado que se partía de situaciones muy desacondicionadas y de ausencia de técnica. Paralelamente se incrementó la exigencia cardiovascular cuando se observaba cierto dominio en la tarea.

1. Movilidad, amplitud articular y coordinación: selección diaria de ciertos grupos musculares, realizados mediante patrones diferentes para variar la implicación articular y neuromuscular.

2. Fuerza propiamente: aumento de carga con mancuernas y gomas. Priorización del trabajo asimétrico para potenciar la orientación estabilizadora y el trabajo de Core, incluyendo cintura pélvica y escapular como núcleos o centros del movimiento. Número y velocidad de las repeticiones variable en función de la carga y complejidad cognitiva del ejercicio para asegurar técnica y variabilidad en la práctica. Evolución de las posiciones: sedente con apoyo, sedente sin apoyo y pies paralelos, sedente con pies tándem, bipodal; y semi-tándem. (No tienen capacidad para el trabajo tándem o unipodal).

3. Educación del paso con equilibrio y control postural: Cintas, marcas y cuerdas ayudan a integrar educación del paso y control postural con la máxima implicación de reequilibrio y trabajo cognitivo tolerada por los participantes sin perder técnica de desplazamiento. Adaptación al espacio disponible en domicilio.

4. Cardiovascular: Aumento del ritmo y/o tiempo de trabajo para subir la implicación cardiovascular, según posibilidades de cada paciente. Mantener la eficiencia técnica.

5. Doble tarea: Aumento de la complejidad de la tarea motriz uniéndola a actividades de asociación, identificación, memoria o cálculo, entre otras (siempre que la técnica lo permita).

Figura 1. Características y tareas realizadas durante el entrenamiento

Siguiendo las directrices de la metodología EFAM-UV©, basada en la doble tarea y el trabajo unilateral, se aumentó progresiva y continuamente la exigencia de las sesiones mediante el aumento de Volumen, Intensidad y Complejidad. En el primer caso se realizaron de dos a tres repeticiones más antes del cambio de ejercicio, con el objetivo de moverse siempre entre 6-10 repeticiones de cierta exigencia; se incrementó también el número de ejercicios y se redujo el descanso entre ellos para hacer la sesión más densa en cuanto fue posible. En el segundo caso se aumentó la duración de la contracción y/o amplitud articular en el trabajo con mancuernas y elásticos, así como la resistencia en los ejercicios asistidos/resistidos, junto a la complejidad cognitiva-coordinativa de las tareas. Reducir los tiempos de recuperación hizo la sesión más densa y por tanto más intensa, como ya se ha señalado. Tal y como se muestra en la figura 1, la exigencia del control postural se empleó como variable para modificar y/o aumentar la carga neuromuscular de los ejercicios. Las tareas de fuerza se iniciaban en una posición estable sedente, pasando de apoyo bilateral a la posición de semi tándem y tándem -también en sedestación-, para tratar de realizar después el ejercicio en situación dinámica si los usuarios lo permitían. En general, los ejercicios no se repiten en la sesión, sino que se modifican para implicar los grupos musculares seleccionados bajo diferentes patrones.

Además, se establece una progresión de trabajo, periodizada según los tres mesociclos citados, pasando de ejercicios con orientación neuromuscular (grandes grupos musculares; coordinación motora, amplitud articular y equilibrio), a tareas con una mayor implicación cognitiva y de plasticidad motora en la parte final del programa (tomar decisiones, asociar o recordar a la vez que nos movemos, entre otros, para ejercitar la función ejecutiva). En resumen, la metodología EFAM se fundamenta en la variación y progresión en la forma de implicación de los diferentes grupos musculares en situaciones cada vez más complejas -ver Blasco-Lafarga et al. (2021) para más detalles sobre las características y periodización del programa-.

El control de las sesiones se realizó diariamente mediante la monitorización tras cada bloque de ejercicios de la tensión arterial, la saturación de oxígeno, la percepción subjetiva de dolor (escala EVA) y la fatiga (escala de Borg modificada de 0 a 10). Al menos tres registros de cada variable por sesión. En la medida en que estas variables se mantenían estables o dentro de rangos seguros para cada individuo, se producía un aumento de intensidad ajustado a sus características. Ello permitió al entrenador adaptar la sesión diaria y aumentar la carga de forma segura.

Para finalizar, también se tuvieron en cuenta las necesidades de los pacientes, sus hábitos o aficiones (por ejemplo, en juegos de mesa, cartas, pasatiempos, etc.) en las tareas de recuperación, entre las cuales en ocasiones se incluían tareas cognitivas o de psicomotricidad fina. El objetivo final fue mantener la estimulación durante los 60 minutos que duraba la sesión.

Instrumentos

Para conocer las características, así como el estado de salud general de los participantes, se recopiló información sociodemográfica y relativa a la medicación que tomaban. Asimismo, se determinó la saturación de oxígeno (SO_2) mediante un pulsioxímetro WristOx2 (Modelo 3150, Nonin Medical, Inc., Amsterdam, The Netherlands), la tensión arterial mediante un monitor de presión arterial automático (modelo OMRON M3 (IM-HEM-7131-E) Omron Healthcare Co., Ltd. Binh Duong, Vietnam), el índice de glucemia con un medidor de glucosa en sangre (Accu-Chek Aviva. Roche diabetes care Spain, S.L., Sant Cugat del Vallès, Barcelona), la composición corporal con una báscula de bioimpedancia Tanita modelo BC545N (TANITA Corporation, Amsterdam, The Netherlands). Esta evaluación inicial incluía la valoración de la capacidad cognitiva mediante el cuestionario Mini-Mental State Examination (MMSE).

En cuanto a la evaluación pre-post, el grado de independencia para las actividades de la vida diaria se determinó mediante el Índice de Barthel (IB) en su versión española (Cid-Ruzafa & Damián-Moreno, 1997). Esta escala analiza el nivel de dependencia (ayuda y tiempo requerido) en 10 actividades de la vida diaria. La puntuación máxima posible es de 100 puntos y para determinar el índice de calificación en el presente trabajo se han empleado los criterios establecidos por Shah et al. (1989): de 0 a 20 puntos dependencia total, de 21 a 60 dependencia severa, de 61 a 90 dependencia moderada, de 91 a 99 dependencia escasa y 100 independencia total.

La calidad de vida relacionada con la salud se evaluó mediante el cuestionario SF-36. Este cuestionario permite determinar la percepción de bienestar físico, mental y total de la persona evaluada. En este estudio se utilizó la versión 1 adaptada al español por Alonso (1995), con un período recordatorio de 4 semanas. El cuestionario se compone de 36 ítems y permite evaluar la salud y calidad de vida percibida en 8 escalas (Función física, Rol físico, Dolor corporal, Salud general, Vitalidad, Función social, Rol emocional y Salud mental) agrupadas en tres categorías, percepción de salud mental (SF_36m), percepción de salud física (SF-36f) (Zeggwagh et al., 2020) y percepción de salud total (SF-36t). El rango de puntuación posible por escala se encuentra entre 0 y 100 (Vilagut et al., 2005).

Para averiguar la fuerza del miembro inferior, se utilizó el test de levantarse y sentarse durante 30 segundos (30s-CST). Se escogió la modalidad propuesta por Rikli and Jones (1999), ya que la mayoría de los participantes eran incapaces de levantarse más de tres veces de la silla. Por ello, realizar la prueba mediante otras modalidades tales como, la de contabilizar el tiempo requerido para levantarse y sentarse cinco veces, no habrían aportado resultados visibles sobre la evolución de los pacientes.

Por último, se elaboraron y administraron exprofeso cuestionarios para que pacientes y personal sanitario aportaran su opinión y/o valoración respecto a la intervención de ejercicio físico. El cuestionario dirigido a los pacientes permitió conocer su grado de satisfacción y percepción de necesidad del programa de entrenamiento. Este estuvo compuesto por 13 preguntas de respuesta en escala Likert (0 = nunca, 1 = rara vez, 2 = algunas veces, 3 = casi siempre y 4 = siempre). Por otro lado, el personal sanitario otorgó una puntuación al programa del 0 al 10 y completó un cuestionario compuesto por 12 preguntas cerradas, también de respuesta en escala Likert (0 = nunca, 1 = rara vez, 2 = algunas veces, 3 = casi siempre y 4 = siempre) y dos preguntas abiertas. Este cuestionario permitió conocer la opinión del personal sanitario hacia el programa de entrenamiento, así como las opiniones que los pacientes les hicieron llegar con respecto al mismo.

La monitorización de las sesiones fue guiada mediante un pulsioxímetro (WristOx2, Model 3150) y un monitor de presión arterial automático modelo M3 (IM-HEM-7131-E) que se emplearon de forma regular para mantener la seguridad y control de intensidad, así como determinar la progresión a lo largo de la intervención. Este control se apoyó igualmente en la valoración del esfuerzo percibido de (Borg 1-10) y la escala visual analógica del dolor (EVA).

Análisis estadístico

Para el análisis estadístico se utilizó el software Statistical Package for the Social Sciences (SPSS versión 26). Tras comprobar la normalidad de la muestra (Shapiro-Wilk n<30), con el objetivo de conocer los cambios provocados por el entrenamiento, se realizó un análisis de medidas repetidas seguida de la prueba de Bonferroni para (Ev_1-Ev_3), la prueba T para muestras relacionadas (Ev_1-Ev_4) para la percepción de calidad de vida relacionada con la salud, y la prueba de Friedman seguida de Wilcoxon para el nivel de independencia y fuerza del miembro inferior.

Por lo que respecta al cuestionario de valoración por parte de los participantes y personal sanitario, estos se sometieron a un análisis descriptivo o de frecuencias. Por último, para conocer la relación existente entre el cuestionario de valoración y los cambios generados por la intervención ($\Delta_{1\text{-}4}$) sobre el SF-36 y el IB, se realizó una correlación bivariada de Pearson para observar la asociación con el SF-36 y una correlación de Spearman para el IB.

La significación se estableció en $p < .05$, considerando también, debido al tamaño de la muestra, las tendencias $p < .1$ (Rosner, 2015). En todas aquellas variables en las que se obtuvo un cambio significativo o una tendencia a la significación se calculó el tamaño del efecto o d de

Cohen. Los resultados se interpretaron según los rangos establecidos por Fritz et al. (2012) considerando como un tamaño pequeño 0.2, medio 0.5 y grande 0.8.

Resultados

La muestra final de este estudio piloto estuvo compuesta por 13 pacientes con una media de edad de 80.15 años. Tal y como se muestra en la tabla 1, se trata de adultos mayores dependientes (84.62% requiere de cuidador), con desaturación moderada y niveles altos de glucosa en sangre. Por lo que respecta a la composición corporal, los 8 participantes que pudieron ser valorados mediante bioimpedancia, presentaron un IMC elevado y alto porcentaje graso que indica la existencia de sobrepeso.

Al evaluar el efecto del programa de entrenamiento sobre el grado de independencia (tabla 2), se observaron mejoras significativas en todas las evaluaciones con respecto a la inicial, con un tamaño del efecto medio: $Ev_{1\text{-}2}$ (p = .011; d = 0.47); $Ev_{1\text{-}3}$ (p = .022; d = 0.45). Como se observa en esta misma tabla 2, también se observaron mejoras en la percepción de calidad de vida relacionada con la salud para la dimensión física, siguiendo una tendencia a la significación en la total. En concreto, se obtuvieron mejoras en el cuestionario SF-36f en $Ev_{1\text{-}2}$ (p = .031; d = 0.84). Por lo que respecta a la fuerza del miembro inferior, únicamente se alcanzó una tendencia a la significación para la evaluación dos y tres respecto a la inicial: Ev1-2 (p = .058; d = 0.62); Ev1-3 (p = .085; d = 0.53).

Tabla 1. Caracterización de la muestra: media, desviación estándar y coeficiente de variación

Variables	***M±DE***	***CV***
Edad (años)	80.15 ± 4.20	5.24%
Sao_2 (%)	92.31 ± 5.99	6.49%
Glucemia (mg/dl)	156.00 ± 77.77	49.85%
TAS (mmHg)	131.69 ± 13.20	10.02%
TAD (mmHg)	70.77 ± 9.91	14.00%
Peso (kg) (n=9)	70.98 ± 13.77	19.40%
Altura (cm) (n=12)	154.25 ± 13.33	8.64%
BMI (n=8)	30.98 ± 5.08	16.40%
Masa muscular (kg) (n=8)	40.40 ± 8.83	21.86%
Masa grasa (kg) (n=8)	41.49 ± 7.59	18.29%
MMSE (30-0)	24.08 ± 3.77	15.66%
	Frecuencia	**Porcentaje**
Género		
Hombre	6	46.15%
Mujer	7	53.85%
Estudios		
Ninguno	6	46.15%
Alguno	7	53.85%
Cuidador		
Familiar	11	84.62%
Formal	1	7.69%
Sin cuidador	1	7.69%
Capaz de andar		
Sí	9	69.23%
No	4	30.77%

M: media ; *DE*: desviación estándar ; *CV*: coeficiente de variación ; Sao 2: Saturación de oxígeno en sangre; TAS. Tensión arterial sistólica; TAD: Tensión arterial diastólica ; BMI : Índice de masa corporal ; mmHg : milímetros de mercurio ; kg : kilogramos ; cm : centímetro ; MMSE : Mini -Mental State Examination.

En segundo lugar, la evaluación tras un mes post entrenamiento (evaluación de la intervención completa), permitió comprobar que, tras el mes autónomo, las mejoras obtenidas se mantuvieron a pesar del posible desentrenamiento. De hecho, aunque no de forma significativa, los resultados fueron superiores respecto a la evaluación tres en todas las variables excepto para el IB. Al realizar la comparación con respecto al inicio del programa se obtuvieron diferencias significativas en IB (p = .045; d = 0.37), Sf3-6f (p = .003; d = 1.09) y Sf-36t (p = .025; d = 0.72) (tabla 2).

En relación con el grado de satisfacción de los participantes con el programa, se obtuvieron altas puntuaciones (44 de 52 puntos posibles), lo que supone una valoración muy positiva del mismo. Por otro lado, teniendo en cuenta el total de respuestas posibles, para los ítems 1, 2, 8, 11, 12 y 13, relacionados con la satisfacción y la percepción de necesidad de este tipo de programas, el 78.20 % del total de las valoraciones emitidas correspondió a la máxima puntuación (respuesta "*siempre*"). Para los ítems relacionados con los beneficios adquiridos a lo largo del programa (ítems 5, 6, 7, 9 y 10) el 72.30% de las valoraciones emitidas fueron la respuesta "*siempre*" o "*casi siempre*" en la valoración Likert del cuestionario.

Tabla 2. Efectos de la intervención

Fases	Entrenamiento supervisado (Ev_{1-3})				Autonomía (Ev_{1-4})
Sesiones semanales	Ev_1	Ev_2 *2 S+1A*	Ev_3 *1 S+2 A*	p_{1-3}	Ev_4
Barthel	32.69 ± 32.70	**48.08 ± 32.37**[1]	**46.15 ± 27.05**[1]	.026*	44.23 ± 30.13[1]
Sf-36m	36.54 ± 23.30	46.00 ± 26.05	44.38 ± 24.96	.216	44.92 ± 23.82
Sf-36f	20.38 ± 15.44	**34.54 ± 18.08**[1]	33.85 ± 22.32	.024*	39.31 ± 18.99[1]
Sf-36t	29.15 ± 19.09	41.77 ± 21.55	40.31 ± 22.69	.072[†]	43.54 ± 20.72[1]
30s-CST	2.15 ± 3.13	**3.54 ± 3.02**[A]	**3.15 ± 3.29**[A]	.109	3.19 ± 2.96

Ev_1: Evaluación previa al programa; Ev_2: Evaluación tras 36 sesiones de entrenamiento (24 dirigidas y 12 autónomas); Ev_3: Evaluación tras 12 sesiones de entrenamiento (4 dirigidas y 8 autónomas); Ev4: Evaluación final tras 1 mes de autonomía; p_{1-3}: Prueba de Friedman (IB y 30s_CST) y ANOVA (Sf_36). Sf_36m: Sf_36 mental; Sf_36f: Sf_36 físico; Sf_36t: Sf_36 total; 30s_CST: 30 segundos levantarse y sentarse. *significación p<.05; [†] tendencia a la significación p<.1. [1] diferencias significativas respecto a la evaluación inicial (Ev1); Atendencia a la significación respecto a la evaluación inicial (Ev1).

Por último , en relación con los ítems referentes a la adecuación del programa (ítems 3 y 4), el 76.92% de las respuestas emitidas correspondieron de nuevo a la máxima valoración . En la tabla 3 se muestra de forma detallada el porcentaje de puntuación asignado a cada pregunta por los pacientes . En cuanto a la valoración realizada por el personal sanitarios (tabla 4), considerando el total de respuestas emitidas por este colectivo en relación con los ítems 1, 2 y 12 (grado de satisfacción y valoración global sobre el programa y entrenador), el 80% de sus respuestas fueron máximas . En segundo lugar , respecto al bene ficio aportado por el programa a los pacientes (ítems 3, 4, 5 y 6) el 65 % de sus respuestas correspondieron de nuevo a la máxima puntuación y el 25% a una puntuación sub-máxima ("*casi siempre*"). Por último, en relación a la percepción del personal sanitario sobre la valoración y grado de satisfacción del paciente (ítems 7, 8, 9, 10 y 11), el 92 % dieron la máxima puntuación a sus respuestas . En general médicos y enfermeros /as dieron una puntuación media al programa de entrenamiento de 9. 8 puntos sobre 10 . Además , todos /as indicaron la necesidad de incluir este tipo de intervenciones en el servicio de la UHD , aportando diferentes percepciones y comentarios reportados por los pacientes . Entre estos , destaca la percepción de una mejor calidad de vida , reducción de la sobrecarga de los cuidadores o aumento de la esperanza por volver a realizar actividades de la vida cotidiana.

Por último, se evaluó la relación existente entre la valoración del programa y los cambios alcanzados en aquellas variables cuya evolución a lo largo de la intervención había sido significativamente positiva (Δ_{1-4}IB y Δ_{1-4}Sf-36). Como se observa en la tabla 5 la percepción de calidad de vida relacionada con la salud no correlacionó de forma significativa con la valoración del programa. Por otro lado, el cambio en el grado de independencia sí que correlacionó, aunque de forma negativa, con la evaluación hacia el programa.

Discusión

Con el fin de mejorar la prescripción de programas de entrenamiento domiciliario para pacientes mayores crónicos multimórbidos y/o paliativos ingresados o dados de alta por la UHD, en primer lugar, se analizó el efecto de un programa de entrenamiento multicomponente (EFAM-UV©) con orientación cognitiva sobre su grado de independencia, percepción de calidad de vida relacionada con la salud y fuerza del miembro inferior. A continuación, se evaluó la satisfacción y percepción de necesidad por parte de los participantes hacía el programa de ejercicio físico, así como la valoración del personal sanitario sobre la necesidad y beneficios de este. Finalmente se analizó la relación existente entre la valoración de los participantes y las posibles mejoras provocadas por la intervención.

El diagnóstico inicial mostró un grado de dependencia severa por parte de los participantes y bajos niveles de calidad de vida y de fuerza del miembro inferior (Rikli & Jones, 1999; Shah et al., 1989; Vilagut et al., 2005). A pesar de ello, y como primer hallazgo, el programa de entrenamiento permitió mejorar de forma significativa su grado de independencia en todas las etapas y de la percepción de salud en su dimensión física tras la fase de entrenamiento con mayor supervisión, manteniéndose estas mejoras tras el mes de autonomía total. En este periodo se observó también una mejora significativa en la percepción de salud en su dimensión total.

En relación con la fuerza del miembro inferior , los valores medios fueron mayores en todas las evaluaciones respecto a la inicial, aunque solo como tendencia a la signifi cación en la segunda y tercera evaluación . Estos cambios podrían ser una de las causas que provocaron los incrementos de la independencia y percepción de salud relacionada con la calidad de vida . Estudios previos ya demostraron como un entrenamiento domiciliario adecuado puede mejorar el estado físico de personas mayores frágiles o con patologías (Boongird et al., 2017 ; Martel et al ., 2018). Además , y en línea con nuestros resultados, este tipo de intervenciones han demostrado su eficacia sobre la dependencia , funcionalidad , movilidad y calidad de vida de adultos mayores frágiles (Clegg et al., 2012).

Tabla 3. Frecuencias expresadas en porcentaje del cuestionario de satisfacción para pacientes hacia el programa de entrenamiento (n=13)

Pregunta	Nunca	Rara vez	Algunas veces	Casi siempre	Siempre
1. En general estoy satisfecho con el programa de ejercicio realizado			7.7%	7.7%	84.6%
2.Estoy satisfecho con el trato recibido					100%
8.Tenía ganas de realizar las sesiones	7.7%		7.7%	23.1%	61.5%
11.Creo que este tipo de programas son importantes para mejorar mi salud				23.1%	76.9%
12.Recomendaría a otras personas mayores participar en el programa				7.7%	92.3%
13.Creo que estos 4-5 meses son suficientes para haber mejorado mi condición física	15.4%		15.4%	15.4%	53.8%
5.He notado mejoría en mi estado físico		7.7%	23.1%	38.5%	30.8%
6.He mejorado mi estado de ánimo	7.7%	15.4%	15.4%	23.1%	38.5%
7.Me encontraba más despierto o con mayor capacidad mental		7.7%	30.8%	30.8%	30.8%
9.Me encontraba mejor los días que tenía sesión con el entrenador	7.7%		7.7%	30.8%	53.8%
10.En general me he encontrado mejor siempre que he hecho actividad física			15.4%	38.5%	46.2%
3.Los ejercicios se han adaptado a mis posibilidades y mi capacidad	7.7%			38.5%	53.8%
4.Tenía todo el material necesario para hacer mis sesiones, tanto autónomas como dirigidas					100%

Tabla 4. Frecuencias expresadas en porcentaje del cuestionario de satisfacción y valoración para personal sanitario hacia el programa de entrenamiento (n=5)

Pregunta	Nunca	Rara vez	Algunas veces	Casi siempre	Siempre
1.¿En general está satisfecho con el trabajo realizado por el técnico?					100%
2.¿Piensa que el programa cumple con los objetivos planteados?				20%	80%
12.¿Considera que a pesar de su corta duración el programa puede contribuir a disminuir el consumo sanitario?			40%		60%
3.¿Piensa que este tipo de programas son importantes y beneficiosos para los pacientes de la UHD?					100%
4.¿Piensa que este tipo de programas produce beneficios y mejoras a nivel físico en los pacientes?				20%	80%
5.¿Piensa que este tipo de programas produce mejoras a nivel cognitivo en los pacientes?			20%	40%	40%
6.¿Piensa que este tipo de programas produce mejoras a nivel psico-social en los pacientes?			20%	40%	40%
7.Al finalizar el programa ¿Diría que el paciente ha mejorado significativamente?			20%	20%	60%
8.¿Cree que los pacientes están contentos con el trato recibido por parte del técnico?					100%
9.¿Cree que los pacientes están contentos con el programa de ejercicio realizado?					100%
10.En relación con el programa ¿Los pacientes le han hecho comentarios positivos sobre el mismo?					100%
11.En relación con el programa ¿Los pacientes le han hecho comentarios negativos sobre el mismo?	100%				

Por lo que respecta a la salud mental percibida, esta no mejoró de forma significativa, aunque las puntuaciones fueron superiores en todas las evaluaciones respecto a la inicial. Que los cambios alcanzados en esta variable no llegaran a ser significativos podría deberse al mayor requerimiento temporal necesario para lograr adaptaciones a nivel mental y/o cognitivo (Blasco-Lafarga et al., 2020). Junto a ello, el retardo en la aparición de mejoras en la percepción de salud física y total, avalan la importancia de incluir intervenciones supervisadas y duraderas en el tiempo, ya que para que se produzca una influencia visible de las adaptaciones físicas sobre la percepción del estado de salud, se requiere de un mayor periodo temporal (Blasco-Lafarga et al., 2020). Por otro lado, la progresiva reducción de las mejoras durante las fases de semi-supervisión (Ev3) y desentrenamiento (Ev4) en independencia y fuerza, apoyan estas necesidades (supervisión y mayor duración de las intervenciones), ya que el cese del entrenamiento supone en la mayoría de los casos la desaparición de las mejoras alcanzadas (Blasco-Lafarga et al., 2021; Sanchis-Soler et al., 2021). Estas pérdidas durante los periodos de desentrenamiento han sido corroboradas por diferentes trabajos. Vogler et al. (2012), en su estudio con una muestra de adultos mayores frágiles (edad media 79 años) observaron que tras 12 semanas post intervención, desaparecieron las mejoras alcanzadas en el equilibrio y riesgo de caídas durante 12 semanas de entrenamiento domiciliario. De igual modo, Cadore et al. (2014) llevaron a cabo un programa de entrenamiento multicomponente de ocho semanas en pacientes mayores con demencia. Tras un periodo de desentrenamiento (12 y 24 semanas) observaron un empeoramiento del estado físico y cognitivo incluyendo el grado de independencia.

Estos empeoramientos de los resultados tras periodos con menor supervisión y tras desentrenamiento a nivel de autonomía, podrían estar explicados en parte por las dificultades para alcanzar adherencia al ejercicio en estas edades. Factores como la comprensión parcial o incluso el desconocimiento de los beneficios que les ha reportado el programa realizado, el miedo a sufrir caídas al estar solos, y/o la falta de interés o capacidad de esfuerzo a estas edades, se postulan, entre otras, como barreras que impiden la práctica de actividad física regular por parte de los adultos mayores más frágiles (Rodrigues et al., 2017). Esto se añade a otras muchas barreras, como la propia dificultad para incluir este tipo de programas de entrenamiento de forma temprana en el sistema sanitario (Annear et al., 2014; Thomas et al., 2019). Según entendemos, el estudio y determinación de estas barreras podría ayudar a la inclusión de más programas de entrenamiento dentro del ámbito hospitalario, así como de su cumplimiento por parte de los pacientes. Por ello era importante evaluar tanto la percepción de los usuarios como de los médicos que los derivaron.

Como segundo hallazgo, los cuestionarios elaborados permitieron conocer que tanto usuarios como médicos valoraron la intervención de forma muy positiva. En los últimos años diferentes autores han empezado a realizar estudios en esta dirección. Así, Evensen et al. (2017) constataron que el 93 % de los adultos mayores entrevistados presentaban interés por realizar ejercicio durante su estancia en el hospital. Sin embargo, el 27% apuntaron una falta de información respecto a las actividades disponibles durante la hospitalización, y el 33% indicaron desconocer las opciones sobre la actividad física tras el alta hospitalaria. Como ya hemos señalado, el miedo a caer, la falta de interés o transporte, y considerarse

Tabla 5. Correlación bivariada entre el cuestionario de valoración del programa y las mejoras en autonomía y calidad de vida relacionada con la salud percibida

	Satisfacción con el programa	
	p	Correlación
$\Delta_{1\text{-}4}$Barthel	**.039**	-.577*
$\Delta_{1\text{-}4}$Sf-36f	.180	-.396
$\Delta_{1\text{-}4}$Sf-36t	.377	-.267

Pearson para el Sf36 y Spearman para el Índice de Barthel. Ev4: Evaluación final; Δ1-3: delta (cantidad de cambio desde la evaluación inicial a la evaluación 3. Cambio provocado por el entrenamiento); Δ1-4: delta (cantidad de cambio desde la evaluación inicial a la evaluación 4. Cambio provocado por la intervención); Sf-36m: Sf-36 mental; Sf-36f: Sf-36 físico; Sf-36t: Sf-36 total. * Significación $p<.05$.

demasiado mayor para participar en un programa de entrenamiento se postulan como barreras que dificultan o impiden la práctica de actividad física de personas mayores (Rodrigues et al., 2017). Por el contrario, es importante señalar que hacer partícipes a los pacientes en la selección de los ejercicios y tras el entrenamiento, sentir menos dolor y fatiga supone un facilitador para la práctica de actividad física (Hager et al., 2019; Rodrigues et al., 2017). En nuestro estudio no se determinaron estas variables directamente, pero la mejor percepción de salud y valoración de mejor estado físico tras el programa ayudarían en esta línea. Lo que sí parece constatado a tenor de nuestros datos es que tener a su disposición todo el material necesario, la adaptación de las sesiones, recibir indicaciones claras, así como el trato proporcionado por parte del técnico, suponen puntos muy importantes para la satisfacción y desarrollo completo del programa en estas poblaciones.

Por último, como tercer y último hallazgo del estudio, podría suceder que aquellas personas que parten con niveles más bajos perciban de forma negativa el tener que esforzarse más, valorando de forma más negativa las propuestas más intensas, incluso realizando una valoración en general más baja del programa frente a los compañeros más en forma, a pesar de presentar más mejoras. En este sentido es importante remarcar la necesidad de mantener la suficiente intensidad y/o exigencia, relacionadas estas con mejoras más notables (Bull et al., 2020). Por ello, intervenciones tempranas podrían permitir realizar un entrenamiento de mayor intensidad y volumen, que junto con una mayor duración provocarían un incremento del rendimiento y/o cambios alcanzados (Cadore et al., 2014). En cualquier caso, se puede considerar que los pacientes valoraron positivamente el programa y que las valoraciones aportadas por los pacientes coinciden con las del personal sanitario (aún más positivas). También que hay que encontrar el equilibrio entre exigir y motivar, que en estas poblaciones no resulta nada sencillo.

En general que todas las mejoras obtenidas se hayan mantenido respecto a la evaluación inicial a pesar de la progresiva autonomía de las sesiones, incluso tras el desentrenamiento, indica que el programa continuó siendo efectivo y manteniendo una evolución física de los pacientes positiva. De hecho, la mejora en la percepción de su propia salud, tanto física como total siguió aumentando tras el periodo autónomo, confirmando el impacto sobre el bienestar tras estos programas domiciliarios de carácter

multicomponente , cognitivo y lúdico , también en adultos MCM-Ps. Además, tanto la significación como el tamaño del efecto medio -alto hacen visible la necesidad , capacidad y beneficio del ejercicio físico sobre la independencia en las actividades de la vida diaria y su repercusión sobre la percepción de salud de MCM -Ps. Por ello , y ante los altos costes económicos que suponen las enfermedades crónicas (Krůtilová et al., 2021), la inclusión de programas de ejercicio físico domiciliarios coordinados desde la UHD podría contribuir a la reducción de estos costes , al mejorar la independencia de los mayores frágiles y reducir su medicación e hiper frecuentación hospitalaria (Garrett et al ., 2011). Se constata , por tanto , la necesidad de establecer intervenciones tempranas y duraderas en el tiempo, ya que un mayor compromiso y control de los pacientes (Gelaw et al., 2020) así como programas de entrenamiento iniciados en edades más tempranas o ante los primeros indicios de pre -fragilidad o des -acondicionamiento , ayudarían a optimizar el entrenamiento y alcanzar mayores progresos , además de facilitar la adherencia a la práctica de ejercicio físico y con ello el mantenimiento de las mejoras adquiridas .

Limitaciones

Al tratarse de un estudio piloto, presenta una muestra reducida y ausencia de grupo control. Por otro lado, los cuestionarios no han sido previamente validados, por este mismo motivo. Como aportación importante, más allá de su validación, tras haber vivido la experiencia de este programa se aconsejaría apoyarse de metodologías cualitativas para poder conocer en profundidad los beneficios producidos en estos pacientes. Por otro lado, es difícil diferenciar entre autonomía o propiamente desentrenamiento. La salud y baja condición física incluso tras el programa en estos pacientes hace difícil pensar que pudieran autogestionarse o fidelizarse con el ejercicio por si solos, habiendo necesitado en todo caso de una intervención más duradera.

Conclusiones

El programa de entrenamiento multicomponente (EFAM-UV©) adaptado al ámbito domiciliario permite mejorar el grado de independencia y la percepción de calidad de vida relacionada con la salud de adultos mayores ingresados en la UHD. Las mejoras, aunque disminuyen tras la retirada de la supervisión de las sesiones, se mantienen por encima de los valores iniciales tras un mes de entrenamiento autónomo. En cuanto a las opiniones de pacientes y personal sanitario, parece que este tipo de programas podría ser una buena estrategia frente al binomio fragilidad-dependencia en el sistema sanitario. Finalmente, la relación negativa entre la valoración del programa y las mejoras en autonomía podría estar explicada por el mayor esfuerzo que supone para la población menos autónoma enfrentarse al ejercicio.

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ESTADÍSTICAS Y REVISORES

Resumen de Visibilidad, Calidad Editorial y Científica e Impacto de CCD (modificado a partir de la Tabla Resumen de la Memoria Anual de CCD)

Visibilidad
ISI Web of Science, SCOPUS, EBSCO, MIAR, LATINDEX, REDIB, REDALYC, DIALNET, COMPLUDOC, RECOLECTA, ERIHPLUS, CEDUS, REDINET, SPORTDISCUS, PSICODOC, DOAJ, ISOC, IN-RECS, DULCINEA, SCIRUS, WORLDCAT, LILACS, GTBib, RESEARCH GATE, SAFETYLIT, REBIUN, Universal Impact Factor, Index Copernicus, e-Revistas, Cabell's Directory, SJIF, DLP, Fuente Académica Plus, ERA, BVS, PRESCOPUS RUSSIA, JournalTOCs, Viref, Genamics

Calidad
REDALYC: Superada
LATINDEX: (Total Criterios Cumplidos: 33/33)
CNEAI: (Total Criterios Cumplidos: 18/18)
ANECA: (Total Criterios Cumplidos: 22/22)
ANEP: Categoría A
CIRC (2020): Categoría B
Valoración de la difusión internacional (DICE): 14.25
DIALNET: C1 (DEPORTE Y EDUCACIÓN)
MIAR (2020): 9.7
ARCE 2014 (FECYT): Sello de calidad - Actualizado 2020
ERIH PLUS (European Reference Index for Humanities and Social Sciences): Indexada

Redes sociales
Twitter: https://twitter.com/UCAM_CCD

Impacto
ISI Web of Science 2021: 0.15 (JCI). Cuarto cuartil en Hospitality, Leisure, Sport & Tourism.

SCOPUS: 2021: 0.184 (SJR). Índice H: 14. Cuarto cuartil en Health (Social Science), Physical Therapy, Sports Therapy and Rehabilitation y en Sports Science.

Emerging Sources Citation Index (ESCI)

FECYT 2020: Ranking de Calidad de las Revistas Científicas Españolas Segundo cuartil en Ciencias de la Educación (puntuación: 34.23), y Psicología (puntuación: 32.23).

Ranking Iberoamericano de Revistas (REDIB)
2020: primer cuartil en el área temática de Ciencias Sociales y Humanidades, materia Hostelería, Ocio, Deporte y Turismo.

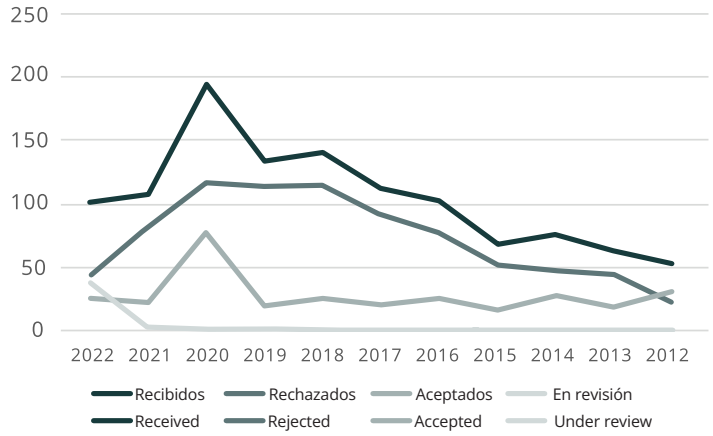
IN-RECS Education (2011): 0.103. Second quartile. Position: 47/162

Índice H (2013-17): 11. Mediana H: 18. Posición 36/96

Scientific Journal Impact Factor (SJIF) 2018: 6.91

Nivel CONICET (Res. 2249/14): Grupo 1

Estadísticas



Lista revisores CCD 54

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Antonio Castillo-Paredes
Antonio Peñalver
Elena Ramírez Rico
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Maria Jose Alvarez Barrio
Maria Mendoza Muñoz
María T. Morales Belando
Marta Borrueco
Mary Z Moya-Sifontes
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NORMAS DE PRESENTACIÓN DE ARTÍCULOS EN CULTURA, CIENCIA Y DEPORTE

La Revista *Cultura, Ciencia y Deporte* considerará para su publicación trabajos de investigación relacionados con las diferentes áreas temáticas y campos de trabajo en Educación Física y Deportes, que estén científicamente fundamentados. Dado el carácter especializado de la revista, no tienen en ella cabida los artículos de simple divulgación, ni los que se limitan a exponer opiniones en vez de conclusiones derivadas de una investigación contrastada. Los trabajos se enviarán telemáticamente a través de nuestra página web: http://ccd.ucam.edu, en la que el autor se deberá registrar como autor y proceder tal como indica la herramienta.

1. TEMPLATE CCD

LA REVISTA CULTURA, CIENCIA Y DEPORTE DISPONE DE UN TEMPLATE/PLANTILLA DE USO OBLIGATORIO PARA EL ENVÍO DE NUEVOS ARTÍCULOS. PUEDE ENCONTRARLO EN EL SIGUIENTE ENLACE: https://docs.google.com/document/d/1jC-GV_xVUqsxpQ2WYkOy9nFiC-Q2w3Vu3/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true
No debe editar el documento en la página web. Debe clicar en "Archivo", darle a la opción "Descargar" y seleccionar "Microsoft Word". Una vez que tenga el Template descargado en su dispositivo podrá editarlo.

Este Template **NO** incluirá las tablas ni las figuras. Estas deben incluirse en un archivo separado titulado "Tablas y Figuras". Puede encontrarlo en el siguiente enlace: https://docs.google.com/document/d/1tHreE-78C9pbLmWWhFYSa-IRyVb5B4HP/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true

2. CONDICIONES

Todos los trabajos recibidos serán examinados por el Editor y por el Comité de Redacción de *Cultura, Ciencia y Deporte*, que decidirán si reúne las características indicadas en el párrafo anterior, para pasar al proceso de revisión por pares a doble ciego, por parte del Comité Asesor. Los artículos rechazados en esta primera valoración serán devueltos al autor indicándole los motivos por los cuales su trabajo no ha sido admitido. Así mismo, los autores de todos aquellos trabajos que, habiendo superado este primer filtro, no presenten los requisitos formales planteados en esta normativa, serán requeridos para subsanar las deficiencias detectadas lo más rápidamente posible. La aceptación del artículo para su publicación en *Cultura, Ciencia y Deporte*, exigirá el juicio positivo de los dos revisores, y en su caso, de un tercero. Durante este proceso, los derechos del artículo serán de la Revista *Cultura, Ciencia y Deporte*, a no ser que el autor/es soliciten que no se continúe con la revisión de su trabajo. La publicación de artículos no da derecho a remuneración alguna. Los derechos de edición son de la revista y es necesario su permiso para cualquier reproducción. El envío de un artículo a *Cultura, Ciencia y Deporte* implica la cesión de derechos a la revista, permitiendo que el artículo pueda ser publicado. En un plazo de cuatro meses se comunicará al autor la decisión de la revisión.

3. ENVÍO DE ARTÍCULOS

3.1 Normativa general

El artículo se enviará a través de la url: http://ccd.ucam.edu/index.php/revista/login. Todo el texto debe escribirse atendiendo a las directrices presentes en **el template de la revista** (https://docs.google.com/document/d/1jCGV_xVUqsxpQ2WYkOy9nFiC-Q2w3Vu3/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true), sin modificar en ningún caso la fuente del texto o el tamaño del mismo. Si su artículo es aceptado para publicación presentará la disposición del template final, por tanto, le rogamos lo revise cuidadosamente antes de proceder a su envío. La extensión máxima recomendada no deberá sobrepasar las 7500 palabras incluyendo Figuras, Tablas y Lista de Referencias.

Cada envío estará compuesto por **CUATRO DOCUMENTOS**. El primero recibirá el nombre de "**artículo anónimo**" en el que se incluirá el título del trabajo, el resumen, las palabras clave, el texto del trabajo y las referencias, **SIN NINGÚN TIPO DE INDICACIÓN QUE PERMITA A LOS REVISORES IDENTIFICAR A LOS AUTORES DEL MANUSCRITO. EL "ARTÍCULO ANÓNIMO" DEBE ADJUNTARSE EN LA PLATAFORMA EN LA OPCIÓN "TEXTO DEL ARTÍCULO"**. El segundo recibirá el nombre de "**artículo con autores**" e incluirá en el manuscrito el nombre de todos los autores que formen parte del trabajo, así como sus afiliaciones, autor de correspondencia, códigos de comités (por ejemplo, comité de ética), proyectos de investigación vinculados, agradecimientos y financiación. **EL "ARTÍCULO CON AUTORES" DEBE ADJUNTARSE EN LA PLATAFORMA EN LA OPCIÓN "OTRO".** El tercer documento recibirá el nombre de "**posibles revisores para el manuscrito**" y debe incluir 5 posibles revisores (nombre, apellidos, institución y email) que no hayan sido coautores de los autores del manuscrito en los últimos tres años y que no pertenezcan a la misma institución. **EL DOCUMENTO DE "POSIBLES REVISORES PARA EL MANUSCRITO" DEBE ADJUNTARSE EN LA PLATAFORMA EN LA OPCIÓN "OTRO".** Y el cuarto documento recibirá el nombre de "**Tablas y Figuras**" y debe incluir todas las tablas y figuras del manuscrito. En el "artículo anónimo" y en el "artículo con autores" debe especificarse claramente el lugar en el que debe insertarse cada Tabla y/o Figura indicando "Tabla x aquí". **EL DOCUMENTO DE "TABLAS Y FIGURAS" DEBE ADJUNTARSE EN LA PLATAFORMA EN LA OPCIÓN "OTRO".**

- En la **primera página** del manuscrito deben ir los siguientes elementos del trabajo (por este orden, presentándose en el orden contrario si el texto del artículo está en inglés). Es importante que no se incluyan los nombres de los autores ni su filiación en el documento titulado "**artículo anónimo**", pero sí deberá hacerse en "**artículo con autores**".

  - **Título** del artículo en español y en inglés (en minúscula ambos, sin punto al final). Se recomiendan 10-12 palabras. Debe ser informativo del contenido y tener fuerza por sí mismo, pues es lo que aparecerá en los índices informativos y llamará la atención de los posibles lectores. Debe procurarse la concisión y evitar un excesivo verbalismo y longitud que no añada información.
  - **Resumen** del trabajo en español y en inglés.

    a. Debe reflejar el contenido y propósito del manuscrito.
    b. Si es la réplica del trabajo de otro autor debe mencionarse.
    c. La longitud del resumen no debe sobrepasar las **200 palabras**.
    d. En estas 200 palabras debe aparecer: el problema, si es posible en una frase; los participantes, especificando las principales variables concernientes a los mismos (número, edad, género, etc.); la metodología empleada (diseño, aparatos, procedimiento de recogida de datos, nombres completos de los test, etc.); resultados (incluyendo niveles estadísticos de significación); y conclusión e implicaciones o aplicaciones. El resumen **no ha de ser estructurado** (no se deben incluir los encabezados "problema", "participantes", etc.) y debe estar escrito en un único párrafo.
  - **Palabras claves** en español e inglés. Las 4 o 5 palabras que reflejen claramente cuál es el contenido específico del trabajo y no estén incluidas en el título (puede utilizar el Tesauro). En cursiva. Sólo la primera palabra se escribirá con mayúscula. Se separarán con comas y al final se incluirá un punto.

- La **segunda página** se iniciará el **texto completo** del artículo. El cuerpo de texto del trabajo deberá empezar en página independiente de la anterior de los resúmenes y con una indicación clara de los apartados o secciones de que consta, así como con una clara jerarquización de los posibles sub- apartados:

  - El primer nivel irá en negrita, sin tabular y minúscula.
  - El segundo irá sin negrita, sin tabular y minúscula.
  - El tercero irá en cursiva, sin tabulación y minúscula.

- Tras el texto completo se debe incluir un apartado de **Referencias**. Las citas y referencias tanto dentro del texto como en el apartado específico deben realizarse en normativa **APA 7ª ed**. A continuación, se presenta un resumen de la misma:

Durante el texto.

- Las citas de trabajos de tres o más autores solo incluyen el apellido del primer autor seguido por "et al.". Ejemplo: Fernández et al. (2019).
- Las citas literales se realizarán en el texto, poniendo tras la cita, entre paréntesis, el apellido del autor, coma, el año del trabajo citado, coma y la página donde se encuentra el texto: (Sánchez, 1995, 143).
- Si se desea hacer una referencia genérica en el texto, es decir, sin concretar página, a los libros o artículos de las referencias, se puede citar de la forma siguiente: paréntesis, apellido del autor, coma y año de edición: (Ferro, 2015). Las referencias citadas en el texto deben aparecer en la lista de referencias.
- Las citas incluidas en el mismo paréntesis deben seguir el orden alfabético.
- Siempre que la cita esté incluida en paréntesis se utilizará la "&". Cuando la cita no está incluida en paréntesis siempre se utilizará la "y". Las citas de dos autores van unidas por "y" o "&", y las citas de varios autores acaban en coma e "y" o "&". Ejemplo: Fernández y Ruiz (2008) o Moreno, Ferro, y Díaz (2007).
- Cuando el mismo autor haya publicado dos o más trabajos el mismo año, deben citarse sus trabajos añadiendo las letras minúsculas a, b, c... a la fecha. Ejemplo: Ferro (1994 a, 1994 b).

Al final del artículo-Lista de referencias.

- Los autores se ordenan por orden alfabético, con independencia del número de los mismos. Cuando son varios, el orden alfabético lo determina, en cada trabajo, el primer autor, después el segundo, luego el tercero y así sucesivamente.
- Es obligado utilizar el DOI (Digital Object Identifier) en las citas bibliográficas de los artículos y publicaciones electrónicas:

  Muñoz, V., Gargallo, P., Juesas, Á., Flández, J., Calatayud, J., & Colado, J. (2019). Influencia de los distintos tipos y parámetros del ejercicio físico sobre la calidad seminal: una revisión sistemática de la literatura. *Cultura, Ciencia y Deporte*, *14(40), 25-42*. http://dx.doi.org/10.12800/ccd.v14i40.1223

- Las citas de varios autores estarán separadas por coma e "&". Algunos ejemplos son los siguientes:

  Autor, A. A., Autor, B. B., & Autor, C. C. (2020). Título del artículo. *Título de la revista, xx*(x), xxx-xxx. http://dx.doi.org/xxxxxx

  Autor, A. A. (2020). *Título del trabajo.* Editorial.

  Autor, A. A., & Autor, B. B. (2020). Título del capítulo. En A. Editor, B. Editor, y C. Editor. (Eds.), *Título del libro* (pp. xxx-xxx). Editorial.

  Autor, A. A., Autor, B. B., & Autor, C. C. (en prensa). Título del artículo. *Título de la revista.*

- Además, para la correcta referenciación habrá que considerar:
  - Aunque haya dos autores, se pone coma antes de la "&".
  - Después de ":" (dos puntos) se empieza con mayúscula.
  - Sólo se escribe en mayúscula la primera letra de la primera palabra del título. Sin embargo, para los títulos de las revistas se pone en mayúscula la primera letra de cada palabra.

– Tras las Referencias, se ha de incluir un apartado de **Agradecimientos.** En el mismo se ha de hacer referencia a cualquier entidad financiadora del estudio de investigación.

3.2. Tipos de artículos que se pueden someter a evaluación en *Cultura, Ciencia y Deporte*

3.2.1. Investigaciones originales

Son artículos que dan cuenta de un estudio empírico original configurados en partes que reflejan los pasos seguidos en la investigación. El texto completo debe tener la siguiente estructura:

3.2.1.1. *Introducción.* Problema del que se parte, estado de la cuestión y enunciado del objetivo e hipótesis de la investigación.

Se debe introducir y fundamentar teóricamente el problema de estudio y describir la estrategia de investigación. En el último párrafo el objetivo del trabajo se debe establecer claramente. Cuando se quiera llamar la atención sobre alguna palabra se usarán las cursivas. El uso de subrayado, negrita y mayúsculas no está permitido. Se evitará también, en lo posible, el uso de abreviaturas. Tampoco se admite el uso de las barras, por ejemplo, y/o, alumnos/as. Habrá que buscar una redacción alternativa. En documento aparte, se presentan las directrices generales de estilo para los informes que utilicen el sistema internacional de unidades.

3.2.1.2. *Método.* Descripción de la metodología empleada en el proceso de la investigación. En esta sección debería detallarse suficientemente todos aquellos aspectos que permitan al lector comprender qué y cómo se ha desarrollado la investigación. La descripción puede ser abreviada cuando las técnicas suficientemente conocidas hayan sido empleadas en el estudio. Debe mostrarse información sobre los participantes describiendo sus características básicas y los controles utilizados para la distribución de los participantes en los posibles grupos. Deben describirse los métodos, aparatos, procedimientos y variables con suficiente detalle para permitir a otros investigadores reproducir los resultados. Si utilizan métodos establecidos por otros autores debe incluirse la referencia a los mismos. No olvidar describir los procedimientos estadísticos utilizados. Si se citan números menores de diez se escribirán en forma de texto, si los números son iguales o mayores de 10 se expresarán numéricamente.

Este apartado suele subdividirse en sub-apartados:

- *Participantes.* Debe describirse la muestra (número de personas, sexo, edad, y otras características pertinentes en cada caso) y el procedimiento de selección. Además, en aquellos estudios realizados con humanos o animales es obligatorio identificar el comité ético que aprobó el estudio. Cuando se describen experimentos que se han realizado con seres humanos, se debe indicar que además del comité ético institucional o regional, el estudio está de acuerdo con la Asociación Médica Mundial y la Declaración de Helsinki. No se deben utilizar nombres, iniciales o números que permitan identificar a los participantes.
- *Instrumentos.* Especificar sus características técnicas y/o cualitativas.
- *Procedimiento.* Resumir cada paso acometido en la investigación: instrucciones a los participantes, formación de grupos, manipulaciones experimentales específicas. Si el trabajo consta de más de un experimento, describa el método y resultados de cada uno de ellos por separado. Numerarlos, Estudio 1, Estudio 2, etc.

3.2.1.3. *Resultados.* Exposición de los resultados obtenidos. Los resultados del estudio deberían ser presentados de la forma más precisa posible. La discusión de los mismos será mínima en este apartado. Los resultados se podrán presentar en el texto, en Tablas o Figuras.

Cuando se expresen los datos estadísticos, las abreviaturas deben ir en cursiva, así como al utilizar el *p*-valor (que irá siempre en minúscula). Por ejemplo: *p, F, gl, SD, SEM, SRD, CCI, ICC*. Es necesario que antes y después del signo igual (=) se incluya un espacio. Se debe incluir un espacio también cuando entre el número y la unidad de medida (7 Kg y no 7Kg), pero no se incluirá dicho espacio entre el número y el signo de porcentaje (7% y no 7 %). Los decimales irán precedidos de puntos (9.1 y no 9,1).

No se incluirán los mismos datos que en el texto, en las tablas o en las figuras. Tanto las Figuras como en las Tablas no deben denominarse de ninguna otra manera. Las Figuras y Tablas serán introducidas donde corresponda en el texto, con su numeración correlativa, poniendo la leyenda de las Figuras en su parte inferior y la leyenda de las Tablas en su parte superior.

Las *Tablas* son un resumen organizado de palabras o cifras

en líneas o renglones. Todas las tablas deben seguir el formato APA, incluyendo: a) su numeración en número arábigos, b) un título, c) líneas solo horizontales sobre el encabezado, debajo del mismo y al fin de la tabla, sin líneas verticales, y d) fondo de tabla blanco. Los decimales dentro de las tablas deben estar separados por **puntos** (.). Se debe incluir en el pie de la tabla todas aquellas abreviaturas o símbolos utilizados en la misma. El tamaño de la fuente en las tablas podrá variar en función de la cantidad de datos que incluya, pudiéndose reducir hasta 8 cpi máximo.

Tabla 1. Ejemplo 1 de tabla para incluir en los artículos enviados a *CCD*.

	P5	POT	STD	SDS	SDI	EQG	SDT	ENF	CA	EH	ES	Esuc	F	MT	ED
MT	9.1	21.	9.1	6.1	92.	63.6	9.0	33.3	3.0	30.	15.	12.	0.0	82.1	35.
ED	33.3	13.3	16.7	6.7	23.0	70.0	16.6	26.7	21.1	63.3	0.0	30	10.0	13.3	96.0

Leyenda: MT=Indicar el significado de las abreviaturas

Tabla 2. Ejemplo 2 de tabla para incluir en los artículos enviados a *CCD.*

Nombre 1	Ítem 1. Explicación de las características del ítem 1 Ítem 2. Explicación de las características del ítem 2 Ítem 3. Explicación de las características del ítem 3
Nombre 2	Ítem 1. Explicación de las características del ítem 1 Ítem 2. Explicación de las características del ítem 2 Ítem 3. Explicación de las características del ítem 3

Las *Figuras* son exposiciones de datos en forma no lineal mediante recursos icónicos de cualquier género. En caso de incluirse fotografías deben ser seleccionadas cuidadosamente, procurando que tengan una calidad de al menos 300 píxeles/pulgada y 8 cm de ancho. Si se reproducen fotografías no se debe poder identificar a los sujetos. En todo caso los autores deben haber obtenido el consentido informado para la realización de dichas imágenes, autorizando su publicación, reproducción y divulgación en *Cultura, Ciencia y Deporte*. Las Figuras deben ser incluidas dentro del texto, incluyendo: a) su numeración en número arábigos, b) un título.

3.2.1.4. *Discusión.* En este apartado se procederá a la interpretación de los resultados y sus implicaciones. Este apartado debe relacionar los resultados del estudio con las referencias y discutir la significación de lo conseguido en los resultados. No debe incluirse una revisión general del problema. Se centrará en los resultados más importantes del estudio y se evitará repetir los resultados mostrados en el apartado anterior. Evitar la polémica, la trivialidad y las comparaciones teóricas superficiales. La especulación es adecuada si aparece como tal, se relaciona estrechamente con la teoría y datos empíricos, y está expresada concisamente. Identificar las implicaciones teóricas y prácticas del estudio. Sugerir mejoras en la investigación o nuevas investigaciones, pero brevemente.

3.2.1.5. *Conclusiones.* Recapitulación de los hallazgos más importantes del trabajo para el futuro de la investigación. Sólo deben relacionarse conclusiones que se apoyen en los resultados y discusión del estudio. Debe comentarse la significación del trabajo, sus limitaciones y ventajas, aplicación de los resultados y trabajo posterior que debería ser desarrollado.

3.2.2. Artículos de revisión

Los artículos de revisión histórica contemplarán los apartados y el formato de las *investigaciones originales*. Las revisiones sobre el estado o nivel de desarrollo científico de una temática concreta deberán ser sistemáticas.

3.2.3. Ensayos

Esta sección de *Cultura, Ciencia y Deporte* admitirá ensayos, correctamente estructurados y suficientemente justificados, fundamentados, argumentamos y con coherencia lógica, sobre temas relacionados con el deporte, que tengan un profundo trasfondo filosófico o antropológico que propicie el avance en la compresión del deporte como fenómeno genuinamente humano. Pretende ser una sección dinámica, actual, que marque la línea editorial y la filosofía del deporte que subyace a la revista. No precisa seguir el esquema de las investigaciones originales, pero sí el mismo formato.

3.3 Información relevante de la revista

La revista Cultura, Ciencia y Deporte se adhiere al "***Code of Conduct and the Best Practices Guidelines for Journals Editors del Committee on Publication Ethics – COPE***" y a las recomendaciones del "***International Committee of Medical Journal Editors - ICJME***". Existe compromiso por parte de la revista para la detección de plagio y otros tipos de fraude en la redacción y presentación de artículos a ***Cultura, Ciencia y Deporte***.

La política editorial de la revista promueve el uso de lenguaje inclusivo en los artículos científicos. Por favor, tenga en cuenta esta directriz y revise su documento antes de remitirlo a la revista.

4 TRATAMIENTO DE DATOS PERSONALES

En virtud de lo establecido en el artículo 17 del Real Decreto 994/1999, por el que se aprueba el Reglamento de Medidas de Seguridad de los Ficheros Automatizados que contengan Datos de Carácter Personal, así como en la Ley Orgánica 15/1999 de Protección de Datos de Carácter Personal, y la Ley Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y garantía de los derechos digitales, la Dirección de *Cultura, Ciencia y Deporte* garantiza el adecuado tratamiento de los datos de carácter personal.

5 INFORMACIÓN RELATIVA A LA CORRECCIÓN DE PRUEBAS / GALERADAS UNA VEZ ACEPTADO EL ARTÍCULO

En caso de aceptación, el autor designado como responsable de correspondencia recibirá un informe de estilo (con aspectos de formato a modificar, en caso de que sea necesario) junto con un documento donde se solicitarán los nombres y apellidos de todos los autores junto a su afiliación (para el encabezado del artículo), la aportación de cada uno de los autores, las redes sociales de los autores y los agradecimientos. Dichos documentos se devolverán completos en un plazo máximo de tres días. Posteriormente, recibirá en su email una prueba de imprenta del artículo en formato PDF. La prueba se revisará y se marcarán los posibles errores con la opción notas de Adobe Acrobat, devolviendo las pruebas corregidas a la redacción de la revista en un plazo máximo de 48 horas. De no recibir estas pruebas en el plazo fijado, el Comité Editorial de la revista podrá decir publicar el artículo en su estado original, no pudiendo hacerse cambios tras su publicación y no haciéndose responsable la revista de cualquier error u omisión que pudiera publicarse; o retrasar su publicación a un número posterior. En esta fase de edición del manuscrito, las correcciones introducidas deben ser mínimas (erratas). El equipo editorial se reserva el derecho de admitir o no las correcciones efectuadas por el autor en la prueba de impresión.

6 INFORMACIÓN SOBRE LA APORTACIÓN DE TODOS LOS FIRMANTES DEL ARTÍCULO

Los autores deberán informar sobre el criterio escogido para decidir el orden de firma y sobre la contribución específica realizada por cada uno de ellos en el trabajo publicado. Esta información se pedirá en la hoja final donde se solicita a los autores sus datos, afiliaciones, aportaciones de los autores, redes sociales y agradecimientos. En la lista de autores firmantes deben figurar únicamente aquellas personas que han contribuido intelectualmente al desarrollo del trabajo. En general, para figurar como autor se deben cumplir los siguientes requisitos: a) haber participado en la concepción y realización del trabajo que ha dado como resultado el artículo en cuestión; b) haber participado en la redacción del texto y en las posibles revisiones del mismo; c) haber aprobado la versión que finalmente va a ser publicada. El equipo editorial de *Cultura,*

Ciencia y Deporte rehúsa cualquier responsabilidad sobre posibles conflictos derivados de la autoría de los trabajos que se publican en la revista.
El autor firmante como autor de correspondencia será el encargado de actuar como mediador entre la revista y los demás autores y debe mantener informados a todos los coautores e involucrarlos en las decisiones importantes sobre la publicación. Posteriormente a la aceptación del artículo no se admitirán cambios en el mismo (salvo erratas), por lo que se recomienda contar con el visto bueno de todos los coautores antes de remitir las revisiones a la revista.

7 REGISTRO DE LA FUENTE DE FINANCIACIÓN DE LOS ARTÍCULOS PUBLICADOS

Los autores deberán declarar si el trabajo ha tenido algún tipo de financiación para realizar la investigación que se pretende publicar, así como los proyectos de investigación o contratos financiados de la que es resultado. Esta información se deberá incluir en los metadatos de la revista a la hora de cargar el artículo en la plataforma. Además, se volverá a pedir esta información en la hoja final donde se solicita a los autores sus datos, filiaciones, aportaciones, redes sociales y agradecimientos.

8 ABONO EN CONCEPTO DE FINANCIACIÓN PARCIAL DE LA PUBLICACIÓN

Las normas de este apartado entran en vigor para los envíos y revisiones realizadas a partir del 29 de octubre de 2019.
De acuerdo con la filosofía de *Open Access* de la revista y con el fin de sufragar parte de los gastos de la publicación en aras de mejorar la calidad de la misma, la visibilidad y la repercusión de la publicación, CCD fija una tarifa de publicación de 120 € (IVA incluido). Este pago deberá hacerse efectivo tras la comunicación de la aceptación del artículo. Para ello tras la aceptación del artículo se debe enviar a gjimenez@ucam.edu el resguardo de la transferencia realizada al nº de cuenta ES02 0081 5089 3800 0109 4420 (CODIGO BIC-SWIFT: BSABESBB), cuyo titular es la "FUNDACIÓN UNIVERSITARIA SAN ANTONIO", indicando en el concepto "Revista CCD + nº del artículo".
Por otra parte, los revisores de artículos CCD tendrán derecho a una publicación sin coste por cada tres artículos que hayan revisado en el tiempo y la forma solicitada por los editores. A tal fin, deben indicar los artículos revisados si quieren beneficiarse de la exención de pago cuando se les solicite el mismo. Los editores están exentos de pago.

9 ACTUALIZACIÓN IMPORTANTE EN LA NORMATIVA DE ENVÍO QUE ENTRARÁ EN VIGOR PARA TODOS LOS ARTÍCULOS ENVIADOS A PARTIR DEL 1 DE ENERO DEL 2021.

Todos los autores que realicen un envío a partir de dicha fecha (en un idioma diferente al inglés), y cuyo artículo finalmente sea aceptado, también deberán remitir la versión definitiva en inglés. En la versión en inglés deberá aparecer el nombre completo del traductor y su email. La intención de este cambio es aumentar la difusión de los artículos publicados en nuestra revista.

10 PROPUESTA DE PUBLICACIÓN DE MONOGRÁFICOS EN *CULTURA, CIENCIA Y DEPORTE.*

Las personas interesadas en proponer la publicación de un monográfico en la *Revista Cultura, Ciencia y Deporte,* deben enviar una descripción de 500-600 palabras (incluidas referencias) a la dirección email de la revista (ccd@ucam.edu). En dicho email, el coordinador o coordinadores del mismo (máximo 3 personas) deben realizar una aproximación a la temática y contenido del monográfico propuesto, así como sus CV.
Una vez aceptada la propuesta de monográfico, se establecerá un período de llamada de artículos *"Call for papers"* y una fecha límite de envíos "*Deadline*" cuya duración será determinada por el coordinador del mismo. El equipo editorial de la *Revista Cultura, Ciencia y Deporte* propondrá la fecha prevista de publicación del monográfico en función de su disponibilidad.
Las funciones del coordinador del monográfico serán, redactar el editorial del mismo, y aportar un listado de posibles revisores que serán seleccionados por el equipo editorial para llevar a cabo las revisiones por pares de los artículos del monográfico. Para que el monográfico sea publicado serán necesarios un mínimo de 10 artículos aceptados. El coordinador del monográfico tendrá la posibilidad de invitar autores para que colaboren con sus manuscritos. La decisión final de aceptación para que un artículo forme parte del monográfico será del equipo editorial, no del coordinador del monográfico.
Todos los manuscritos aceptados para publicación, incluido el editorial, contarán con DOI.

11 PUBLICACIÓN DE ARTÍCULOS EN UN MONOGRÁFICO

Los manuscritos deben presentarse a través de la web *Cultura, Ciencia y Deporte* (https://ccd.ucam.edu), registrándose e iniciando sesión. Durante el proceso de envío, se seleccionará la pestaña con el nombre del monográfico donde se pretende publicar. Se invita a presentar artículos de investigación y de revisión. Los trabajos aceptados se publicarán en la página web de la *Revista Cultura, Ciencia y Deporte*, y contarán con su correspondiente DOI.
Los manuscritos que se presenten no deben haber sido publicados anteriormente, ni estar en consideración para su publicación en otro lugar. Todos los manuscritos se someten a un riguroso proceso de revisión por pares a ciegas. Los manuscritos deben redactarse de acuerdo a las directrices generales de la revista: https://ccd.ucam.edu/index.php/revista/about/submissions#authorGuidelines y siguiendo las directrices del template de la revista (https://docs.google.com/document/d/1Y-jojriyIgd0VUNS9Jk55gPbdf5oEcuN_/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true). El coste de procesamiento de artículos para los autores en números especiales (monográficos) de acceso abierto es de 250 euros por artículo (IVA incluido). El coordinador del monográfico no debe abonar ninguna tasa por la edición del editorial y tendrá un artículo gratuito en dicho monográfico. Los artículos presentados deben tener el formato correcto de acuerdo a las normas de publicación de la revista, de lo contrario no serán aceptados. Los envíos pueden realizarse en idioma español o inglés, siendo necesario en caso de que se hayan enviado en español su traducción al inglés por parte de los autores una vez que el artículo haya sido aceptado.

CHECKLIST FORMATO PARA ARTÍCULOS EN *CCD*

- *Texto*: adaptado al template disponible en la página web y en las normas de publicación de la revista.
- *Alineación del texto:* a izquierda y derecha (justificada).
- *Extensión:* no debe sobrepasar las 7500 palabras incluyendo Figuras, Tablas, y Referencias.
- *Primera página:* debe contener los siguientes elementos del trabajo: título del artículo en español y en inglés en minúscula, un resumen del trabajo en español y en inglés, más las palabras claves en español y en inglés. Por este orden, o el contrario si el artículo está escrito en inglés.
- *Segunda página*: se iniciará con el texto completo del artículo. El cuerpo de texto del trabajo deberá empezar en página independiente de la anterior de los resúmenes.
- Indicación clara de los apartados o secciones de que consta, así como con una clara jerarquización de los posibles sub-apartados (primer nivel irá en negrita y sin tabular, segundo irá en cursiva y sin tabular, tercero irá en cursiva y con una tabulación). Todos ellos en minúscula.
- *Título*: Se recomiendan 10-12 palabras.
- *Resumen:* La longitud no debe sobrepasar las 200 palabras.
- *Palabras clave*: 4 ó 5 palabras que reflejen claramente cuál es el contenido específico del trabajo.
- No repetidas del título.
- *Figuras y Tablas*: introducidas donde corresponda en el texto, con su numeración correlativa.
- *Figuras y Tablas*: leyenda de las Figuras en su parte inferior y la leyenda de las Tablas en su parte superior.
- *Figuras y Tablas*: Mantener las tablas simples sin líneas verticales.
- *Figuras y Tablas*: El tamaño de la fuente en las tablas podrá variar en función de la cantidad de datos que incluya, pudiéndose reducir hasta 8 cpi máximo.
- *Citas y referencias:* Deben seguir formato APA 7th edición.
- *Agradecimientos:* se colocan al final del artículo, tras las referencias.
- *Envío*: se incluyen dos manuscritos, uno con el nombre de "**artículo con autores**" y el otro "**artículo anónimo**".

En Murcia, a 19 de Agosto de 2022
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CULTURA, CIENCIA Y DEPORTE MANUSCRIPTS SUBMISSION GUIDELINESS

Cultura, Ciencia y Deporte will consider research studies related to the different areas of Physical Activity and Sport Sciences, which are scientifically based. Given the specialized nature of the journal, popular articles will not be accepted, nor will those limited to exposing opinions without conclusions based on academic investigation. Papers should be sent electronically through our website: http://ccd.ucam.edu, where the author must register as an author and proceed as indicated by the tool.

1. CCD TEMPLATE

THE JOURNAL CULTURA, CIENCIA Y DEPORTE HAS A TEMPLATE THAT MUST BE USED FOR THE SUBMISSION OF NEW ARTICLES. YOU CAN FIND IT AT THE FOLLOWING LINK: https://docs.google.com/document/d/1jCGV_xVUqsx-pQ2WYkOy9nFiC-Q2w3Vu3/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true

You should not edit the document on the web page. You must click on "Archivo/File", click on "Descargar/Download" and select "Microsoft Word". Once you have the template downloaded to your device you will be able to edit it.

This Template **will NOT** include tables and figures. These should be included in a separate file titled "Tables and Figures". You can find it in the following link: https://docs.google.com/document/d/1tHreE-78C9p-bLmWWhFYSa-IRyVb5B4HP/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true

2. CONDITIONS

All manuscripts received will be examined by the Editorial Board of *Cultura, Ciencia y Deporte*. If the manuscript adequately fulfills the conditions defined by the Editorial Board, it will be sent on for the anonymous peer review process by at least two external reviewers, who are members of the Advisory Committee. The manuscripts rejected in this first evaluation will be returned to the author with an explanation of the motives for which the paper was not admitted. Likewise, the authors of those manuscripts that having passed this first filtering process may be subsequently required to alter any corrections needed in their manuscript as quickly as possible. Acceptance of the article for publication in *Cultura, Ciencia y Deporte*, will require the positive judgment of the two reviewers, and where appropriate, of a third review. Throughout this process, the manuscript will continue to be in possession of the journal, though the author may request that his/her paper be returned if so desired. The publication of articles does not entitle any remuneration. Editing rights belong to the journal and permission is required for any reproduction. The acceptance of an article for publication in the *Cultura, Ciencia y Deporte* implies the author's transfer of copyright to the editor, to allow the paper to be reproduced or published in part or the entire article. Within four months the outcomes from any paper submitted will be communicated to the author.

3 SUBMISSION

3.1 General guideliness

Manuscripts must be submitted via http://ccd.ucam.edu/index.php/revista/login. All text should be written according to the guidelines in the **journal template** (https://docs.google.com/document/d/1YjojriyIgd0VUNS9Jk55gPbdf5oEcuN_/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true), without modifying the font or size of the text. If your article is accepted for publication, it will present the layout of the final template, therefore, please review it carefully before submitting it. The maximum recommended length should not exceed 7500 words including Figures, Tables and Reference List.

Each submission will consist of **FOUR DOCUMENTS**. The first one will be called "**anonymous article**" in which the title of the paper, the abstract, the keywords, the text of the paper and the references will be included, **WITHOUT ANY INDICATION THAT ALLOWS THE REVIEWERS TO IDENTIFY THE AUTHORS OF THE MANUSCRIPT**. **THE "ANONYMOUS ARTICLE" MUST BE ATTACHED ON THE PLATFORM IN THE "ARTICLE TEXT" OPTION**. The second will be called "**article with authors**" and will include in the manuscript the name of all authors who are part of the paper, as well as their affiliations, author of correspondence, committee codes (e.g., ethics committee), linked research projects, acknowledgements and funding. **THE "ARTICLE WITH AUTHORS" MUST BE ATTACHED IN THE PLATFORM UNDER THE "OTHER" OPTION**. The third document will be called "**potential reviewers for the manuscript**" and should include 5 potential reviewers (name, surname, institution and email) who have not been coauthors of the authors of the manuscript in the last three years and who do not belong to the same institution. **THE DOCUMENT OF "POSSIBLE REVIEWERS FOR THE MANUSCRIPT" MUST BE ATTACHED IN THE PLATFORM IN THE "OTHER" OPTION.** And the fourth document will be called "**Tables and Figures**" and should include all the tables and figures of the manuscript. In the "anonymous article" and in the "article with authors" the place where each Table and/or Figure should be inserted must be clearly specified, indicating "Table x here". **THE "TABLES AND FIGURES" DOCUMENT MUST BE ATTACHED IN THE PLATFORM IN THE "OTHER" OPTION.**

- On the **first page** of the article, the following elements should be presented (in this order, or the opposite order if the text of the article is in English). It is important not to include the names of the authors or their affiliation in the document entitled "**anonymous article**", but this should be done in "**article with authors**".
  - **Title** in Spanish and English (both in lowercase, without full stop). 10 – 12 words are recommended. Since it will be shown on the index information, the title should be informative itself and call the attention of potential readers. The title must be concise and avoid being over long.
  - **Abstract** of the work in Spanish and English.
    a. Should reflect the content and purpose of the manuscript.
    b. If the paper is reproducing another author´s work, it should be acknowledged.
    c. The length of the abstract should not exceed **200 words**.
    d. The abstract should include: the problem, if possible in one sentence; participants, identifying the main variables (number, age, gender, etc.); methodology (design, equipment, procedure data collection, full names of tests, etc.); results (including levels of statistical significance); conclusions and implications or applications. The summary should not be unstructured and **should be written in a single paragraph**.
  - **Key words** in Spanish and English**.** 4 or 5 words that reflect the specific content of the work (in italics and not included in the title). Only the first word is written with a capital letter. Words should be separated with commas, and a full stop at the end of a sentence. plus the key words in Spanish and English, in this order, or the opposite if the item is in English. A full stop should not be included at the end of the title.
- On the **second page** of the article, will start the **full text** of the article. Full text of the article should begin on separate page to the abstracts with a clear indication of the paragraphs or sections and with a clear hierarchy of possible sub-paragraphs: .
  - The first level should be in bold, without tabs and lowercase.
  - The second should be without bold, tabs and lowercase.
  - The third should be in italics, without tabs and lowercase.
- After the full text, a **References** section must be included. Citations and references in the text and in the specific section must be made in **APA 7th ed** regulations. Below is a summary of it:

References through the text.

- References of three or more authors only the first author should appear followed by "et al." For example: Fernandez et al. (2019).
- The literal references will be made in the text, after being reference in parentheses, the author's last name, coma, the year of the cited work, coma and page where the text: (Sanchez, 1995, 143).
- If you want to make a generic reference in the text, i.e. without specifying the page of the book or article, it should be cited as follows: the author's name, comma and year of publication in parentheses: (Ferro, 2015).
- References cited in the text should appear in the reference list.
- The references included in the same parentheses should be in alphabetical order.
- Whenever the reference is included in parentheses: the "&" will be used. When the reference is not included in parentheses, "and" should always will be used. The references of two authors are linked by "and" or "&", and references from various authors end up in a coma plus "and" or "&". For example: Fernandez and Ruiz (2008) or Moreno, Ferro, and Diaz (2007).
- When citing two authors with the same name, the initials of the relevant names must precede them.
- When the same author published two or more pieces of work in the same year, their work should add in the lowercase letters a, b, c. For example: Ferro (1994a, 1994b).

At the end of the manuscript – References list

- Authors are listed in alphabetical order, independently of the number. When various authors are listed, the alphabetical order should be determined in each work by the first author, then the second, then the third successively.
- The DOI (Digital Object Identifier) must be used in the bibliographic citations of articles and electronic publications:

  Muñoz, V., Gargallo, P., Juesas, Á., Flández, J., Calatayud, J., & Colado, J. (2019). Influence of the different types and parameters of the physical exercise on seminal quality: a systematic review of the literature. *Cultura, Ciencia y Deporte*, *14(40), 25-42*. http://dx.doi.org/10.12800/ccd.v14i40.1223

- References of various authors will be separated by a comma and "&". Some examples as follows:

  Author, A. A.; Author, B. B., & Author, C. C. (2020). Title. *Journal, xx*(x), xxx-xxx. http://dx.doi.org/xxxxxx

  Author, A. A. (2020). *Title*. Publisher.

  Author, A. A., & Author, B. B. (2020). Title. In A. Editor, B. Editor, & C. Editor. (Eds.),

  Book title (pp. xxx-xxx). Publisher.

  Author, A. A.; Author, B. B., & Author, C. C. (in press). Title. *Journal*

- In addition, for correct referencing:
  - If there are two authors, add a comma before "&".
  - After a ":" (colon) a capital letter should be used.
  - Just type the uppercase for the first letter of the first word of the title for a Book reference. However, titles of journal references are capitalized, using the first letter of each word.

– After the References, a section of **Acknowledgments.** It must be placed in the space set out for this purpose. If is necessary, you can refer to the financing entity of the research study.

3.2 Type of papers that can be submitted for evaluation in CCD

3.2.1 *Original research*

These are articles that account for an empirical study set in original parts that reflect the steps taken in the investigation. The full text must have the following structure:

3.2.1.1. *Introduction.* State the problem of the investigation and the aim and hypothesis of the work. The research problem should be substantiated theoretically, describing the experimental approach to the problem. In the last paragraph, the aim of the work should be established clearly.

Use **italics** to show relevant information. Underline, bold or capital letters are not allowed. The use of abbreviations should be as minimum as possible. See the International System of Units for general style guidelines International System of Units.

3.2.1.1. *Method*. Description of the methodology used in the research process. This section should be detailed enough to allow the reader to understand all aspects regarding what and how the research has been developed. Well known techniques used within the study should be abbreviated. Information about the participants must be displayed to describe their basic characteristics and criteria used for the distribution of participants in any group. The experiment must be reproducible by others and methods, devices, procedures and variables must be detailed. Methods used by other authors should include a reference. All statistical procedures must be described. Numbers lower than ten should be in the form of text, if the numbers are equal to or greater than 10, they should be expressed numerically.

The method is usually divided into subsections:

- *Participants.* The sample´s characteristics (number, sex, age and other relevant characteristics in each case) and selection process. Studies involving humans or animals must cite the ethical committee that approved the study. When describing experiments that have been performed with human beings, it should be noted that in addition to the institutional or regional ethical committee, the study agrees with the World Medical Association and the Helsinki Declaration. No names, initials or numbers should be used to identify the participants.
- *Instruments.* Specify technical characteristics.
- *Procedure.* Summarize each step carried out in the research: instructions to the participants, groups, and specific experimental manipulations. If the study involves more than one experiment, describe the method and results of each of them separately. Numbered, Study 1, Study 2,etc.

3.2.1.3. *Results.* The results must be presented as accurately as possible. The discussion should be minimal and reserved for the Discussion section. The results may be presented as text, tables or figures. To report statistical data, abbreviations should be in italics, as well as when using the *p*-value (which should always be in lowercase). For example: *p, F, gl, SD, SEM, SRD, ICC, ICC*. It is necessary to include a space before and after the equal sign (=). A space must be included also between the number and the unit of measure (not 7Kg but 7 Kg), conversely the space between the number and the percentage sign should not be included (7% and 7% do not). Decimals will be preceded by points (9.1 and not 9,1).

Do not include the same information in the text as used in the tables or figures. The Figures and Tables will be introduced where appropriate in the text, with their correlative numbering, putting the legend of the Figures at the bottom and the legend of the Tables at the top.

Tables are an organized summary of words or figures in lines or lines. All tables must follow the APA format, including: a) their numbering in Arabic numerals, b) a title, c) only horizontal lines above the heading, below it and at the end of the table, without vertical lines, and d) background of white table. Decimals within tables must be separated by dock (.). All abbreviations or symbols used in it should be included at the bottom of the table. The font size in the tables may vary depending on the amount of data that is included, and can be illustrated up to 8 cpi as a maximum.

Table 1. Example Table 1 to include articles sent to *CCD*.

	P5	POT	STD	SDS	SDI	EQG	SDT	ENF	CA	EH	ES	Esuc	F	MT	ED
MT	9.1	21.	9.1	6.1	92.	63.6	9.0	33.3	3.0	30.	15.	12.	0.0	82.1	35.
ED	33.3	13.3	16.7	6.7	23.0	70.0	16.6	26.7	21.1	63.3	0.0	30	10.0	13.3	96.0

Note: P5=Write the meaning of abbreviations.

Table 2. Example Table 2 to include articles sent to *CCD*.

Name 1	Item 1. Explanation of the characteristics of the item 1 Item 2. Explanation of the characteristics of the item 2 Item 3. Explanation of the characteristics of the item 3
Name 2	Item 1. Explanation of the characteristics of the item 1 Item 2. Explanation of the characteristics of the item 2 Item 3. Explanation of the characteristics of the item 3

The Figures are exposures of data in a non-linear way by means of iconic resources of any genre. If photographs are included, they must be carefully selected, ensuring that they have a quality of at least 300 pixels / inch and 8 cm wide. If photographs are reproduced, subjects should not be identified. In any case, the authors must have obtained the informed consent for the realization of these images, authorizing their publication, reproduction and dissemination in CCD. Figures should be included in the text, including: a) their numbering in Arabic numerals, b) a title.

3.2.1.4. *Discussion.* The discussion is an interpretation of the results and their implications. This section should relate the results of the study to theory, and or, previous research with references and discuss the significance of what has been achieved. A general review of the problem must not be included. The discussion will be focused on the most important results of the study and avoid repeating the results shown in the previous paragraph. Avoid controversy, triviality and comparisons theoretical surface. Speculation is appropriate if it appears as such and is closely related to the theory and empirical data. Identify theoretical and practical implications of the study. Suggest improvements in the investigation or further investigation, but briefly.

3.2.1.5. *Conclusions.* Summarize the most important findings of the work for future research. Only conclusions supported by the results of the study and discussion must be presented. The significance of the work, its limitations and advantages, the application of results and future lines of investigation should be presented.

3.2.2. *Review articles.* Historical review articles should use the following the same sections and style from original research. Reviews on the status of an issue should be systematic.

3.2.3. *Essays.* This section of *Cultura, Ciencia y Deporte* will admit essays, properly structured and sufficiently justified, grounded, we argue and with logical coherence, on issues related to sport, that have a deep philosophical or anthropological background that promotes the advance in the compression of sport as a phenomenon genuinely human. It aims to be a dynamic, current section that marks the editorial line and the philosophy of the sport that underlies the journal. You do not need to follow the original research scheme, but the same format.

3.3 Relevant information from the journal

The journal *Cultura, Ciencia y Deporte* adheres to the "Code of Conduct and the Best Practices Guidelines for Journals Editors of the Committee on Publication Ethics - COPE" and the recommendations of the "International Committee of Medical Journal Editors - ICJME". There is a commitment by the journal to detect plagiarism and other types of fraud in the writing and submission of articles to *Cultura, Ciencia y Deporte.*

The journal's editorial policy promotes the use of inclusive language in scientific articles. Please take note of this guideline and review your document before submitting it to the journal.

4 TREATMENT OF PERSONAL DATA

In virtue of what was established in article 17 of the Royal Decree 994/1999, in which the Regulation for Security Measures Pertaining to Automated Files That Contain Personal Data was approved, as well as the Constitutional Law 15/1999 for Personal Data Protection, and Law Organic Law 3/2018, of 5 December, on the Protection of Personal Data and guarantee of digital rights, the editorial committee of *Cultura, Ciencia y Deporte* guarantees adequate treatment of personal data.

5 INFORMATION REGARDING PROOFS AFTER ACCEPTANCE OF THE ARTICLE

In case of acceptance, the author appointed as correspondent will receive a style report (with formatting aspects to be modified, if necessary) together with a document requesting the names and surnames of all authors together with their affiliation (for the head of the article), the contribution of each of the authors, the authors' social networks and acknowledgements. These documents will be returned complete within a maximum of three days. You will then receive a proof of the article in PDF format by email. The proof will be reviewed and any errors marked with the Adobe Acrobat notes option, and the corrected proofs will be returned to the journal's editorial staff within a maximum of 48 hours. If these proofs are not received by the deadline, the journal's Editorial Committee may decide to publish the article in its original state, with no changes made after publication and the journal will not be responsible for any errors or omissions that may be published; or delay publication to a later issue. At this stage of editing the manuscript, corrections made should be kept to a minimum. The editorial team reserves the right to admit or not the corrections made by the author in the proof print.

6 INFORMATION ON THE CONTRIBUTION OF ALL SIGNATORIES TO THE ARTICLE

Authors must inform about the criteria chosen to decide the order of signature and about the specific contribution made by each one of them in the published work. This information will be requested on the final sheet where the authors are asked for their details, affiliations, contributions from the authors, social networks and acknowledgements. Only those persons who have contributed intellectually to the development of the work should appear on the list of signatory authors. In general, in order to appear as an author, the following requirements must be met: a) to have participated in the conception and execution of the work that has resulted in the article in question; b) to have participated in the drafting of the text and possible revisions of the same; c) to have approved the version that is finally going to be published. The editorial team of *Cultura, Ciencia y Deporte* refuses any responsibility for possible conflicts derived from the authorship of the works published in the journal.

The author who signs as a correspondent will be responsible for acting as a mediator between the journal and the other authors and must keep all co-authors informed and involved in important decisions about the publication. After the article has been accepted, no changes will be made to it, and it is therefore recommended that all co-authors give their approval before revisions are sent to the journal.

7 SOURCE OF FUNDING FOR PUBLISHED PAPERS

Authors must declare whether the work has had any funding to carry out the research to be published, as well as the research projects or contracts funded as a result. This information must be included in the journal's metadata when the article is uploaded to the platform. In addition, this information will be requested again in the final page where authors are asked for their data, affiliations, contributions, social networks and acknowledgements.

8 PAYMENT IN CONCEPT OF PARTIAL FINANCING OF PUBLICATION

The rules in this section are effective for submissions and revisions send from 29 October, 2019. In accordance with the Open Access philosophy of the journal and in order to cover part

of the expenses of the publication in to improve its quality, visibility and impact of the publication, CCD sets a publication fee of €120 (VAT included). This payment must be done after the notification of acceptance of the article.

To do this, after acceptance of the article, the receipt of the transfer made to "FUNDACIÓN UNIVERSITARIA SAN ANTONIO" in the account number ES02 0081 5089 3800 0109 4420 (BIC-SWIFT CODE: BSABESBB) must be sent to gjimenez@ucam.edu, indicating in the concept of the transfer "CCD journal + article number".

Furthermore, reviewers of CCD articles will be entitled to a free publication for every three articles they have reviewed in time and in the form requested by the editors. To this end, they must indicate the reviewed articles if they want to benefit from the exemption of payment when requested. Editors are exempt from payment.

9 IMPORTANT UPDATE IN THE SENDING REGULATIONS AS OF JANUARY 1, 2021.

All authors who submit an article after this date (in a language other than English), and whose article is finally accepted, must also submit the final version in English. The full name of the translator and his/her e-mail address must appear on the English version. The intention of this change is to increase the circulation of articles published in our journal.

10 PROPOSAL FOR THE PUBLICATION OF MONOGRAPHS ON *CULTURA, CIENCIA Y DEPORTE*

Those interested in proposing the publication of a monograph in the journal Cultura, Ciencia y Deporte should send a 500-600 word description (including references) to the journal's email address (ccd@ucam.edu). In this email, the coordinator or coordinators (maximum 3 people) must provide an approximation of the subject matter and content of the proposed monograph, as well as their CVs.

Once the monograph proposal has been accepted, a "Call for papers" period and a "Deadline" for submissions will be established, the duration of which will be determined by the coordinator of the monograph. The editorial team of the Journal Cultura, Ciencia y Deporte will propose a date for the publication of the monograph according to its availability.

The functions of the coordinator of the monograph will be to write the editorial of the monograph, and to provide a list of possible reviewers who will be selected by the editorial team to carry out the peer reviews of the articles in the monograph. A minimum of 10 accepted articles will be required for the monograph to be published. The coordinator of the monograph will have the possibility to invite authors to collaborate with their manuscripts. The final decision as to whether an article is accepted for inclusion in the monograph will be made by the editorial team, not by the monograph coordinator. All manuscripts accepted for publication, including the editorial, will have a DOI.

11 PUBLICATION OF ARTICLES IN A MONOGRAPH

Manuscripts must be submitted through the Cultura, Ciencia y Deporte website (https://ccd.ucam.edu), by registering and logging in. During the submission process, select the tab with the name of the monograph where you intend to publish. Research and review articles are invited. Accepted papers will be published on the website of the Journal Cultura, Ciencia y Deporte, and will have their corresponding DOI.

Manuscripts submitted must not have been previously published, nor be under consideration for publication elsewhere. All manuscripts undergo a rigorous blind peer review process. Manuscripts should be written according to the general guidelines of the journal: https://ccd.ucam.edu/index.php/revista/about/submissions#authorGuidelines and following the guidelines of the journal's template(https://docs.google.com/document/d/1YjojriyIgd0VUNS9Jk55gPbdf5oEcuN_/edit?usp=sharing&ouid=109045219128359206476&rtpof=true&sd=true).

The article processing fee for authors in open access special issues (monographs) is 250 euros per article (including VAT). The coordinator of the monograph is not required to pay any editorial editing fee and will have a free article in the monograph. Articles submitted must be in the correct format according to the journal's publication guidelines, otherwise they will not be accepted. Submissions can be made in Spanish or English, and if the article is submitted in Spanish, it must be translated into English by the authors once the article has been accepted.

CHECKLIST FORMAT FOR ARTICLES IN CCD

- Text: adapted to the template available on the website and in the journal's publication guidelines.
- Text alignment: left and right (justified).
- Length: should not exceed 7500 words including figures, tables, and references.
- First page: should contain the following items of the work: title in Spanish and English in lowercase, a summary of the work in Spanish and English, plus the key words in Spanish and English. By this order, or the opposite if the article is written in English.
- Second page: start with the text. The main document should be in a new page (after abstract).
- Clear indication of paragraphs or sections that comprise, and with a clear hierarchy of
- possible sub-sections (first level will be without tabulating in bold type, second will be in italic without tabulating, and the third will be in italics and with tabulation). All in lowercase letter.
- Title: Recommended 10 to 12 words.
- Abstract: The length of the abstracts should not exceed 200 words.
- Keywords: 4 or 5 words that clearly reflect what the specific content of the work. Do not
- repeat the title. Only the first word is written with capital. Words separated with commas, and point at the end.
- Figures and Tables: In the "Tables and Figures" document, with consecutive numbering.
- Figures and Tables: Figures caption in the bottom and Tables caption at the top.
- Figures and Tables: Maintain simple tables without vertical lines.
- Figures and Tables: The font size in the tables may vary depending on the amount of data that includes, and can be cut up to 8 cpi.
- References: They must follow the APA 7th edition format.
- Acknowledgements: They must be placed in the application in the space defined for this purpose.
- Submission: two manuscripts are included, one with the name "**article with authors**" and the other "**anonymous article**"; a "**5 potential reviewers**" document; and a "**Tables and Figures**" document.

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doi.10.12800/ccd

MANUAL DE AYUDA PARA LOS REVISORES EN EL PROCESO DE REVISIÓN DE ARTÍCULOS EN CCD*

Estimado revisor, su labor es inestimable. Le estamos extraordinariamente agradecidos. Sin su aportación rigurosa , la calidad de los trabajos que se publican en CCD, no sería tal. Es por ello por lo que estamos completamente abiertos a tantas recomendaciones y aportaciones que sirvan para mejorar el ya de por sí complejo proceso de revisión. En esta nueva etapa de CCD tenemos una premisa: agilidad, eficiencia y rigor de los procesos de revisión. Por ello le pedimos que, por favor, plantee valoraciones sólidas y las argumente de forma constructiva con un objetivo principal: mejorar la calidad del artículo (siempre que sea posible). Además, le recomendamos que tenga en cuenta las premisas para los revisores que marca la *Declaración de Ética y Negligencia de la Publicación* que puede ver en el pie de página.

A continuación se presenta un manual, en el que los revisores de la revista CCD podrán seguir paso a paso todas y cada una de las tareas que deben acometer para realizar un proceso de revisión riguroso y que se ajuste a las características de la plataforma de revisión (OJS) y de la filosofía de la revista. Cualquier duda que le surja, por favor, no dude en contactar con los editores de la revista (rvaquero@ucam.edu y labenza@ucam.edu). Todas y cada una de las fases se describen a continuación:

1. El revisor recibe el e-mail de CCD con la solicitud de revisión de un artículo. Debe decidir si acepta (o no) la petición del editor de sección. Para ello, debe clicar sobre el título del artículo dentro de "Envíos activos".
2. Una vez hecho esto, aparecerá una pantalla como la siguien- te, en la que el revisor debe seleccionar si hará (o no) la revisión. Si se acepta (o no), aparecerá una ventana automática con una plantilla de correo al editor de sección para comunicarle su decisión. Independientemente de su decisión, el revisor debe enviar este correo electrónico. Una vez la revisión es aceptada el revisor debe cumplir las indicaciones que aparecen en la pantalla siguiente.
3. A continuación debe primero abrir y descargar el fichero del manuscrito; y segundo, abrir y descargar la hoja de evaluación de CCD que puede encontrar en el apartado "Normas de revisor" (parte inferior en el epígrafe 1). La revisión y todos los comentarios que el revisor realice deberán plasmarse en esta hoja de evaluación (nunca en el texto completo a modo de comentarios o utilizando el control de cambios). Con ambos documentos descargados se procederá a la revisión propiamente dicha. Es muy importante que el revisor conozca las normas de publicación de CCD, para proceder de forma exhaustiva. Si bien los editores en fases previas del proceso de revisión han dado visto/bueno al formato del artículo, es importante que se conozcan las normas a nivel general para poder evaluar el artículo con mayor rigurosidad.
4. Una vez completada la revisión y rellenada la hoja de evaluación puede escribir algunos comentarios de revisión para el autor y/o para el editor. El comité editorial de CCD recomienda no introducir comentarios específicos en estos apartados. De utilizarse (pues no es obligatorio) se recomienda que hagan una valoración global del artículo, en la que se utilice un lenguaje formal.
5. A continuación debe subir el fichero con la hoja de evaluación del manuscrito actualizada. En este apartado únicamente se debe subir un archivo con la correspondiente evaluación del artículo. No se olvide de clicar en "Subir" o de lo contrario, a pesar de haber sido seleccionado, no se subirá el archivo, y el editor de sección no podrá acceder a él.
6. Por último, se debe tomar una decisión sobre el manuscrito revisado y enviarla al editor. Para ello debe pulsar el botón de enviar el correo, ya que de no ser así el correo no será enviado. Las diferentes opciones de decisión que la plataforma ofrece son las que puede ver en la pantalla. En el caso de considerar que "se necesitan revisiones" o "reenviar para revisión" llegado el momento, el editor se volverá a poner en contacto con usted y le solicitará empezar con la segunda (o siguientes rondas de revisión), que deberá aceptar y volver a empezar el proceso tal y como se explica en el presente manual. Caso de aceptar o rechazar el manuscrito, el trabajo del revisor habrá terminado cuando informe al editor de sección de esta decisión, tal como se ha indicado anteriormente (correo al editor mediante la plataforma).

En la segunda y siguientes rondas de revisión, el revisor se encontrará con dos archivos: uno con el texto completo del manuscrito, en el que el autor ha modificado con otro color distinto al negro en función de las aportaciones sugeridas; y otro fichero adicional con la planilla de evaluación, en la que el autor ha respondido punto por punto en un color distinto al negro, a todas las aportaciones que usted le hizo. Por favor, compruebe que todo está correctamente modificado. Caso de no producirse, responda en la misma hoja de evaluación con tantos comentarios considere, para que el autor pueda "afinar más" y realizar las modificaciones de forma satisfactoria y rigurosa. Este proceso se repetirá tantas veces como los editores de sección consideren oportuno.

Una vez completada la segunda (o siguientes rondas de revisión) del manuscrito, se volverá a tomar una decisión sobre el mismo, y se procederá de la misma manera que en la primera ronda. Una vez se da por finalizada la revisión doble-ciego del manuscrito, desaparecerá de su perfil de revisor, en el que encontrará 0 activos.

Equipo editorial de Cultura, Ciencia y Deporte.
(ccd@ucam.edu)

RESPONSABILIDADES DE LOS REVISORES

1) Los revisores deben mantener toda la información relativa a los documentos confidenciales y tratarlos como información privilegiada.
2) Las revisiones deben realizarse objetivamente, sin crítica personal del autor.
3) Los revisores deben expresar sus puntos de vista con claridad, con argumentos de apoyo.
4) Los revisores deben identificar el trabajo publicado relevante que no haya sido citado por los autores.
5) Los revisores también deben llamar la atención del Editor-jefe acerca de cualquier similitud sustancial o superposición entre el manuscrito en cuestión y cualquier otro documento publicado de los que tengan conocimiento.
6) Los revisores no deben revisar los manuscritos en los que tienen conflictos de interés que resulte de la competencia, colaboración u otras relaciones o conexiones con alguno de los autores, empresas o instituciones en relación a los manuscritos.

INFO FOR REVIEWERS IN THE REVIEW PROCESS FOR ARTICLES IN CCD*

Dear reviewer, your work is essential. We are remarkably grateful. Without your rigorous contribution, the qua-lity of the papers published in CCD would not be the same. That is why we are completely open to recommendations and contributions that can open the already complex process of revision. In this new stage of CDD we have a premise: agility, efficiency and the exactitude of the revision process. Thus, we please ask you solid ratings, and argue constructively with one main objective: to improve the quality of the article. In addition, we recommend you to consider the premises that denotes the Statement of Ethics and Publication Malpractice that can be ob-served in the footer.

Below a manual is presented, where the CCD journal reviewers are going to be able to follow step by step the process in order to perform a rigorous review process that fits the characteristics of the review platform (OJS) and the philosophy of the journal. Any questions that may raise, please do not hesitate to contact the publishers of the journal (rvaquero@ucam.edu y labenza@ucam. edu). Each and every one of the steps are described here:

1. The reviewer receives the e-mail of CCD with the request for revision of an article. You must decide whether to accept (or not) the request of the "Section Editor". For this, you must click on the title of the article under "Active Submissions".
2. Once this is done, a screen like the following one is going to appear in which the reviewer must select whether will (or not) review the article. If accepted (or not) an automatic window ap-pears with a template email to the Section Editor to communi-cate its decision. Regardless its decision, the reviewer must send this email. Once the revision is accepted, the reviewer should fo-llow the directions that appear on the screen below.
3. The next step is to open and download the file of the ma-nuscript; and second, open and download the evaluation sheet that can be found under the "Reviewer Guidelines" (in the sec-tion 1). The review and any comments that the reviewer makes, should be written in the evaluation sheet (not in the full text as a comment). It is very important that the reviewers knows the CCD publishing standards in order to proceed exhaustively. When the editors accept the format of the article, it is crucial that the re-viewers know the general rules, to assess more rigorously the article.
4. After completing the revision and filled the evaluation sheet, you can write some review comments to the author and/or publisher. The CCD editorial committee recommends not to introduce specific comments on these sections. If it needs to be used (not required) make an overall assessment of the article, using a formal language.
5. The next step consists of uploading the manuscript evalua-tion sheet updated. Here, you only need to upload a file with the corresponding evaluation of the article. Make sure you first click on "select file" and then on "upload".
6. Eventually, a decision on the manuscript must be taken and send it to the Editor. Thus, it is needed to press the button to send the email because if not it will not be sent. The different op-tions that can be chosen appear in the screen below. In the case of considering "revisions required" or "resubmit for review", the editor will get in touch with you and ask you to start with the second round (or further rounds), having to accept and start the same process that has been explained. If the manuscript is accepted or declined, the reviewer´s job will be over, informing the Section Editor by email.

In the second and subsequent rounds of review, the reviewer will find two files: one with the full text of the manuscript in which the author has modified with another colour different to black depending on the contributions suggested, and another additional file with the evaluation form, where the author has responded point by point in a different colour to black all contri-butions that the reviewer made. Please, check that everything is correctly modified. If not, answer the same evaluation sheet with the considered comments, so that the author can "refine" and make the changes in a satisfactory and rigorous way. This process will be repeated as many times as the Section Editors consider appropriate.

Once the second (or subsequent rounds of revision) of the ma-nuscript is completed, a new decision will be made, and proceed in the same way as in the first round. Once ends the double-blind review of the manuscript, it will disappear from your reviewer profile, where you will find none "Active Submissions".

Equipo editorial de Cultura, Ciencia y Deporte.
(ccd@ucam.edu)

RESPONSIBILITIES OF THE REVIEWERS

1) Reviewers should keep all information relating to confidential documents and treat them as privileged.
2) The revisions must be made objectively, without personal criticism of the author.
3) Reviewers should express their views clearly with supporting arguments.
4) Reviewers should identify relevant published work that has not been mentioned by the authors.
5) Reviewers also should draw the attention of Editor-in-chief about any substantial similarity or overlap between the manuscript in question and any other document of which they are aware.
6) Reviewers should not review manuscripts in which they have conflicts of interest resulting from competitive, collaborative, or other relationships or connections with any of the authors, companies, or institutions connected to the manuscripts.

BOLETÍN DE SUSCRIPCIÓN
SERVICIO DE PUBLICACIONES CIENTÍFICAS

CULTURA, CIENCIA Y DEPORTE
REVISTA DE LA FACULTAD DE DEPORTE

SUSCRIPCIÓN ANUAL
(Incluye 4 números en papel: marzo, junio, septiembre y diciembre)

DATOS DE SUSCRIPCIÓN

D./Dª.....DNI/NIF .....
con domicilio en C/ .....C.P.....
Provincia de ..... E-mail .....
Teléfono ..... Móvil .....
Fecha ..... Firmado por D./Dª. .....

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FORMA DE PAGO

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Cuota a pagar (gastos de envío incluidos):

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- ⬭ Profesionales (territorio español) - 27€
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- ⬭ Profesionales (internacional) - 15€
- ⬭ Instituciones Nacionales - 20€
- ⬭ Instituciones Internacionales - 30€

Disposición para el canje:

La Revista CCD está abierta al intercambio de revistas de carácter científico de instituciones, universidades y otros organismos que publiquen de forma regular en el ámbito nacional e internacional. Dirección específica para intercambio: ccd@ucam.edu (indicar en asunto: CANJE).

Disposición para la contratación de publicidad:

La Revista CCD acepta contratación de publicidad prioritariamente de empresas e instituciones deportivas y editoriales.

Para efectuar la suscripción, reclamaciones por no recepción de fascículos, cambios, cancelaciones, renovaciones,
o notificaciones en alguno de los datos de la suscripción, dirigirse a:

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Facultad de Deporte
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