EFFECTS OF A LATIN DANCE COMPETITION ON PHYSICAL AND COGNITIVE PARAMETERS IN ELITE DANCERS

EFECTOS DE UNA COMPETICIÓN DE BAILES LATINOS SOBRE PARÁMETROS FÍSICOS Y COGNITIVOS EN BAILARINES DE ÉLITE

***Cristina Monleón García*[1], *Luis Casanova*[1], *Carlos Sanchis Sanz*[1], *Encarnación Liébana*[1]**

[1] Facultad de Ciencias de la Actividad Física y del Deporte, Universidad Católica de Valencia San Vicente Mártir, España

Correspondence:
Cristina Monleón García, cristina.monleon@ucv.es

Short title:
Effects for a DanceSport Competition

How to cite this article:
Monleón García, C., Casanova, L., Sanchis Sanz, C. & Liébana, E. (2026). Effects of a Latin Dance Competition on Physical and Cognitive Parameters. *Cultura, Ciencia y Deporte, 21*(68), 2410. https://doi.org/10.12800/ccd.v21i68.2410

Received: 22 January 2025 / **Accepted:** 09 September 2025

Abstract

The present study focuses on evaluating fatigue induced by a competition simulation in Latin dances, analyzing heart rate, perceived effort, ankle dorsiflexion and changes in executive vigilance. Twelve high-level athletes were evaluated at three different times: 1) familiarization, 2) competition simulation 3) delayed fatigue analysis. The results obtained indicate significant differences in the following cases: greater CMJ post competition simulation (p = .016), linear increase in heart rate during the development of the dance round (p < .0001), differences between perceived effort and heart rate during the round (p < .001), and significant differences were found in dorsiflexion between both legs (p = .005). Likewise, after the simulation there was a significant decrease in errors committed (p = .028). Therefore, it can be observed that fatigue induced by a competition simulation can influence the performance of athletes, affecting cognitive activity and performance.

Keywords: Athletic performance, attention, fatigue, dance.

Resumen

El presente estudio se centra en evaluar la fatiga inducida por un simulacro de competición en bailes latinos, analizando la frecuencia cardíaca, el esfuerzo percibido, la dorsiflexión del tobillo y los cambios en la vigilancia ejecutiva. Doce deportistas de alto nivel fueron evaluados en tres momentos diferentes: 1) familiarización, 2) simulacro de competición, 3) análisis fatiga retardada. Los resultados obtenidos indican diferencias significativas en los siguientes casos: mayor CMJ post simulacro de competición (p = .016), incremento lineal en la frecuencia cardíaca en el desarrollo de la ronda de baile (p < .0001), diferencias entre el esfuerzo percibido y la frecuencia cardíaca en el transcurso de la ronda (p < .001), y en dorsiflexión se encontraron diferencias significativas entre ambas piernas (p = .005). Asimismo, tras simulacro se produjo un descenso significativo de errores cometidos (p = .028) en la tarea atencional. Por tanto, se puede observar que la fatiga inducida por un simulacro de competición puede influir en el rendimiento de los atletas, afectando a la actividad cognitiva y al rendimiento.

Palabras clave: Rendimiento deportivo, atención, fatiga, baile.

Introduction

Dancesport (competitive ballroom dancing) is a team sport in which couples, composed of one man and one woman, compete (Liu, Yang, et al., 2023). It is an artistic sport featuring different types of music (McCabe et al., 2014) and includes three modalities: Standard (Waltz, Tango, Viennese Waltz, Slow Foxtrot, and Quickstep), Latin (Samba, Cha-cha-cha, Rumba Bolero, Paso Doble, and Jive), and 10 Dance (a combination of Standard and Latin dances) (Kruusamäe et al., 2015; McCabe et al., 2013). Couples compete against each other seeking maximum performance through the beauty of movement (Chae & Koh, 2012; Liu, Yang, et al., 2023).

For competitive performance, couples dance 5 dances per round, each lasting between 1.5 and 2 minutes (Keijsers et al., 2023), with a 20-second pause between dances (FEBD, 2024, p. 36) approximately 10 minutes per round (McCabe et al., 2014), which makes Dancesport an intermittent sport. Couples advance through rounds (with a mandatory rest of at least 20 minutes) (FEBD, 2024, p. 18) until reaching the final, in which only six couples remain (Keijsers et al., 2023).

Several studies have highlighted the high intensity—often above the anaerobic threshold—at which couples compete, reaching submaximal intensities (Liébana et al., 2021) while maintaining proper technique so that their performance appears effortless, elegant, and harmonious (Liu, Wu, et al., 2023).

During Dancesport competitions, several authors have reported high mean heart rates (HR) in Latin dances, with men reaching 183.5 ± 1.5 beats per minute (bpm) and women 182.4 ± 1.5 bpm, indicating a high demand on both aerobic and anaerobic energy systems (Bria et al., 2011; Keijsers et al., 2023), frequently exceeding 180 bpm (McCabe et al., 2014).

Blanskby and Reidy (1988) found sex differences in HR during Latin dances, with men showing lower HR values (168 bpm) than women (177 bpm). In line with this, Liébana et al. (2021) reported high physiological stress influenced by dance type. They noted that cardiovascular demand varies by dance: Samba shows the lowest HR demand, whereas Jive, Cha-cha-cha, and Paso Doble elicit higher responses.

In addition, as an intermittent, high-intensity sport, Dancesport relies on multiple energy pathways, with dancers' aerobic capacity ranging between 37 and 35 ml·kg^{-1}·min^{-1}, depending on sex, dance discipline, and technical skill (Rodrigues-Krause et al., 2015).

Given these characteristics, this sport is performed under fatigued conditions, which may affect athletes' cognitive activity (Brisswalter et al., 2002; Eddy et al., 2015), increase injury risk (Verschueren et al., 2020), and ultimately impact performance during competition (Benítez-Jiménez et al., 2020).

Some studies have examined the relationship between athletes' arousal, attention, and ability to discriminate relevant stimuli, both at rest (Chang et al., 2015; De Sousa et al., 2018; Huertas et al., 2011; Llorens et al., 2015) and during exercise (Cantelon & Giles, 2021; McMorris & Hale, 2015; Sanchis et al., 2020). Sustained attention in Dancesport is of particular interest due to its role in maintaining appropriate environmental information processing, motor control and preparation (Langner & Eickhoff, 2013), and even inter-joint coordination during physical activity (Wang et al., 2021), all of which can directly influence performance and technique throughout competition. Moreover, studies in other intermittent sports, such as cycling or change-of-direction exercises, have reported a decline in response accuracy in sustained attention tasks (Donnan et al., 2020; Moore et al., 2012). Physical fitness level also appears to modulate this response, with trained athletes exhibiting faster recovery of accuracy following short rest periods (Kayvani et al., 2023).

Dancesport athletes are not exempt from injury susceptibility, with a reported lifetime injury prevalence of 80% (Keijsers et al., 2023). Therefore, analyzing injury incidence in the lower limbs is particularly relevant, especially in the foot and ankle, as they are the most affected areas in dance (Keijsers et al., 2023; Schrefl et al., 2023). High injury frequency has also been observed in the knees and lower back (lumbar spine) (Keijsers et al., 2023; McCabe et al., 2014; Pellicciari et al., 2016). Several studies have examined the relationship between reduced ankle dorsiflexion and injuries or dysfunctions in the hip/lumbar region and knees (Fong et al., 2011; Lima et al., 2018; Rao et al., 2023). Together with the use of heeled shoes, this may contribute to a reduction in tendon reactive elasticity and, consequently, Achilles tendon functionality (Zagorc et al., 2010). Additionally, areas such as the hip, groin, ankle joint, forefoot, and toes are more frequently affected in women than in men (Wanke et al., 2020).

The aim of this study was to analyze the effects of fatigue induced by a simulated Latin dance competition (one round) on physiological, physical, and cognitive variables in elite dancers. The specific objectives were: i) to assess heart rate (HR) response during the simulation, hypothesizing that high values indicative of substantial cardiovascular demand would be reached; ii) to analyze the evolution of perceived exertion (RPE) across the different dances, expecting a progressive increase throughout the competition round; iii) to examine the effect of the simulation on ankle dorsiflexion, hypothesizing a reduction due to heeled footwear and neuromuscular fatigue; and iv) to evaluate changes in executive vigilance, anticipating a decrease in reaction time (RT) and an increase in errors committed after the simulation.

Methodology

Study Design

The study followed an analytical, cross-sectional, experimental design.

Participants

Twelve elite dancers in Spain (six men and six women) with right-side dominance (11 right-handed, one left-handed) voluntarily participated in the study. Descriptive data are presented in Table 1. Participants were recruited by contacting dance clubs and schools, as well as regional federations and the Spanish Dancesport Federation.

Table 1

Descriptive Data on the Physical and Training Characteristics of Elite Dancers

	Years competing	Days of training per week	Weight (Kg)	Age (years)	Height (cm)	Hours of training per week	Duration of the training sessions (hours)
M	13.33	4.83	60.75	21	171.38	11	2.75
SD	4.40	0.94	9.41	3.1	8.03	5.75	0.40
Min.	6	3	43	17	157	6	2
Max.	20	6	75.5	28	181	24	3

Note. M: mean values; *SD*: standard deviation; Min: minimum; Max: maximum

Eligibility criteria included having more than one year of competition experience, being actively engaged in competitions, belonging to the Youth or Adult I categories at the highest competitive level (Category A), having sustained no injuries during the month prior to data collection, and refraining from intense physical activity during the 24 hours preceding the measurements. All participants signed informed consent and were assigned to a single experimental group based on the inclusion criteria.

The study was approved by the Ethics Committee of the Catholic University of Valencia San Vicente Mártir (UCV/2018-2019/077) and complies with the principles set out in the 1964 Declaration of Helsinki, updated in its most recent revision in October 2024 in Finland.

Instruments

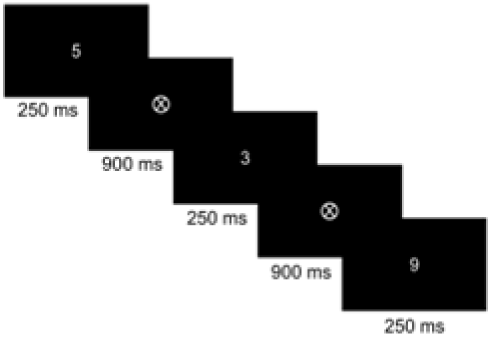
The instruments used to carry out the research were:

- SECA scale and stadiometer.
- App myjump2: validated by Balsalobre-Fernández et al. (2015), used to measure vertical jump height and the reactive strength index in this exercise (Haynes et al., 2019).
- 10-point Rating of Perceived Exertion (RPE) scale (Borg et al., 1987).
- Polar Team 2 System (Polar, United States of America): heart rate receiver and Polar Team Pro System software.
- Sustained Attention to Response Task (SART) (Manly et al., 1999) (Figure 1): This task aims to quantify sustained attention. Numbers (from 1 to 9) are displayed in the center of a computer screen, and participants are required to press a button as quickly as possible for all numbers (Go stimuli) except for the number 3. The numbers are

presented in random order, each appearing for 250 milliseconds followed by a blank screen for 900 milliseconds. The task lasts 4 minutes and 20 seconds. The error score consists of the total number of errors committed, calculated as the sum of commission errors (pressing the key when number 3 is presented) and omission errors (failing to press the key when a response is required). The task was administered using PsychoPy[3] v.3.0.5. The screen was placed in front of the participant at a distance of approximately 70 cm (Fronczek et al., 2006) and the test was conducted in a quiet room with dimmed lights.

Figure 1

SART Task



Note. Taken from Robertson et al. (1997)

- Dorsiflex/My ROM app validated by Balsalobre-Fernández et al. (2019): participants were asked to stand in a lunge position and shift their center of gravity slightly forward (weight support). The participant then placed the device with the screen touching their own tibia, just below the tibial tuberosity, and was asked to try to align the Z-axis of the phone with their tibia. The app starts with a 5-second countdown and the tilt is recorded. The right leg was analyzed first, followed by the left leg.

Procedure

The study was designed to analyze the physical, physiological, and psychological demands arising from a simulated competition. To this end, the study was divided into three sessions, separated by 48 hours (Benítez-Jiménez et al., 2020) to eliminate the transfer of any negative elements.

In the first session, the athletes went to the Physical Activity and Sports Sciences laboratory, where their weight and height were recorded. After this, they performed a general warm-up with 10 minutes of running on a treadmill and a series of dynamic stretches (Benítez-Jiménez et al., 2020; Jiménez-Reyes et al., 2017).

After the warmup, participants familiarized themselves with the CMJ by performing vertical jumps without weight. To do this, they were instructed on the correct way to perform this exercise, while measurements were taken of the length of their legs from the trochanter to the most caudal part of the foot with the leg extended, in order to enter this data into the myjump2 app. The participants stood upright with their hands on their hips and, from this position, bent their knees to a 90º angle, then jumped as high as possible without losing this position. The participants performed three jumps with a two-minute rest between each jump to minimize the effects of fatigue during the familiarization period with the CMJ (Jiménez-Reyes et al., 2017). It should be noted that the athletes performed the CMJ barefoot in both the familiarization session and the data collection session.

During the 30-minute break, to allow for complete recovery (Muriel et al., 2012), the athletes familiarized themselves with the SART task, during which its functioning was explained.

Regarding the second session, data collection was carried out. Athletes first performed the SART task; afterward, ankle dorsiflexion of both legs was measured using the app by Balsalobre-Fernández et al. (2019), recording one measurement per leg. They then completed a warm-up at 40–60% of VO# max, lasting approximately 10 minutes, which included global joint mobility exercises, dynamic stretching, neuromuscular exercises, and core activation (Monleón, 2018).

After this, the pre-competition-simulation CMJ assessment was conducted, consisting of three CMJs with a 10-second rest between jumps (Keir et al., 2013; Oliveira et al., 2018).

After this assessment, athletes had a 4–5 minute rest period (Jiménez-Reyes et al., 2017) before proceeding with the competition simulation, in which the real times used at national and international levels were applied (WDSF, 2024). The competition simulation consisted of performing five Latin dances (Samba, Cha-cha-cha, Rumba Bolero, Paso Doble, and Jive), each lasting 90 seconds, with 20 seconds of rest between dances (FEBD, 2024).

Following this, the post-competition assessment was conducted 30 seconds later and consisted of performing the same measurements as in the pre-simulation phase. After 10 minutes, another assessment was carried out (three CMJs separated by 10 seconds) in order to analyze both the acute and delayed effects of fatigue (Jiménez-Reyes et al., 2017; Pareja-Blanco et al., 2017). Additionally, dancers completed the RPE scale after each dance and at the end of the competition simulation.

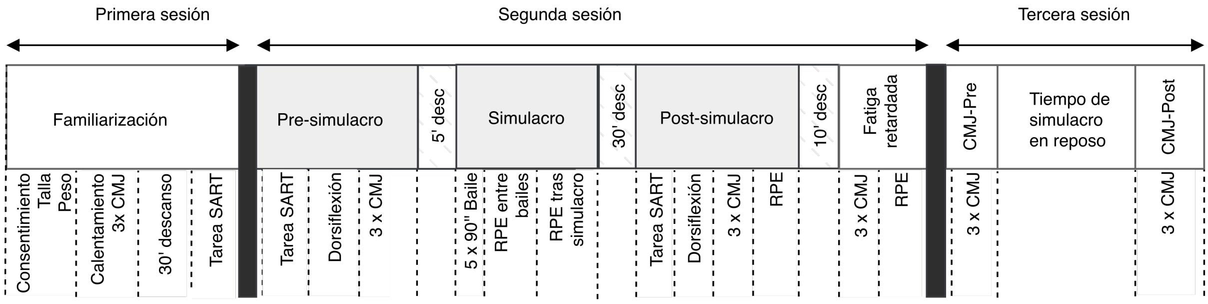
During this simulation, participants were monitored using the Polar Team system, which allowed real-time recording of heart rate for each of the dances performed (Liiv et al., 2014). After the simulation, assessments were conducted under the same conditions as in the pre-simulation phase.

Finally, after a 10-minute rest period, athletes were reassessed to check for the presence of delayed fatigue. During the 10-minute rest between CMJ blocks, participants performed the post-simulation SART task.

The third session was conducted 48 hours later with the aim of analyzing delayed fatigue (Benítez-Jiménez et al., 2020; Fatouros et al., 2010). Three CMJs were performed, separated by 10 seconds, followed by a rest period of identical duration to that of the simulation, after which three additional CMJs were performed using the same methodology. It is important to note that all three sessions (Figure 2) were counterbalanced, and environmental conditions were recorded at the start of each session, with efforts made to maintain similar conditions for all participants (~22 °C and ~60% humidity), as measured with a Geonaute weather station.

Figure 2

Overview of the Assessment Sessions



Statistical Analysis

Study data were collected in Excel (Microsoft, Inc.) and analyzed using the JASP statistical software (v.0.18.3). Five within-subject repeated-measures ANOVAs were conducted so as to test the proposed hypotheses and examine the effects and interactions of the study variables: CMJ (pre/post/10 minutes post-simulation); Simulation (simulation/no-simulation) × CMJ (pre/post/10-min post-simulation); Dance round (Dance 1/Dance 2/Dance 3/Dance 4/Dance 5) × heart rate; Dance round (Dance 1/Dance 2/Dance 3/Dance 4/Dance 5) × RPE; Simulation (simulation/no-simulation) × dorsiflexion × leg (left/right) × gender (male/female).

The relationship between RPE and the other study variables was examined using Pearson's correlation coefficient. The relationship between RPE and the other study variables was examined using Pearson's correlation coefficient. Paired-samples t-tests or Wilcoxon signed-rank tests were used to analyze pre–post changes in reaction time (RT) and error rates from the SART task. Statistical significance and confidence intervals were set at .05 and 95%, respectively.

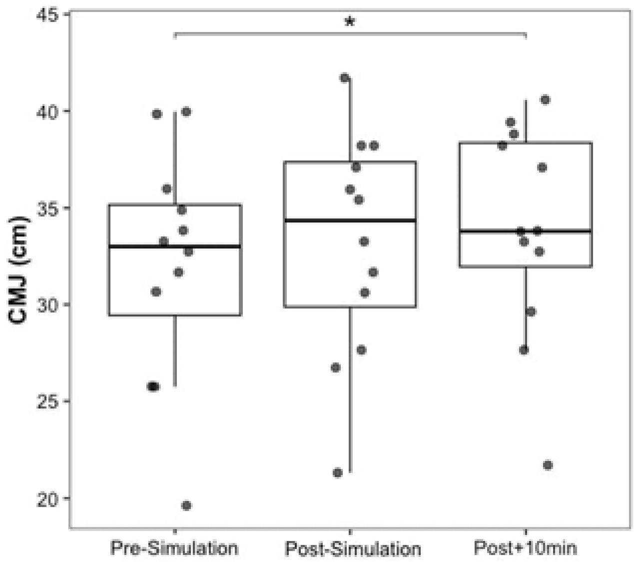
Results

CMJ

First, a repeated-measures ANOVA was conducted to examine the effect of performing a dance competition simulation on three CMJ measurements (pre, post, and 10-min post-simulation), showing a main effect of measurement time, $F(2,22) = 7.561$, $p = .003$, $\eta^2_p = .407$. Contrary to our hypotheses, planned comparisons revealed a linear increase in CMJ performance ($p < .001$), with higher jump height observed in the post-simulation conditions (see Figure 3).

Figure 3

Impact of the Dance Competition Simulation on Pre-, Post-, and Delayed CMJ Performance

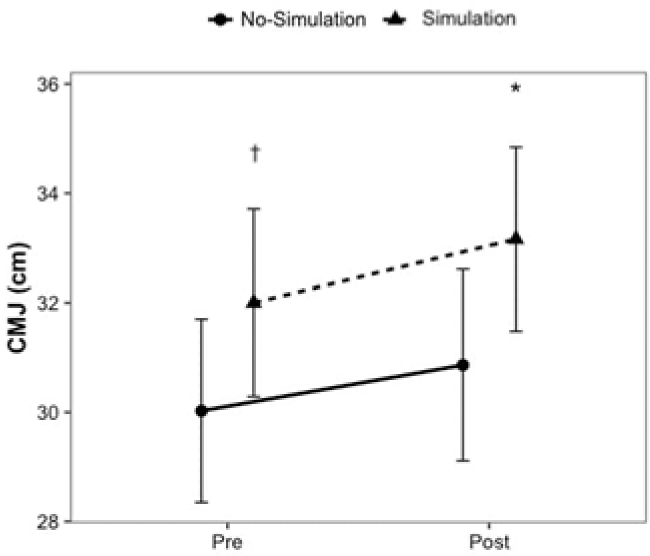


Note. Pre-simulation: measurement taken before the dance simulation; Post-simulation = measurement taken immediately after the dance simulation; Post +10min = measurement taken after 10 minutes of rest, following the dance simulation.

Secondly, a repeated-measures ANOVA was conducted to examine the effect and interaction of measurement time and the presence or absence of the dance simulation on the CMJ variable. The analysis revealed main effects of measurement time [$F(1, 11) = 11.980$, $p = .015$, $\eta^2_p = .430$] and of the dance simulation [$F(1,11) = 14.645$, $p = .003$, $\eta^2_p = .571$] on CMJ. No significant interaction effects were observed between measurement time and the simulation ($F < 1$, $p > .05$). The Bonferroni *post-hoc* analysis showed significant differences between groups, with higher CMJ jump height in the simulation condition compared to the non-simulation condition, both in the PRE ($p = .049$) and POST ($p = .016$) measurements (see Figure 4).

Figure 4

Changes in pre- and Post-CMJ for Simulated and Non-Simulated Dance Conditions



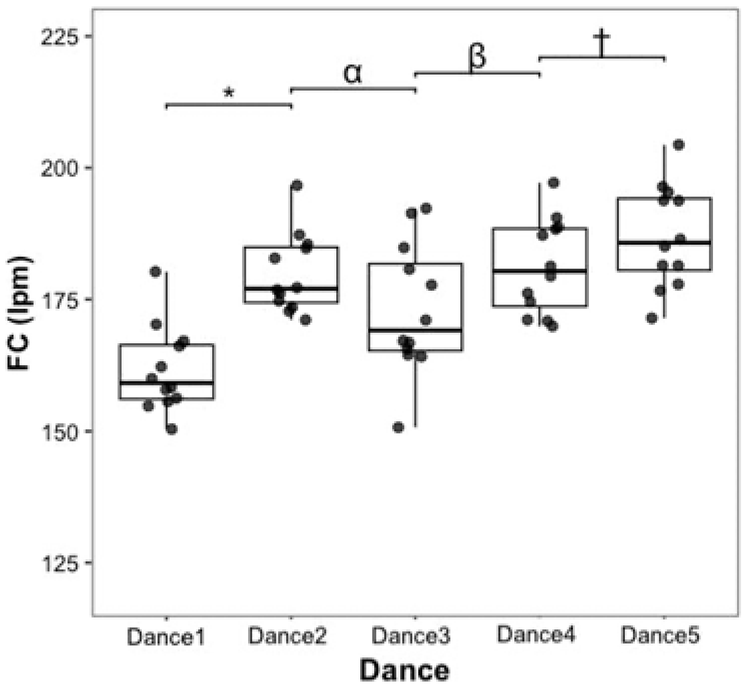
Note. † = Significant differences between PRE measurements (p = .049). * = Significant differences between POST measurements (p = .016).

Cardiac Frequency

The repeated-measures ANOVA showed main effects of the dance variable on HR [$F(4,44) = 49.087$, $p < .001$, $\eta^2_p = .817$]. Planned contrasts based on the study hypotheses confirmed a significant linear increase ($t = 11.879$, $p < .0001$) in HR as the dances progressed. The planned contrasts also show an increase in HR after each dance, with the exception of Dance 3 (see Figure 5), in which a decrease in HR was observed during the dance.

Figure 5

HR Evolution During Dance Sessions



Note. Each line shows the data of one participant. * = $p < .01$ between Dance 1 and Dance 2; a = $p < .01$ between Dance 2 and Dance 3; b = $p < .01$ between Dance 3 and Dance 4; † = $p < .01$ between Dance 4 and Dance 5.

RPE

The repeated-measures ANOVA revealed a main effect of dance round on RPE [$F(4,44) = 12.733$, $p < .001$, $\eta^2_p = .526$], with a significant linear increase ($t = 6.259$, $p < .001$) in RPE across dances.

Pearson's correlation analysis showed a significant positive relationship between RPE during the first dances and pre-simulation RT, such that higher pre-simulation RT was associated with higher RPE during Dance 1 ($r = 0.741$, $p = .009$), Dance 2 ($r = 0.777$, $p = .005$), Dance 3 ($r = 0.831$, $p = .002$) and Dance 5 ($r = 0.634$, $p = .036$).

SART Task

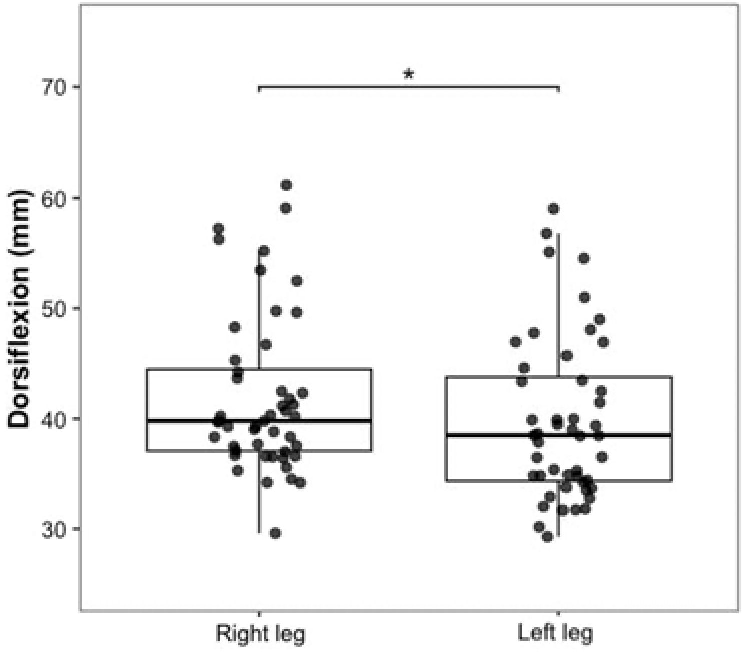
The paired-samples *t*-test did not reveal significant differences in RT ($p > .05$) or lapses ($p > .05$) between the pre- and post-simulation measurements. However, the Wilcoxon signed-rank test showed a significant decrease ($p = .028$) of 1.319% (*SD* ± 0.25) in errors committed post-simulation.

Dorsiflexion

The repeated-measures ANOVA revealed a significant within-subject main effect of the Leg variable [$F(1,11) = 11.989$, $p = .005$, $\eta^2_p = .522$] on dorsiflexion, showing lower dorsiflexion in the left leg (see Figure 6). The between-subject effect of Gender [$F(1,10) = 3.572$, $p = .088$, $\eta^2_p = .263$] on dorsiflexion did not reach statistical significance. No main effects of Measurement Time or Simulation were observed (both, $F < 1$, $p > .05$) on dorsiflexion. A significant interaction was found between Measurement Time and Simulation [$F(1,11) = 8.465$, $p = .014$, $\eta^2_p = .435$], whereas the four-way interaction of Measurement Time × Simulation × Leg × Gender [$F(1,10) = 4.027$, $p = .077$, $\eta^2_p = .287$] was not significant. No interactions were observed for Simulation × Leg, Measurement Time × Leg, or Simulation × Leg × Measurement Time (all $F < 1$, $p > .05$) (see Figure 6). Planned comparisons showed a significant decrease in dorsiflexion ($p = .037$) between the two measurements (PRE,POST), but only in the no-simulation condition (Figure 7). No significant differences were observed between the other conditions ($p > .05$) (Figure 7).

Figure 6

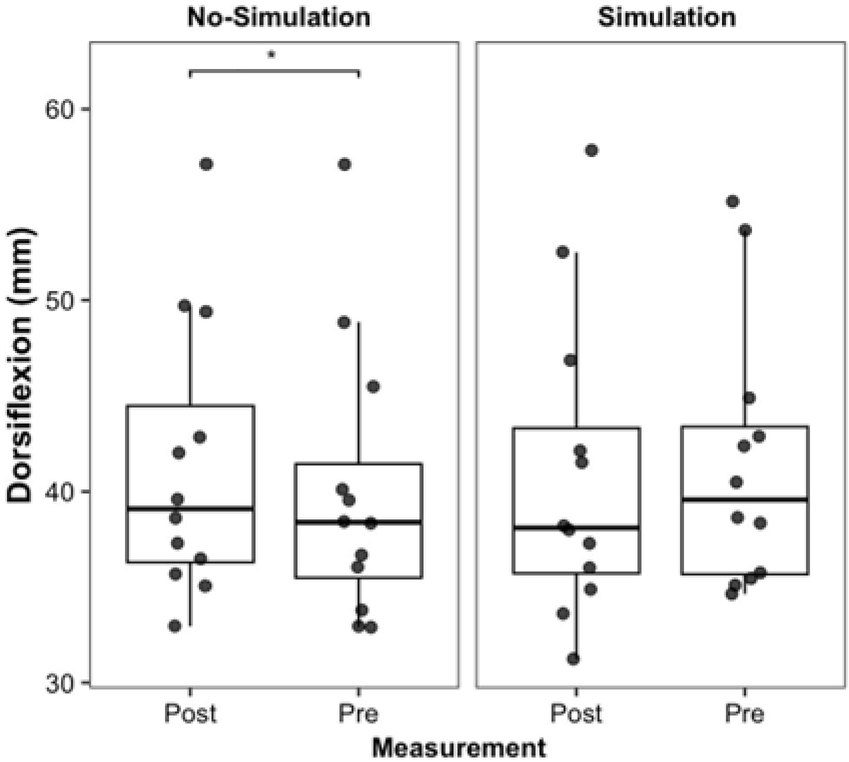
Dorsiflexion Values for Both Legs



Note. * Significant differences between dorsiflexion of the right and left leg ($p = .005$).

Figure 7

Changes in Dorsiflexion According to Measurement Time and Simulation Condition



Note. * Significant differences in dorsiflexion at the Post measurement in the no-simulation condition (*p* = .037).

Discussion

In this study, we aimed to assess fatigue induced by a simulated Latin dance competition within the context of Dancesport. Our main objective was to evaluate the competition-induced fatigue and its consequences on several variables such as HR, RPE, ankle dorsiflexion, and executive vigilance.

The CMJ analysis revealed a linear increase in jump height after the simulated competition. This suggests that the dancers experienced an improvement in their jumping ability. These data are relevant for coaches and athletes, as they may indicate a positive adaptation to the physical stress induced by competition, potentially resulting in an enhanced capacity to generate force. This finding suggests that a proper warm-up prior to a competition round could positively influence subsequent physical performance, as previously reported by San Román-Quintana et al. (2010). Furthermore, these results support the recommendation that, when a competition involves a direct final, a non-scoring preliminary round (technically referred as 'general look') should be included in order to maximize subsequent performance.

The HR data also showed a significant linear increase, indicating that as the competition progressed, a greater cardiovascular demand was generated. However, a decrease in HR was observed during the third dance. This could be attributed to the lower tempo of the Rumba Bolero music (120 bpm), which results in slower movements and, consequently, lower intensity and HR, as noted in previous studies (Terry et al., 2020).

In line with these findings, a significant linear increase in RPE was also observed as the dances progressed. Thus, RPE appears to be a valuable tool for evaluating exercise intensity due to its similarity with HR data. Moreover, a positive relationship was found between RPE and RT, which may indicate greater central fatigue, leading to an increased perception of effort throughout the dances. This implies that elevated HR may negatively impact cognitive function; in other words, longer RTs in cognitive tasks suggest that the brain requires more time for information processing. This may contribute to technical errors and even impair floorcraft (the ability to navigate the dance floor skillfully, avoiding collisions with other couples and mastering the available space). Conversely, it is worth noting that better physical fitness contributes to improved information processing and cognitive function (Luque-Casado, Perakakis, Ciria, et al., 2016; Luque-Casado, Perakakis, Hillman, et al., 2016).

The assessment of ankle dorsiflexion is key to understanding how dance affects dancers' mobility and biomechanics. It has been reported that the use of heeled footwear reduces ankle joint moment, shortens muscle fiber length, and increases co-contraction around the joint (Simonsen, 2014), particularly involving the medial gastrocnemius and tibialis anterior muscles between heel strike and toe-off (Johanson et al., 2010), which may impair contraction velocity (Zagorc et al., 2010). Therefore, the results obtained in the present research are consistent with findings reported by other authors.

Additionally, the within-subject analysis revealed lower dorsiflexion in the left leg, which could be related to the technical demands of Latin dances. In this style, technical patterns require constant weight transfer, resulting in a functional differentiation between the two lower limbs. Typically, the left leg acts as a stabilizing segment, whereas the right leg performs more dynamic and extensive movements. This functional differentiation and specialization may lead to chronic musculoskeletal adaptations, reflected in reduced mobility in the stabilizing leg (left leg). However, choreographic elements specific to each dancer should be considered before establishing a definitive cause. It is also important to highlight that all dancers were right-foot dominant, and thus the right leg may assume a dominant role in terms of mobility. Finally, the use of heeled shoes may accentuate these differences, generating unilateral dorsiflexion restrictions.

The findings from the executive vigilance analysis suggest that psychological factors such as concentration and competition-related anxiety, or physiological and physical variables such as fatigue and adaptation to the competitive environment, may be influencing athletes' performance, reducing the number of errors committed after the simulated competition. Future research could explore these relationships in greater depth in order to develop strategies for improving performance in competitive situations.

Conclusion

The findings obtained in this study contribute to a deeper understanding of fatigue in the context of Dancesport and indicate the need for comprehensive and systematic planning to contribute to conditional improvement, prevent injuries resulting from non-modifiable factors such as the use of high-heeled shoes, as well as improving and maintaining executive vigilance throughout a competition simulation in order to promote the maintenance of technique throughout the course of the competition.

In this regard, coaches and athletes are urged to ensure optimal physical preparation and a good pre-competition warm-up to improve variables related to strength, as well as good neuromuscular and cognitive work in order to reduce technical errors. Finally, coaches are advised to plan and monitor areas susceptible to injury, preventing and reducing the consequences of sports practice.

Ethics Committee Statement

The study was approved by the Ethics Committee of the Catholic University of Valencia San Vicente Mártir (UCV/2018-2019/077) and complies with the principles established in the 1964 Declaration of Helsinki.

Conflict of Interest

The authors and the affiliated institution (Catholic University of Valencia San Vicente Mártir) declare that there are no conflicts of interest regarding this study.

Funding

This research received no external funding.

Acknowledgements

The authors would like to thank the Spanish DanceSport Federation (FEBD), the participating dancers, and their respective dance academies for providing facilities and time to conduct the measurements.

Author Contributions

Conceptualization: Monleón, C., Casanova, L., Sanchis. C & Liébana, E; Methodology: Monleón, C., Sanchis. C & Liébana, E; Software: Monleón, C., & Sanchis. C; Formal Analysis: Sanchis. C; Investigation: Monleón, C., Casanova, L., Sanchis. C & Liébana, E; Writing – Original Draft: Monleón, C., Casanova, L., Sanchis. C & Liébana, E; Writing – Review & Editing: Monleón, C., Sanchis. C & Liébana, E; Supervision: Monleón, C., Sanchis. C & Liébana, E. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

Data are available upon reasonable request from the corresponding author at cristina.monleon@ucv.es

References

Balsalobre-Fernández, C., Glaister, M., & Lockey, R. A. (2015). The validity and reliability of an iPhone app for measuring vertical jump performance. *Journal of Sports Sciences, 33*(15), 1574-1579. https://doi.org/10.1080/02640414.2014.996184

Balsalobre-Fernández, C., Romero-Franco, N., & Jiménez-Reyes, P. (2019). Concurrent validity and reliability of an iPhone app for the measurement of ankle dorsiflexion and inter-limb asymmetries. *Journal of Sports Sciences, 37*(3), 249-253. https://doi.org/10.1080/02640414.2018.1494908

Benítez-Jiménez, A., Falces-Prieto, M., & García-Ramos, A. (2020). Jump performance after different friendly matches played on consecutive days. *Revista Internacional de Medicina y Ciencias de La Actividad Física y Del Deporte, 20*(77), 185. https://doi.org/10.15366/rimcafd2020.77.012

Blanskby, B. A., & Reidy, P. W. (1988). Heart rate and estimated energy expenditure during ballroom dancing. *British Journal of Sports Medicine, 22*(2), 57-60. https://doi.org/10.1136/bjsm.22.2.57

Borg, G., Hassmén, P., & Lagerström, M. (1987). Perceived exertion related to heart rate and blood lactate during arm and leg exercise. *European Journal of Applied Physiology and Occupational Physiology, 56*(6), 679-685. https://doi.org/10.1007/BF00424810

Bria, S., Bianco, M., Galvani, C., Palmieri, V., Zeppilli, P., & Faina, M. (2011). Physiological characteristics of elite sport-dancers. *The Journal of Sports Medicine and Physical Fitness, 51*(2), 194-203. https://www.minervamedica.it/en/journals/sports-med-physical-fitness/article.php?cod=R40Y2011N02A0194

Brisswalter, J., Collardeau, M., & René, A. (2002). Effects of acute physical exercise characteristics on cognitive performance. *Sports Medicine, 32*(9), 555-566. https://doi.org/10.2165/00007256-200232090-00002

Cantelon, J. A., & Giles, G. E. (2021). A review of cognitive changes during acute aerobic exercise. *Frontiers in Psychology, 12*, 653158. https://doi.org/10.3389/fpsyg.2021.653158

Chae, J. S., & Koh, Y. B. (2012). The relationship between perfectionism, partnership, and sport coping in Dancesport players. *Journal of Sport and Leisure Studies, 49*, 387-399.

Chang, Y.-K., Pesce, C., Chiang, Y.-T., Kuo, C.-Y., & Fong, D.-Y. (2015). Antecedent acute cycling exercise affects attention control: An ERP study using attention network test. *Frontiers in Human Neuroscience, 9*, 156. https://doi.org/10.3389/fnhum.2015.00156

De Sousa, A. F. M., Medeiros, A. R., Del Rosso, S., Stults-Kolehmainen, M., & Boullosa, D. A. (2018). The influence of exercise and physical fitness status on attention: A systematic review. *International Review of Sport and Exercise Psychology, 12*(1), 202-234. https://doi.org/10.1080/1750984X.2018.1455889

Donnan, K., Williams, E., & Stanger, N. (2020). The Effects of Heat Exposure During Intermittent exercise on physical and cognitive performance among team sport athletes. *Perceptual and Motor Skills, 128*, 439 - 466. https://doi.org/10.1177/0031512520966522

Eddy, M. D., Hasselquist, L., Giles, G., Hayes, J. F., Howe, J., Rourke, J., Coyne, M., O'Donovan, M., Batty, J., Brunyé, T. T., & Mahoney, C. R. (2015). The Effects of load carriage and physical fatigue on cognitive performance. *PloS One, 10*(7), e0130817. https://doi.org/10.1371/journal.pone.0130817

Fatouros, I. G., Chatzinikolaou, A., Douroudos, I. I., Nikolaidis, M. G., Kyparos, A., Margonis, K., Michailidis, Y., Vantarakis, A., Taxildaris, K., Katrabasas, I., Mandalidis, D., Kouretas, D., & Jamurtas, A. Z. (2010). Time-course of changes in oxidative stress and antioxidant status responses following a soccer game. *Journal of Strength and Conditioning Research, 24*(12), 3278-3286. https://doi.org/10.1519/jsc.0b013e3181b60444

FEBD (2024). *Código básico de competición de las especialidades Standard y Latino y anexos obligatorios (Versión 15.3)*. Federación Española de Baile Deportivo. https://febd.es/es/section/normativa

Fong, C.-M., Blackburn, J. T., Norcross, M. F., McGrath, M., & Padua, D. A. (2011). Ankle-dorsiflexion range of motion and landing biomechanics. *Journal of Athletic Training, 46*(1), 5-10. https://doi.org/10.4085/1062-6050-46.1.5

Fronczek, R., Middelkoop, H. A. M., van Dijk, J. G., & Lammers, G. J. (2006). Focusing on vigilance instead of sleepiness in the assessment of narcolepsy: High sensitivity of the Sustained Attention to Response Task (SART). *Sleep, 29*(2), 187-191. https://doi.org/10.1093/sleep/29.2.187

Haynes, T., Bishop, C., Antrobus, M., & Brazier, J. (2019). The validity and reliability of the My Jump 2 app for measuring the reactive strength index and drop jump performance. *Journal of Sports Medicine and Physical Fitness, 59*(2), 253-258. https://doi.org/10.23736/S0022-4707.18.08195-1

Huertas, F., Zahonero, J., Sanabria, D., & Lupiáñez, J. (2011). Functioning of the attentional networks at rest vs. during acute bouts of aerobic exercise. *Journal of Sport and Exercise Psychology, 33*(5), 649-665. https://doi.org/10.1123/jsep.33.5.649

Jiménez-Reyes, P., Samozino, P., Pareja-Blanco, F., Conceição, F., Cuadrado-Peñafiel, V., González-Badillo, J. J., & Morin, J.-B. (2017). Validity of a simple method for measuring force-velocity-power profile in countermovement jump. *International Journal of Sports Physiology and Performance, 12*(1), 36-43. https://doi.org/10.1123/ijspp.2015-0484

Johanson, M. A., Allen, J. C., Matsumoto, M., Ueda, Y., & Wilcher, K. M. (2010). Effect of heel lifts on plantarflexor and dorsiflexor activity during gait. *Foot & Ankle International, 31*(11), 1014-1020. https://doi.org/10.3113/FAI.2010.1014

Kayvani, M., Kavyani, A., & Soltani, S. (2023). The induced fatigue on attention networks of active and inactive individuals effect of exercise. *bioRxiv*. https://doi.org/10.1101/2023.08.14.553215

Keijsers, P. J. H., Busscher, I., Crijns, H. J. M. J., & Ewals, R. C. T. (2023). Injuries in ballroom DanceSport: A retrospective study on prevalence and relation with demographic data. *Journal of Dance Medicine & Science, 27*(4), 194-202. https://doi.org/10.1177/1089313X231178090

Keir, D. A., Thériault, F., & Serresse, O. (2013). Evaluation of the running-based anaerobic sprint test as a measure of repeated sprint ability in collegiate-level soccer players. *Journal of Strength and Conditioning Research, 27*(6), 1671-1678. https://doi.org/10.1519/JSC.0b013e31827367ba

Kruusamäe, H., Maasalu, K., Wyon, M., Jürimäe, T., Mäestu, J., Mooses, M., & Jürimäe, J. (2015). Spinal posture in different DanceSport dance styles compared with track and field athletes. *Medicina, 51*(5), 307-311. https://doi.org/10.1016/j.medici.2015.08.003

Langner, R., & Eickhoff, S. B. (2013). Sustaining attention to simple tasks: A meta-analytic review of the neural mechanisms of vigilant attention. *Psychological Bulletin, 139*(4), 870-900. https://doi.org/10.1037/a0030694

Liébana, E., Monleón, C., Moratal, C., & Garcia-Ramos, A. (2021). Heart rate response and subjective rating of perceived exertion to a simulated Latin DanceSport competition in experienced latin dancers. *Medical Problems of Performing Artists, 36*(1), 39-44. https://doi.org/10.21091/mppa.2021.1006

Liiv, H., Wyon, M., Jürimäe, T., Purge, P., Saar, M., Mäestu, J., & Jürimäe, J. (2014). Anthropometry and somatotypes of competitive DanceSport participants: A comparison of three different styles. *Homo, 65*(2), 155-160. https://doi.org/10.1016/j.jchb.2013.09.003

Lima, Y. L., Ferreira, V. M. L. M., de Paula Lima, P. O., Bezerra, M. A., de Oliveira, R. R., & Almeida, G. P. L. (2018). The association of ankle dorsiflexion and dynamic knee valgus: A systematic review and meta-analysis. *Physical Therapy in Sport: Official Journal of the Association of Chartered Physiotherapists in Sports Medicine, 29*, 61-69. https://doi.org/10.1016/j.ptsp.2017.07.003

Liu, X., Wu, B., Weng, X., & Shan, Q. (2023). The effect of the partnership between DanceSport couples on competitive performance: The mediating role of athlete engagement. *Frontiers in Psychology, 14*, 1278874. https://doi.org/10.3389/fpsyg.2023.1278874

Liu, X., Yang, G., Wang, S., Wang, X., & Wang, X. (2023). Development and initial validation of the Partnership Scale-DanceSport Couples. *Frontiers in Psychology, 14*, 1032767. https://doi.org/10.3389/fpsyg.2023.1032767

Llorens, F., Sanabria, D., & Huertas, F. (2015). The influence of acute intense exercise on exogenous spatial attention depends on physical fitness level. *Experimental Psychology, 62*(1). https://doi.org/10.1027/1618-3169/a000270

Luque-Casado, A., Perakakis, P., Ciria, L. F., & Sanabria, D. (2016). Transient autonomic responses during sustained attention in high and low fit young adults. *Scientific Reports, 6*(1), 27556. https://doi.org/10.1038/srep27556

Luque-Casado, A., Perakakis, P., Hillman, C. H., Kao, S.-C., Llorens, F., Guerra, P., & Sanabria, D. (2016). Differences in sustained attention capacity as a function of aerobic fitness. *Medicine & Science in Sports & Exercise, 48*(5), 887. https://doi.org/10.1249/MSS.0000000000000857

Manly, T., Robertson, I. H., Galloway, M., & Hawkins, K. (1999). The absent mind: Further investigations of sustained attention to response. *Neuropsychologia, 37*(6), 661-670. https://doi.org/10.1016/S0028-3932(98)00127-4

McCabe, T. R., Ambegaonkar, J. P., Redding, E., & Wyon, M. (2014). Fit to dance survey: A comparison with dancesport injuries. *Medical Problems of Performing Artists, 29*(2), 102-110. https://doi.org/10.21091/mppa.2014.2021

McCabe, T. R., Wyon, M., Ambegaonkar, J. P., & Redding, E. (2013). A bibliographic review of medicine and science research in Dancesport. *Medical Problems of Performing Artists, 28*(2), 70-79. https://www.jstor.org/stable/48717662

McMorris, T., & Hale, B. J. (2015). Is there an acute exercise-induced physiological/biochemical threshold which triggers increased speed of cognitive functioning? A meta-analytic investigation. *Journal of Sport and Health Science, 4*(1), 4-13. https://doi.org/10.1016/j.jshs.2014.08.003

Monleón, C. (2018). *Acondicionamiento físico específico en el Baile Deportivo. En Baile Deportivo, entrenamiento multidisciplinar hacia el alto rendimiento*. Editorial Wanceulen.

Moore, R., Romine, M., O'Connor, P., & Tomporowski, P. (2012). The influence of exercise-induced fatigue on cognitive function. *Journal of Sports Sciences, 30*, 841–850. https://doi.org/10.1080/02640414.2012.675083

Muriel, X., Cámara-Tobalina, J., Fernández-López, J. R., & Pallarés, J. G. (2012). Validez del test de salto para la valoración del rendimiento anaeróbico y la asimetría en el ciclismo de alto nivel. *SPORT TK-Revista EuroAmericana de Ciencias del Deporte, 1*(1). https://doi.org/10.6018/185541

Oliveira, M. P., Couto, B. P., Melo, C. C., Lúcio Junior, J., Flôr, C. A. G., Szmuchrowski, L. A., & Andrade, A. G. (2018). Effect of different rest interval lengths on the countermovement jump. *Journal of Physical Education, 29*, e2960. https://doi.org/10.4025/jphyseduc.v29i1.2960

Pareja-Blanco, F., Rodríguez-Rosell, D., Sánchez-Medina, L., Ribas-Serna, J., López-Lopez, C., Mora-Custodio, R., & González-Badillo, J. J. (2017). Acute and delayed response to resistance exercise leading or not leading to muscle failure. *Clinical Physiology and Functional Imaging, 37*(6), 630-639. https://doi.org/10.1111/cpf.12348

Pellicciari, L., Piscitelli, D., De Vita, M., D'Ingianna, L., Bacciu, S., Perno, G., Lunetta, L., Rosulescu, E., Cerri, C. G., & Foti, C. (2016). Injuries among italian DanceSport Athletes: A questionnaire survey. *Medical Problems of Performing Artists, 31*(1), 13-17. https://doi.org/10.21091/mppa.2016.1003

Rao, Y., Yang, N., Gao, T., Zhang, S., Shi, H., Lu, Y., Ren, S., & Huang, H. (2023). Effects of peak ankle dorsiflexion angle on lower extremity biomechanics and pelvic motion during walking and jogging. *Frontiers in Neurology, 14*, 1269061. https://doi.org/10.3389/fneur.2023.1269061

Robertson, I. H., Manly, T., Andrade, J., Baddeley, B. T., & Yiend, J. (1997). "Oops!": Performance correlates of everyday attentional failures in traumatic brain injured and normal subjects. *Neuropsychologia, 35*(6), 747–758. https://doi.org/10.1016/S0028-3932(97)00015-8

Rodrigues-Krause, J., Krause, M., & Reischak-Oliveira, Á. (2015). Cardiorespiratory considerations in dance: From classes to performances. *Journal of Dance Medicine & Science: Official Publication of the International Association for Dance Medicine & Science, 19*(3), 91-102. https://doi.org/10.12678/1089-313X.19.3.91

San Román-Quintana, J., Calleja-González, J., Castellano-Paulis, J., & Casamichana-Gómez, D. (2010). Analysis of jumping capacity before, during and after competition in international junior basketball players. *RICYDE. Revista Internacional de Ciencias del Deporte, 6*(21), 311-321. https://doi.org/10.5232/ricyde2010.02105

Sanchis, C., Blasco, E., Luna, F. G., & Lupiáñez, J. (2020). Effects of caffeine intake and exercise intensity on executive and arousal vigilance. *Scientific Reports, 10*(1), 1-13. https://doi.org/10.1038/s41598-020-65197-5

Schrefl, A., Erlacher, D., & Schärli, A. (2023). The single leg heel rise test-a helpful tool for dance science?: A systematic review. *Medical Problems of Performing Artists, 38*(4), 234-248. https://doi.org/10.21091/mppa.2023.4028

Simonsen, E. B. (2014). Contributions to the understanding of gait control. *Danish Medical Journal, 61*(4), B4823. https://content.ugeskriftet.dk/sites/default/files/scientific_article_files/2018-11/b4823.pdf

Terry, P. C., Karageorghis, C. I., Curran, M. L., Martin, O. V., & Parsons-Smith, R. L. (2020). Effects of music in exercise and sport: A meta-analytic review. *Psychological Bulletin, 146*(2), 91-117. https://doi.org/10.1037/bul0000216

Verschueren, J., Tassignon, B., De Pauw, K., Proost, M., Teugels, A., Van Cutsem, J., Roelands, B., Verhagen, E., & Meeusen, R. (2020). Does acute fatigue negatively affect intrinsic risk factors of the lower extremity injury risk profile? A systematic and critical review. *Sports Medicine (Auckland, N.Z.), 50*(4), 767–784. https://doi.org/10.1007/s40279-019-01235-1

Wang, C., Wang, G., Lu, A., & Zhao, Y. (2021). Effects of attentional control on gait and inter-Joint coordination during dual-task walking. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.665175

Wanke, E. M., Haenel, J., & Groneberg, D. A. (2020). Musculoskeletal pain in latin american formation dance: localization, assessment, and related behavior. *Journal of Dance Medicine & Science, 24*(1), 24-32. https://doi.org/10.12678/1089-313X.24.1.24

World DanceSport Federation. (2024, October 6). *Competition*. https://www.worlddancesport.org/about/competition

Zagorc, M., Simunic, B., Pišot, R., & Oreb, G. (2010). A comparison of contractile parameters among twelve skeletal muscles of inter-dance couples. *Kinesiologia Slovenica, 16*(3), 57-65. https://www.kinsi.si/en/archive/2010/208/analiza-medmisicnih-kontraktilnih-lastnosti-pri-plesnih-parih