

Decision-making, contextual intelligence, maximum oxygen consumption and explosive strength in futsal players during COVID-19

Toma de decisiones, inteligencia contextual, consumo máximo de oxígeno y fuerza explosiva en deportistas de futsal durante el covid-19

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Psychological and physiological variables in futsal

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Abstract

The present research sought to determine the relationship between maximum oxygen consumption, explosive strength, decision making and contextual intelligence in futsal players during confinement by COVID-19. This is a descriptive study, carried out with 30 futsal players from the city of Popayan during confinement by COVID-19. Training characteristics, body mass index, aerobic capacity, lower limb explosive strength, contextual intelligence and decision making were evaluated. The average value of players' VO₂max was 43.60 ml/kg/min, the average jumping height was 38.22 cm, the average reaction time for the Stroop test was 1,41 s. Furthermore, a statistical relationship among VO₂max, intuition to detect the opponent's actions ($p=0,016$), quick reaction to changes in the competition ($p=0,012$) and the taking of initiative ($p=0,017$) was found. During confinement, players showed overweight levels, slow reaction times for decision making and low values in Vo₂max and explosive strength. VO₂max. is related to better cognitive response and decision making.

Keywords: COVID-19, Sports, Oxygen consumption, Muscle strength, Sport teams, (MeSH).

Resumen

La presente investigación buscó determinar la relación entre el consumo máximo de oxígeno, la fuerza explosiva, la toma de decisiones y la inteligencia contextual en deportistas de fútbol sala durante el aislamiento por Covid-19. Estudio descriptivo, realizado con 30 deportistas de fútbol sala de la ciudad de Popayán durante el confinamiento por Covid-19, en donde se evaluó las características de entrenamiento, el índice de masa corporal, la capacidad aeróbica, la fuerza explosiva de miembros inferiores, la inteligencia contextual y la toma de decisiones. El promedio de VO₂máx de los deportistas fue de 43,60 ml/kg/min, la media en la altura de salto fue de 38,22 cm; el tiempo de reacción promedio para la prueba de Stroop fue de 1,41 s. Además, se encontró relación estadística entre el VO₂máx, la intuición para detectar las acciones de mi oponente ($p=0,016$), la reacción rápida a los cambios en la competición ($p=0,012$) y tomar la iniciativa ($p=0,017$). Durante el aislamiento, los deportistas presentaron niveles de sobrepeso, tiempos de reacción lentos para la toma de decisiones, y valores bajos en Vo₂ máx. y fuerza explosiva. El VO₂ máx. está relacionado con una mejor respuesta cognitiva y toma de decisiones.

Palabras clave: Covid-19, Deportes, Consumo de oxígeno, Fuerza muscular, Equipos de deporte, (DeCS).

Introduction

Futsal is characterized by the high physical, physiological, biomechanical, neuromuscular, cognitive and biochemical demand generated by the intermittent moderate and vigorous intensity that require effective responses from the player from a physical, technical, tactical and psychological point of view during the two 20-minute halves of a game (Spyrou et al., 2020). The rules of this sport were designed to maintain a high intensity in the game, playing between 75 to 85% of the total scheduled time. During this time the player is constantly fulfilling defensive and offensive tasks framed in different patterns of play, performing high and maximum intensity efforts every 43 to 56 seconds, respectively (Naser et al., 2017; Sanmiguel et al., 2021).

Futsal players must have an optimal aerobic condition to be able to tolerate the high intensity physiological demands present both in training and in competition. The level of maximum oxygen consumption (VO₂max) has been related to a greater number of sprints performed, greater distance traveled, greater contact and participation with the ball, with less fatigue and less cardiovascular stress during the game (Álvarez-Kurogi, 2020; Matzenbacher et al., 2014). For its part, jumping ability is a basic and determining gesture in sports practice (Portilla et al., 2019). Likewise, Sekulic et al., (2021) state that measuring jumping performance is essential for the assessment of lower limb power, which is related to specific high-intensity game actions such as sprinting, jumping and changing direction.

By the end of 2019 and early 2020, the world was affected by the COVID-19 pandemic, which generated the adoption of isolation and social distancing measures by national and local governments in order to reduce the contagion. This negatively affected the participation of athletes in different organized competitions, generating that futsal players were forced to long-term isolation (Spyrou et al., 2022). In sport, confinement produced negative effects on physiological, emotional and training variables, on sleep patterns and on players' lifestyle (Mon-Lopez et al., 2020). The decrease in athletic performance induced by prolonged detraining periods during the isolation process could cause changes in aerobic performance (Bisciotti, 2020), jumping ability and body composition (Grazioli et al., 2020). Besides, the stoppage of specific training for futsal and/or the adaptation of this in reduced and limited spaces at home, the lack of motivation to continue with the preparation process by the athlete, difficulties in the management and control of intensities and workloads, could also influence the total or partial detriment of physiological and cognitive adaptations (Sarto et al., 2020).

Regarding the cognitive variables, contextual intelligence allows the athlete to know when to take the initiative, to recognize his strengths and weaknesses, giving him the possibility to adapt and propose a timely response to demanding situations in the physiological and psychological component (Pérez et al., 2014). Additionally, the set of cognitive operations that are essential for decision-making in complex environments such as a futsal match must be taken into account in the assessment processes. This on the understanding that cognitive function has been related to aerobic fitness, and that adequate training generates physiological and performance adaptations that favor cognition and executive function (Hansen et al., 2004). Furthermore, memory, attention, information gathering, anticipation and decision-making skills may be modulated by individual characteristics and sport context (Huertas et al., 2019).

For their part, interaction with the environment through sufficient and necessary stimuli to improve decision making, and attention are essential for the development of contextual intelligence. This allows the player to collect information from his environment, process, select and execute motor responses according to the game, fundamental for sporting success (Guerrero, 2020). This reasoning confirms the relevance of decision making and contextual intelligence as essential elements to determine the athletes' response to the game conditions (Salazar & Montoya, 2015). This is a situation that should be considered by coaches for evaluation and monitoring, especially during the process of confinement that brought noticeable and substantial changes in the way of training. As a result, the present research sought to determine the relationship among maximum oxygen consumption, explosive strength, decision making and contextual intelligence in futsal players from the city of Popayan during confinement by COVID-19.

Method

Study design

Descriptive cross-sectional study.

The present research was conducted under the parameters and recommendations established for research in humans given by the Declaration of Helsinki (World Medical Association - WMA, 2013) and resolution 8430 (Ministry of Health, 1993), this research was classified as minimal risk and had the approval of the Ethics Committee of the Vice-Chancellery of Research of the Universidad del Cauca and registration in the research system with identification code No. 5666.

Participants

Thirty futsal players from the city of Popayan participated in this study. The sample was selected intentionally from a population of 40 players registered in the club and who met the selection criteria: to belong as a futsal player attached to a professional club with current recognition by the Cauca Soccer League, to have participated as a player in national competitions in 2019, to be performing the mandatory confinement in the city of Popayan, to manifest, by signing the informed consent, the voluntary participation in the study. For the purposes of this research, players who did not completely finish the tests, presented some musculoskeletal injury at the time of the evaluation and those who requested voluntary withdrawal were excluded. It is important to mention that 10 athletes were not taken into account because they were performing their mandatory confinement outside the city and/or had not participated in official competitions during 2019, although they were part of the tele-directed trainings during the confinement.

Procedure

For the execution of the research, the club's directors, coaching staff and players were initially informed of the objectives and scope of the project. Once they had given their approval, the process of data collection and respective evaluations with the players at each of their homes was initiated. These evaluations were carried out in September, with the evaluators adopting and complying with the restriction and biosecurity measures issued by the national and municipal governments during that month.

As a first step for data collection, a survey was conducted to collect sociodemographic data (age, sex, socioeconomic stratum and schooling), sports data (years of practice,

practice time per daily session, weekly frequency of practice, among others), and training data during COVID 19 confinement (type of training, training place, training space (open, closed), musculoskeletal injuries, signs and symptoms of COVID 19), adjusted by pilot test. Subsequently, the questionnaire of contextual intelligence perceived in sport was administered. This has a three-dimensional structure (anticipatory intelligence, tactical intelligence and competitive intelligence), composed of 23 items, where each item presented a Likert-type scale from 1 to 10, validated by Ruiz et. al (2014).

Once the two previous questionnaires were answered, the evaluators went to the athlete's home to take anthropometric measurements (Stewart et al., 2011) and to continue with the Stroops test. This is a test of mental speed (Afsaneh et al., 2012), considered as a reliable psychometric measure to determine performance in terms of selective attention by introducing an interference, where the words inserted in the identification of colors act as a distractor for the individual (Araya and Saenz, 2019), based on the premise that individuals can read words much faster than they can identify and name colors, generating the Stroops effect (Golden, 1999). This test has been validated, presenting high reliability for various population groups, being successfully applied as a psychometric measure (Ahmed et al., 2015). The result of each test showed the total score, the total number of successful attempts and missed attempts, and the average time per response (Suresh et al., 2018).

Adapting to the confinement regulations and using the resources available at each player's confinement site for the assessment of maximum oxygen consumption, the Chester Step Test (Heydenreich et al., 2019) was used. This allowed the assessment of the athlete's aerobic capacity. The test consists of 5 stages, 1st stage: 15 *steps/min*, 2nd stage: 20 *steps/min*, 3rd stage: 25 *steps/min*, 4th stage: 30 *steps/min* and 5th Stage: 35 *steps/min*; where the assessed person had to go up and down a 30 cm high step. To mark the rhythm of execution of the test an audio was used. This determined the steps per minute executed by the assessed person while going up and down. The test marks a speed established by the beat of the metronome of the aforesaid previously recorded audio where the initial speed is 15

steps per minute and every 2 minutes the time increased by 5 steps per minute. At the end of each stage, the heart rate (*HR*) and the range of perceived exertion (*RPE*) were taken on a Borg scale of 6-20. The following formula was used to find the $VO_2\max$:

$$VO_2\max = \text{Step height (m)} \times \text{number of cycles} \times \text{weight (kg)} \times 0.16357.21$$

Subsequently, lower limb explosive strength was evaluated by means of the Counter Movement Jump (*CMJ*) vertical jump through the mobile application My Jump 2 (Haynes et al., 2019). The application is a mobile tool that takes advantage of the cell phone camera, capable of recording at 120 Hz, which allows accurate measurement of jump performance, with high validity and reliability in the data, with excellent correlation between the application and contact platforms, making it an easy-to-use tool and with a much lower economic cost than jumping platforms (Balsalobre et al., 2014).

Statistical analysis

For the statistical analysis, descriptive analysis was performed with frequency and percentage distributions, and measures of central tendency and dispersion for quantitative variables. Subsequently, inferential analysis was performed with nonparametric Mann Whitney U tests for two independent samples, the Wilcoxon test for two related samples and the Kruskal-Wallis test for several independent samples, assuming the value of $p < 0,05$ as statistically significant. Bivariate correlations between quantitative and ordinal variables were also used. Microsoft Excel was used for data collection and the analysis was performed using SPSS software version 24.

Results

Regarding sociodemographic and anthropometric variables, the mean age of the athletes was 25 years, while body weight was $70,22 \pm 8.78$ kg. As for height, the mean height was $170,7 \pm 6.21$ cm, with a mean *BMI* of $24,07 \pm 2.51$ kg/m². However, it was shown that 36,6 % of the athletes were overweight.

Table 1. Training characteristics during confinement by COVID-19

	N	%
Place of confinement		
House	28	93,3
Apartment	1	3,3
Room	1	3,3
Has undergone training during confinement		
Yes	29	96,7
No	1	3,3
Training days during confinement		
1 - 3	5	16,7
3 - 5	21	70
More than 5	4	13,3
Type of space for training during confinement		
None	1	3,3
Open	4	13,3
Closed	9	30
Open and Closed	16	53,3
Type of training performed during confinement		
None	1	3,3
Endurance and/or strength or speed	12	40
Endurance, strength and/or speed or Technical gestures or Flexibility	11	36,7
Endurance, strength, speed and/or flexibility or Technical gestures	3	10
Flexibility, technical gestures and/or speed, endurance or strength	2	6,7
Strength and technical gestures	1	3,3
Training time per day during confinement		
None	1	3,3
30 to 60 minutes	15	50,0
60 to 90 minutes	13	43,3
More than 90 minutes	1	3,3
Do you train under the guidance of a professional in the sport?		
Yes	4	13,3
No	9	30,0
Sometimes	17	56,7
Injuries during this time of confinement		
Yes	7	23,3
No	23	76,7

In relation to the players' mean VO₂max, this was 43,60 ml/kg/min ±4,75 ml/kg/min; regarding the perceived exertion during the test (RPE), it was observed that there was a proportional perception of exertion according to the stages of the VO₂max test, the players' mean perceived exertion was 16, which indicated that towards the end of the test the

athletes made a maximum effort (Very hard classification) (figure 1). Regarding explosive strength, a mean of 32,88 cm ±3,28 cm was found. On the power side a mean of 516,73 w ±5,89 w was found and for strength a mean of 1507,6 N ± 83,4 N.

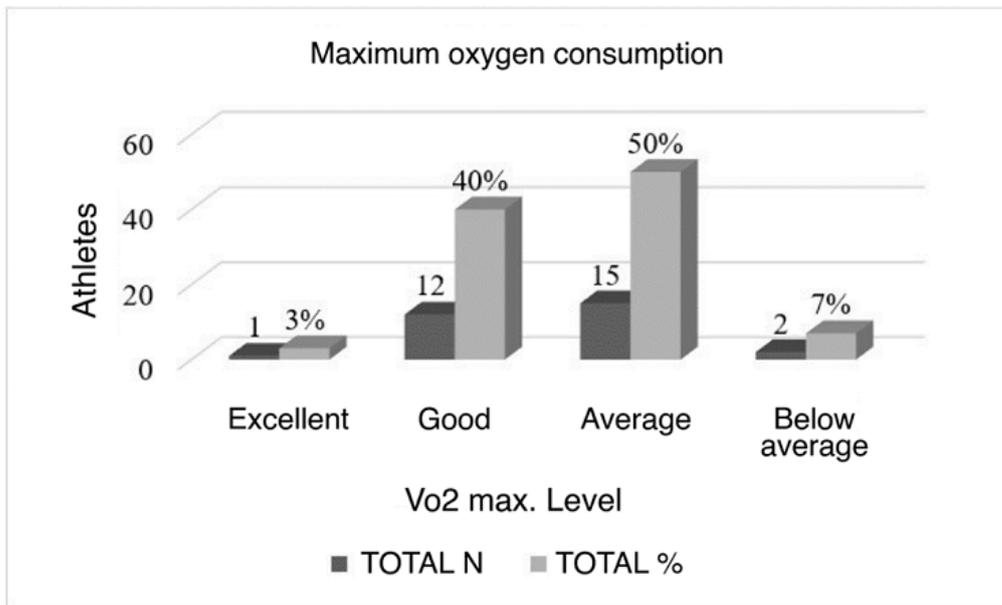


Figure 1. Maximum oxygen uptake (VO2max) of the athletes

Regarding the contextual intelligence questionnaire, it was found that 56,7 % of the futsal players easily intuit the actions of their opponents, 60 % agree that they react quickly to changes in the competition, 36,7 % totally agree

that they easily detect the weak points of their opponents, while 43,3 % of the players act with determination in complex situations during the competition (Table 2).

Table 2. Contextual Intelligence in Sport Questionnaire (CISQ) of futsal players

Contextual Intelligence in Sport Questionnaire (CISQ)		
Item	N	%
1. I easily sense the actions of my opponents.		
Disagree	1	3.3
Neither agree nor disagree	6	20.0
Agree	17	56.7
Strongly agree	6	20.0
2. I usually choose the appropriate technique for each competition situation.		
Neither agree nor disagree	5	16.7
Agree	18	60.0
Strongly agree	7	23.3
3. I react quickly to changes in the competition.		
Disagree	1	3.3
Neither agree nor disagree	6	20.0
Agree	18	60.0
Strongly agree	5	16.7
4. When I compete, I know how to be in the right place at the right time.		
Neither agree nor disagree	7	23.3
Agree	11	36.7
Strongly agree	12	40.0
5. I tend to be good at deciding on the competition.		
Disagree	2	6.7
Neither agree nor disagree	4	13.3
Agree	18	60.0
Strongly agree	6	20.0
6. I quickly adapt my performance to the circumstances of the competition.		
Disagree	1	3.3
Neither agree nor disagree	5	16.7
Agree	15	50.0
Strongly agree	9	30.0
7. I catch the tricks of my opponents.		
Neither agree nor disagree	4	13.3
Agree	19	63.3
Strongly agree	7	23.3
8. I like to take the initiative in competition.		
Disagree	2	6.7
Neither agree nor disagree	2	6.7
Agree	16	53.3
Strongly agree	10	33.3
9. I am alert to the possible actions of my opponents.		
Neither agree nor disagree	1	3.3
Agree	13	43.3
Strongly agree	16	53.3
10. I am able to surprise my opponents with sudden attacking actions.		
Strongly Disagree	1	3.3
Neither agree nor disagree	2	6.7
Agree	10	33.3
Strongly agree	17	56.7
11. I easily detect my opponents' weaknesses.		
Neither agree nor disagree	5	16.7
Agree	14	46.7
Strongly agree	11	36.7
12. My main strength is in my intelligence for competition.		
Disagree	1	3.3
Neither agree nor disagree	2	6.7
Agree	22	73.3
Strongly agree	5	16.7
13. I quickly sense the best tactic to use in competition.		
Disagree	2	6.7
Neither agree nor disagree	3	10.0
Agree	22	73.3
Strongly agree	3	10.0
14. I alternate, without hardly thinking about it, changes of pace with sudden attacks when I compete.		
Strongly Disagree	1	3.3
Disagree	2	6.7
Neither agree nor disagree	3	10.0
Agree	12	40.0
Strongly agree	12	40.0
15. I am able to stay ahead of the intentions of my opponents.		
Neither agree nor disagree	4	13.3
Agree	19	63.3
Strongly agree	7	23.3
16. I have a knack for deceiving my opponents when competing.		
Disagree	1	3.3
Neither agree nor disagree	2	6.7
Agree	22	73.3
Strongly agree	5	16.7
17. I take advantage of and learn from defeats.		
Neither agree nor disagree	2	6.7
Agree	10	33.3
Strongly agree	18	60.0
18. I have a special instinct to detect the solution of complicated situations in competition.		
Disagree	1	3.3
Neither agree nor disagree	5	16.7
Agree	18	60.0
Strongly agree	6	20.0
19. I am accurate in analyzing competitive situations.		
Neither agree nor disagree	7	23.3
Agree	19	63.3
Strongly agree	4	13.3
20. I have a facility for picking up the style of play of my opponents.		
Neither agree nor disagree	1	3.3
Agree	20	66.7
Strongly agree	9	30.0
21. I conceal my intentions well in competition.		
Disagree	2	6.7
Neither agree nor disagree	5	16.7
Agree	16	53.3
Strongly agree	7	23.3
22. I always find the opportunity to outperform my opponents in competition.		
Disagree	1	3.3
Neither agree nor disagree	6	20.0
Agree	17	56.7
Strongly agree	6	20.0
23. I do not hesitate in complex situations and act with determination.		
Disagree	1	3.3
Neither agree nor disagree	4	13.3
Agree	12	40.0
Strongly agree	13	43.3

When analyzing the results of the Stroop test, it was found that the minimum number of responses was 131 and the maximum was 203 total responses, with a maximum of 197 correct responses, 43 % of the soccer players were in the range between 140 to 158 correct responses, while 53

% of the athletes had between 2 to 10 incorrect responses. The average reaction time reached a minimum of 1,10 seconds (s), a maximum of 1,73 s and a mean of 1,41 s (Figure 2).

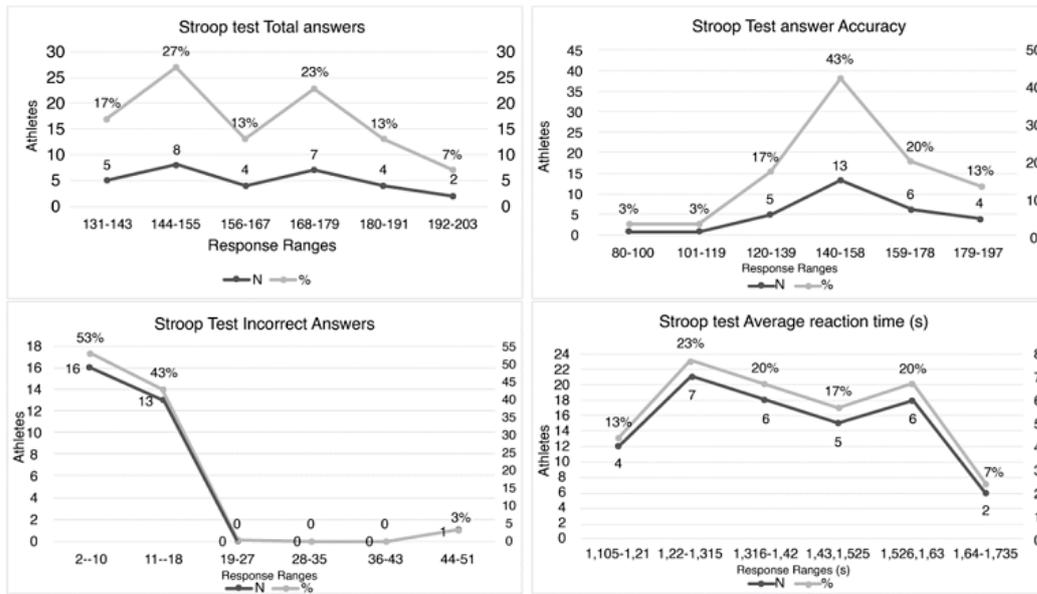


Figure 2. Stroop test of futsal players during confinement by COVID-19

A statistically significant association was found between years of futsal practice with ease of detecting the weak points of my opponents and ease of deceiving my opponents when competing. On the other hand, an association between training under professional guidance,

total responses and average reaction time for the Stroop test was found. In addition, a statistical relationship was established between BMI and explosive strength (N) and power (W) (Table 3).

Table 3. Association between sports experience, training under professional guidance, body mass index (BMI), Stroop test, contextual intelligence and explosive strength

Variables	Sig.
Years of practice* I easily detect my opponent(s)' weaknesses.	0,038*
Years of practice* I have a knack for deceiving my opponents when competing.	0,027*
Undergoes training under professional guidance* Stroop Test Total Responses	0,016*
Performs training under professional guidance* average reaction time on the Stroop Test	0,005*
BMI * Explosive force strength(N)	0,002*
BMI* Explosive strength power (W)	0,003*
BMI * Years of futsal practice	0,005*

With reference to the correlations between the variables, a statistically significant relationship was found between VO2max and the intuition to detect the actions of my opponent and the quick reaction to changes in the competition. Likewise, statistical significance was found with taking the initiative in the competition, although the latter presented a negative correlation. On the other

hand, the BMI showed a statistical relationship with the performance with determination and a negative correlation with the facility to intuit the actions of my opponents. Finally, a positive correlation was found between incorrect answers in the Stroop test and the liking to take initiative during competition (Table 4).

Table 4. Correlations between study variables

Variables	Sig.	Value
VO2max * I can easily sense the actions of my opponents.	0,016*	0,437
VO2max * I react quickly to changes in competition.	0,012*	0,455
VO2max * I like to take the initiative in competition.	0,017*	-0,433
I easily intuit the actions of my opponents * body mass index	0,031*	-0,394
I do not hesitate in complex situations and I act with determination * Body mass index	0,027*	0,403
I like to take the initiative in competition * Incorrect Answers Stroop Test	0,033*	0,391

Discussion

The present research showed that futsal players reported low values of VO2max and lower limb explosive strength. It also found a significant relationship between aerobic fitness, contextual intelligence and decision making. As well, an association was reported between the performance of training under professional guidance and the total responses and the average reaction time for the Stroop test, results that influence the player's performance at the time of his return to competition. In this regard, Spyrou et al., (2021) mentioned that the pandemic brought negative changes in neuromuscular performance, which should be taken into account for periods of reduced training by coaches and athletes for the planning and implementation of efficient strategies for the return to competition after detraining phases.

In relation to body mass index, this study found that 36 % of the futsal players were overweight. Regarding the above, Nikolaidis et al., (2019) reported a prevalence of overweight of 25 % in the different groups of soccer players participating in their research, a situation related to a decrease in performance in specific situations, such as sprinting and jumping during the game. On this, Rubio- Arias et al., (2015) state that an adequate selection of food and liquids consumed, taking into account the requirements of sports practice, can significantly benefit the health of the athlete, providing sufficient caloric intake, maintaining an adequate body weight and maximizing sports performance.

Additionally, on this subject, Sekulic et al., 2021 stated that a reduction in body mass can significantly favor relative strength, producing better responses in acceleration and deceleration actions, jumps and agility. This situation should be taken into account given the results found in the present study where a statistically significant association was found between BMI and explosive strength. In the

same way, the confinement measures taken to mitigate the transmissibility of COVID-19 could have contributed negatively to the athletes' diet, as stated by Pillay et al. (2020), who found a significant increase in the consumption of carbohydrates, soft drinks, red meat and processed foods during confinement.

Regarding the characteristics of training during confinement, it was found that most of the athletes trained more than 30 minutes a day and between 3 to 5 days a week, with work on different capacities such as endurance, strength and/or speed. On this subject, during confinement, soccer, field hockey, rugby and netball athletes reported that 61 % trained daily, while 71 % performed strength training with their own body weight, and 89% trained more than 30 minutes daily (Pillay et al., 2020). These results that differ from those reported by futsal players in the city of Popayan. It is also important to highlight that only 13 % of the players performed their training under professional guidance, a situation that should be reviewed, since training guided by sports professionals can generate safe, specific exercise programs with favorable stimuli that can benefit the components related to health and sports skills (Días et al., 2017).

On the other hand, the means found in the evaluation of contextual intelligence were 7.6 for tactical intelligence, 7,8 points for anticipatory and competitive intelligence. However, Ruiz et al, (2014) found an average of anticipatory intelligence of 7.04 points at local level, of 7,15 points at national level and of 7,39 points at international level. In tactical intelligence, the average was 6,86 points at local level, 6,92 points at national level and 7,22 points at international level. In competitive intelligence, the local average was 7,14 points, the national average was 7,26 points and the international average was 7,50 points, values below those found by the present research. It is important to highlight that contextual intelligence in sport stands out

for the relevance it has on the player's decision making in the game, where he must be able to interpret, dominate the context, understand the competition, have reading of the game to decide, anticipate and compete, which allows him to achieve the objectives set (Ruiz et al., 2014). For this, it is important to provide sufficient stimuli for cognitive adaptation with training, however, the perceptual-motor demands could hardly be reproducible during the confinement given the conditions of space to perform the training, which could generate a decrease in the perceptual-cognitive orientation of the game (Luna et al., 2021).

In relation to decision making, an average response time of 1,41 seconds was reported, which shows a reaction time worse than that found in the study by Goenarjo et al. (2020), who found average reaction times of 0,72 seconds in physically active people, while inactive people marked an average time of 0,78 seconds. As stated by Huijgen et al., (2015) "the nature and orientation of the practice environments, of the teaching tasks, constitute a determining variable in the development of executive functions." These practice environments were affected by the restriction measures during confinement, which could bring a negative effect on cognitive abilities due to the cessation of training in the playing field, the emotional load and the stress generated by the confinement (Erazo, 2021). The execution of trainings under professional guidance presented statistically significant association with the total number of responses and the average reaction in the Stroop test. This shows that the cognitive ability of athletes can be favored thanks to planning, organization and execution of trainings supervised by suitable and trained personnel (Yanagisawa et al., 2010).

The maximum oxygen consumption also assessed in this study, showed results that fall far short those reported by other investigations, such as Alvarez et al., 2009. That research found higher VO₂max averages at different levels of competition in futsal players (62,9 ml/kg/min in professionals, 55,26 ml/kg/min in semi-professionals). Similarly, Barcelos et al., (2017) found VO₂max values of 55,7 ml/kg/min in preseason, 56,6 ml/kg/min before competition and 56,2 ml/kg/min after competition. For its part, the jump height shows a detriment in its values, in comparison with the data shown by Grazioli et al., (2020) in soccer players after 63 days of confinement, which presented values of 41,90 cm. Nevertheless, it is important to highlight that these athletes also showed a decrease in neuromuscular performance, although the values are above those found in the futsal players of the present study. The above, allows establishing that the confinement by COVID-19 generated deficiencies in the capacities related to power and aerobic capacity, a situation that should be taken into account by sports professionals once training is restarted for the planning process.

Regarding VO₂max and contextual intelligence, this study found statistically significant relationship with the facility to intuit opponents' actions, quick reaction to changes in the competition and taking the initiative in the competition. According to Cuaspa-Burgos (2019), futsal is a sport with a high dynamic of physical, motor, technical, tactical and cognitive demand. This requires an adequate VO₂max that allows competing, minimizing technical and tactical errors, and a better cognitive response raising the levels of attention, concentration and decision making during the competition. In other words, a sufficient aerobic capacity has a positive impact on the cognitive response of athletes, in this case it would mean a better expression of the player in terms of anticipating, reading plays, dominating the context and flexibility to adapt to the dynamics of the game. Schmidt et al. (2019) stated in their paper that soccer involves a high physical and mental demand, where neuronal activation in the prefrontal

cortex plays an important role in motor function in high intensity requirements. Therefore, it has been found that physiological adaptations of physical exercise can regulate the response of central and peripheral catecholamines favoring the activation of the PFC for attention and executive control, which will translate into better decision making during the game.

A correlation between VO₂max and the daily time allocated by the athletes for training during confinement was also found. This result demonstrates the importance of maintaining daily training times that allow stimulating aerobic capacity despite not training in the usual proportions and conditions. About this, Martinez et al., (2020) found that confinement increased physical inactivity and sedentary behaviors, which could generate losses in cardiorespiratory fitness and muscle strength.

This study presented limitations for the assessment of VO₂max, due to the established confinement and the space available at the players' homes for the development of measurement tests for this parameter. However, the results of this research can contribute to the assessment of this capacity with simple tests adapted to the specific context of the athlete, which will allow having data closer to the reality of the soccer player, generating a better decision making in tele-directed training. In addition, it should be noted that the sample of 30 athletes may be small, however, these athletes were part of the training processes for high performance, given their characteristics and their participation in federated competitions at the national level.

It is relevant to highlight the importance of controlling the body mass index to favor sports performance. Even so, for future studies it is important to contemplate the evaluation of body composition that allows discriminating aspects such as lean mass, fat percentage and body distribution. Yet, it is necessary to remember that given the measures imposed during confinement to maintain a distance of at least two meters, to avoid close contact and the ease of measuring the BMI, the option of taking this variable as a reference for this study was viable given the conditions imposed by the COVID-19 pandemic.

Conclusions

COVID-19 brought about different changes in the usual training activities of the athletes, such as the reduction in the space to develop exercise, the lack of professional orientation and the reduction of the daily and weekly stimuli to which the athletes were accustomed before the restrictions implemented for the control of the pandemic, as well as a decrease in the values of aerobic capacity and explosive strength.

Another important aspect that should be highlighted has to do with the significantly low values reported for cognitive functions such as decision making and contextual intelligence; relevant aspects and factors in the sports performance of futsal players. Additionally, this research found a significant relationship between aerobic fitness and aspects related to cognitive capacity, contextual intelligence and decision making. This implies greater attention by coaches and other exercise professionals for the inclusion of exercises that train initiative, decision making, anticipation and mental speed in situations of high physical demand, allowing the soccer player to perform in competition with possibilities of achieving success.

Conflict of interest

No potential conflict of interest was reported by the authors.

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