ISSN 1646-107X
eISSN 2182-2972

motricidade

2022, vol. 18, n. 3

revista motricidade
Estatuto Editorial
https://revistas.rcaap.pt/motricidade/about

Escopo
A revista Motricidade (ISSN 1646-107X, eISSN 2182-2972) é uma publicação científica trimestral. A política editorial da revista visa contribuir para o desenvolvimento e disseminação do conhecimento científico de caráter teórico e empírico nas áreas científicas do desporto, psicologia e desenvolvimento humano, e saúde, adotando sempre que possível uma natureza interdisciplinar.

Ficha Técnica
ISSN (print): 1646-107X
ISSN (online): 2182-2972
Depósito legal: 222069/05
ICS: 124607
Periodicidade: Trimestral (Março, Junho, Setembro e Dezembro)

Correspondência/Edição
Revista Motricidade
(A/C Prof. Dr. Nuno Domingos Garrido)

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Propriedade
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journal motricidade
Editorial Status
https://revistas.rcaap.pt/motricidade/about

Scope
Journal Motricidade (ISSN 1646-107X, eISSN 2182-2972) is a scientific electronic journal, publishing quarterly. Its editorial politics aim is contributing to the development and dissemination of scientific knowledge of theoretical and empirical character in the context of sports, psychology and human development, and health assuming whenever is possible an interdisciplinary commitment.

Technical Information
ISSN (print): 1646-107X
ISSN (online): 2182-2972
Legal Deposit: 222069/05
ICS: 124607
Frequency: Quarterly (March, June, September and December)

Correspondence/Edition
Journal Motricidade
(A/C Prof. Dr. Nuno Domingos Garrido)

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revistamotricidade@revistamotricidade.com

Property
Sílabas Didáticas LDA
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Indexação
Index Coverage

Web of Knowledge/Scielo Citation Index (Clarivate Analytics), ELSEVIER (SCOPUS, EMCare), SCImago (SJR: Medicine, Health Professions), PsycINFO, IndexCopernicus, Scielo, CABI (CAB Abstracts, Global Health, Leisure, Recreation and Tourism Abstracts, Nutrition Abstracts and Reviews Series A), Qualis, SPORTDiscus, EBSCO (CINAHL Plus with Full Text, Academic Search Complete, Fonte Acadêmica, Fuente Academica, Fuente Academica Premier), Proquest (CSA Physical Education Index, ProQuest Psychology Journals, Summon by Serial Solutions, Ulrich's Periodicals Directory), DOAJ, Open J-Gate, Latindex, Gale/Cengage Learning (InfoTrac, Academic OneFile, Informe) Google Scholar, SIIC Databases (siicsalud), BVS ePORTUGUESe, SHERPA/RoMEO, e-Revistas, OCLC, Hinari/WHO, Swets Information Services, ScienceCentral, Genamics JournalSeek, Cabell's Directories, SafetyLit, NLM Catalog, SCIRUS, BASE Bielefeld, Academic Journals Database, *Índex* Online RMP, Saúde em Movimento

Produção editorial

ZEPPELINI PUBLISHERS

SUMÁRIO

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.23834

Age-related sarcopenia index and functional capacity in elderly community members: a correlational study

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ABSTRACT

Sarcopenia affects performance in simple activities of daily life, directly impacting the quality of life of the elderly. The objective of the present study was to analyse the correlation between age, sarcopenia index and functional capacity in community-dwelling elderly. The sample comprised 40 community-dwelling elderly, 12 men (69.16± 8.13 years) and 28 women (67.96± 6.23 years). All participants underwent the Electrical Bioimpedance (BIA), Handgrip Strength test (HS), and Timed-Up-and-Go test (TUG). A strong correlation was found between age x TUG in men (r= 0.733; p= 0.021), between age x fat mass in women (r= 0.775; p= 0.032), between HS and TUG in men (r= − 0.713; p= 0.0003), and a weak correlation between HS and Free Fat Mass in women (r= 0.394; p= 0.043). Weak negative correlations were found regarding age in both men and women. In functional performance, concerning test time and age, strong correlations were found for men and weak correlations for women.

KEYWORDS: physical performance; ageing; strength.

INTRODUCTION

The process of world population ageing in recent decades has been treated by many as alarm and concern, particularly in developed countries. Brazil is a model of this affirmation, since the elderly population aged 60 and over grew by 16% between 2012 and 2016, reaching 29.6 million people according to data from the National Household Sample Survey of the Brazilian Institute of Geography and Statistics (IBGE, 2016). This makes various studies on ageing one of the main points encouraged by social, government and medical actors in general.

Among several disorders affecting ageing, sarcopenia has particular attention, since it is a syndrome characterised by loss of strength, quality and quantity of muscle and physical performance (Cruz-Jentoft et al., 2019). In addition, it is accompanied by adversities such as physical disability, risk of falls, poor quality of life, limitations in activities of daily life, increased risk of premature death and even negative outcomes during hospitalisation (Tzeng et al., 2020). Data presented by Martinez et al. (2014), shows that the prevalence of sarcopenia in the world varies between 3 and 30% in elderly community members, and in Brazil, in 2012, with older people over 60, it was found that 36.1% had reduced muscle mass.

With the approach of ageing, there is a reduction in physical abilities, causing impairment of daily activities,

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Conflict of interests: nothing to declare. Funding: nothing to declare.
Received: 03/02/2021. Accepted: 03/14/2022.

followed by adverse diseases that affect the quality of life and may lead to social isolation and depression (Costa et al., 2018). Quality of life is related to self-esteem and personal well-being and encompasses a number of aspects such as functional capacity, socio-economic level, emotional state, social interaction, intellectual activity, self-care, family support, health status itself, cultural, ethical and religious values, lifestyle, job satisfaction and/or daily activities and the environment (Vecchia et al., 2005). Quality of life can also be associated with three relevant principles: functional capacity, socioeconomic level and satisfaction, in addition, it can be associated with other elements: self-protection of health, economic situation, emotional state, physical capacity, social interaction and intellectual activity (Santos et al., 2002).

Therefore, we know that degenerative diseases, such as sarcopenia, affect performance in simple activities of daily life, directly impacting the quality of life of the elderly. Thus, early diagnosis of sarcopenia, and verification of functional ability of participants, can be a tool for guiding strategies to identify and prevent risks associated with ageing. Therefore, the objective of this study was to verify the associations between age, sarcopenia index and functional ability in elderly community members.

METHOD

Sample

It was a descriptive, cross-sectional and correlational study. The research was conducted with older participants at the Academy of the Best Age (ABA) in Tocantinópolis (TO), Brazil. The participants were randomly selected from those who regularly participated in the physical activity programs of ABA. The ABA program is a public community space, accessed by community elders. The systematised exercise program the elderly followed was essentially 2 days/week, with multimodal activities, i.e., dynamic resistance and aerobic (walking/dancing) exercises.

The sample consisted of 40 volunteers, 12 males (69.16± 8.13 years) and 28 females (67.96± 6.23 years), all participants of AMI. The following were considered as inclusion criteria: a) individuals aged 60 years or older; b) participants who did not have physical limitations to perform the tests c) regularly enrolled and frequent in AMI. The exclusion criteria were: a) participants who did not complete the proposed tests; b) voluntary withdrawal from the research.

After the participants knew all the stages and objectives of the research, those who accepted to participate signed a Free and Informed Consent Term. All research followed the ethical precepts recommended by Resolution 466/12 of the National Health Council and was approved by the Ethics and Research Committee of the Federal University of Tocantins (UFT) with nº 3.024.560.

Instruments and procedures

Body mass and height were measured using a 0.100 kg anthropometric scale with a 0.1 cm (Whelmy®) coupled stadiometer. The measurements were performed with the participants in an anatomic position, with as little clothing as possible.

For body composition analysis, the Electric Bioimpedance (BIA) technique was used because it is an accurate and reliable method, especially due to the high speed of information processing, being a non-invasive, practical, reproducible and low-cost method. A Tetrapolar Bioimpedance Body Analyzer (Model BIA 1010, Sanny®) was used for measuring body composition parameters (fat mass in kg, fat mass in %, fat-free mass in kg and fat-free mass in %).

During the analysis of the BIA, the following procedures were adopted: a) fasting for 12 hours; b) no alcohol intake before the tests; c) no high or moderate intensity physical activity in the previous 12 hours; d) no fever on the day of the evaluation; e) be hydrated; f) no use of objects or metallic implants; g) no coffee intake before the evaluation. All the evaluations were carried out in the morning, between 6 and 8 am. The placement of four electrodes fixed in the right hemicorp of the individual being evaluated: in the hand, near the metacarpal phalangeal joint of the dorsal surface; in the wrist, between the distal prominences of the radius and ulna; in the foot, in the transverse arch of the upper surface; and in the ankle, between the medial and lateral malleoli (Letieri et al., 2019).

The skeletal muscle mass (SMM) was calculated using the equation of Lee et al. (2000) (Equation 1):

$$SMM\ (kg) = Htm^{*}\ (0.244^{*}BM) + (7.8^{*}Htm) + (6.6^{*}sex) - (0.098^{*}age) + (ethnicity - 3.3) \quad (1)$$

where:
Htm= Height (m);
BM= Body Mass (kg);
Sex: 1= men e 0= women;
ethnicity: 1.2= asian; 1.4= afro-descendants; 0= caucasian.

The value of SMM was used to calculate the muscle mass index (MMI), represented by the ratio between the SMM and height, in meters, squared *(MMI= SMM/Htm²)*.

The verification of muscle quantity was according to the EWGSOP, the parameters being the values < 20 kg for men < 15 kg for women (Cruz-Jentoft et al., 2019).

To evaluate muscle strength, the Handgrip Strength (HS) test was applied using a digital manual handgrip dynamometer (E-Clear®), which shows the values of the manual handgrip force in kg. The test was performed with the individual seated, with shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position, and the wrist between 0° and 30° of extension and 0° to 15° of ulnar deviation. The mean of 3 measurements in the dominant limb was used, with an interval of 60" in each measurement (Letieri et al., 2019). The cutting parameters recommended by EWGSOP were adopted, which consider the following values as sarcopenic: < 27 kg for men < 16 kg for women (Cruz-Jentoft et al., 2019).

The physical performance was evaluated through the Timed-Up-and-Go (TUG) test, which is considered appropriate for motor function assessment in relation to mobility (Cedervall et al., 2020). This test is based on the performance of the individual being affected by the reaction time, muscle strength of the lower limbs, balance and the ability to walk (Hsu et al., 2020). The TUG was performed considering the time spent for the elderly to get up from a chair without arms and walk a distance of three meters, making a 180º turn, returning and sitting in the same chair. For TUG performance analysis, according to EWGSOP (Cruz-Jentoft et al., 2019), the values ≥ 20" as a reference for low functional performance in older people.

Statistical analysis

Initially, a descriptive analysis of the data was performed to obtain the mean and standard deviation values. The data were categorised by gender. The normality of the data was verified by the Kolmogorov-Smirnov test, and after the identification of normality, the correlations between the variables were analysed by Pearson's Correlation Coefficient (r) The magnitude of the associations was classified as follows: trivial (r< 0.1), small (r= 0.1 to 0.3), moderate (r= 0.3 to 0.5), strong (r= 0.5 to 0.7), and robust (r= 0.7 to 0.9) (Furtado et al., 2019). Statistical significance was 95% or p< 0.05. Statistical analyses were performed in the Statistical Package for the Social Sciences (SPSS) software version 23 (Armonk, NY: IBM Corp, USA).

RESULTS

In general, the prevalence of sarcopenia was 3.6% of the sample.

Table 1 presents all mean values and standard deviations of variables collected from participants, both sex.

Table 2 presents the general results of the correlations for the functional ability, body composition, skeletal muscle mass and muscle mass index variables.

DISCUSSION

In this study, although not significant, it was possible to verify a strong and inverse correlation between age and HS in men and a weak and inverse correlation in women. In a study by Dodds et al. (2016), the authors found that as age progresses, people tend to have a reduction in manual grip strength and, generally, women have weaker HS compared to men. In a systematic review study with meta-analysis, it was observed that the highest manual grip strength seems to be a

Table 1. Body composition and functional variables of participants in the Baseline.

Variables	Sex	Mean	Standard Deviation
Age (years)	M (n= 12)	69.16	8.133
	W (n= 28)	67.96	6.238
Body Mass (kg)	M (n= 12)	68.50	7.151
	W (n= 28)	65.32	9.136
Height (m)	M (n= 12)	1.61	0.045
	W (n= 28)	1.54	0.067
BMI (kg/m2)	M (n= 12)	26.29	2.906
	W (n= 28)	27.43	4.562
FFM (kg)	M (n= 12)	44.32	4.723
	W (n= 28)	38.71	3.908
FM (kg)	M (n= 12)	35.11	5.465
	W (n= 28)	40.22	5.206
FFM (%)	M (n= 12)	64.88	5.465
	W (n= 28)	59.77	5.206
FM (%)	M (n= 12)	35.11	5.465
	W (n= 28)	40.22	5.206
SMM (kg)	M (n= 12)	27.23	2.012
	W (n= 28)	19.45	2.424
MMI (kg/m2)	M (n= 12)	10.44	0.693
	W (n= 28)	8.14	1.074
TUG test (s)	M (n= 12)	6.70	1.963
	W (n= 28)	6.90	1.691
HS (kg)	M (n= 12)	29.27	5.719
	W (n= 28)	19.37	4.982

M: Men; W: Women; BMI: Body Mass Index; FFM: Free Fat Mass; FM: Fat Mass; SMM: Skeletal Muscle Mass; MMI: Muscle Mass Index; TUG: Timed-And-Up-Go; HS: Handgrip Strength.

Table 2. Correlation values of the variables.

		1	2	3	4	5	6
	AGE						
1	M	---					
	W	---					
	HS						
2	M	-0.531	---				
	W	-0.268	---				
	TUG						
3	M	0.733**	-0.713**	---			
	W	0.364	-0.322	---			
	SMM						
4	M	-0.375	0.254	-0.308	---		
	W	-0.316	0.276	0.189	---		
	MMI						
5	M	-0.064	0.081	-0.116	0.664*	---	
	W	-0.183	0.131	0.218	0.749**	---	
	FFM						
6	M	-0.247	0.146	-0.128	0.829**	0.300	---
	W	-0.121	0.394*	0.044	0.841**	0.493**	---
	FM						
7	M	0.378	-0.138	0.172	0.439	0.814**	0.38
	W	0.037	0.012	0.415*	0.795**	0.905**	0.487**

*p< 0.05; **p< 0.001; in each variable the values of (r) are expressed; M: Men; W: Women; HS: Handgrip Strength; TUG: Timed-Up-and-Go; SMM: Skeletal Muscle Mass; MMI: Muscle Mass Index; FFM: Fat Free Mass in kg; FM: Fat Mass in kg.

protective factor for the decline in cognition, mobility, functional status and mortality in elderly populations (Rijk et al., 2016). In a research conducted by Musalek and Kirchengast (2017), it was found that HS reflects a variety of indices of physical function, and this is considered an important indicator of health and quality of life in the elderly. In this way, it can be said that HS can help predict physical disability, morbidity and mortality (Sayer and Kirkwood, 2015). Cruz-Jentoft et al. (2019) state that muscle strength is a relevant predictor of poor outcomes in people with functional limitations. Thus, HS can be an important tool in clinical practice to identify subjects with poor mobility.

Regarding the physical performance verified in the TUG test associated with age, it was observed in this study a high correlation in men and weak in women. Thus, it can be stated that in the sample of the present study, participants of higher ages performed the test for the longest time. The findings of the physical performance of the participants in this study corroborate with the Soares et al. (2019) study, in which the authors state that ageing is accompanied by a natural physical decline, affecting, above all, muscle strength/mass, and age is, therefore, a significant factor in such changes. Thus, the loss of muscle mass with the ageing process is accompanied by a decrease in functional independence, especially in activities that require strength from the lower limbs, such as: sitting, lifting, walking, and going up and down stairs (Sato et al., 2020). In the study of Binotto et al. (2018), the authors point out that the reduction of walking speed in elderly communities is one of the main pillars of phenotypes of fragility that is strongly related to sarcopenia. Furthermore, a moderate and significant correlation was observed in women between fat percentage and TUG. Souza Saraiva et al. (2019) state that obese people, with reduced physical function and less independence in daily life, are more likely to have low physical performance.

Although age has been negatively correlated with SMM of participants in our study, it is important to understand that the loss of muscle mass can be caused by several factors, including diseases, decreased calorie intake, reduced blood flow to the muscles, mitochondrial dysfunction, decreased anabolic hormone levels, increased pro-inflammatory cytokines, among others. However, disuse associated with ageing is the main underlying cause (Colón et al., 2018).

The results observed between FFM and SMM showed positive correlational values. It is worth noting that elderly people with lower muscle mass tend to have a prevalence of physical disability, decreasing their fitness and physical performance, and may influence their autonomy, well-being and quality of life (Thaweechotiphat et al., 2021). In the study by Costa et al. (2018), it was pointed out the importance of physical exercise programs aimed at the elderly population, moreover, it was verified a positive association between quality of life and the practice of exercises for this group.

It is important to note that sarcopenia is a multifactorial process. The HS and TUG indicators are tools that help in the assessment of clinical practice, but other factors of aging that impact Sarcopenia should be observed, such as age, gender, geography, and individual risk factors (Moreira et al., 2019).

This study has some limitations. First, the diagnosis of sarcopenia was obtained by BIA and HS, which although it presents good sensitivity and specificity, does not measure muscle mass and strength directly, but derives an estimate of muscle mass based on the conductivity of electrical energy of the entire body, which can be influenced by the state of hydration of the patient, and is less accurate than other reference methods (gold standard) in the literature, such as double energy radiological absorption (DEXA) and isokinetic dynamometry. Secondly, the study sample was relatively

small, which makes it difficult to extrapolate the results to other populations.

The main strengths of the study were based on the nature, the methods used to obtain the parameters and the ease of access to the target population. In addition, the use of the updated reference for the diagnosis and classification of sarcopenia indices may serve as an academic-scientific subsidy for future studies.

CONCLUSION

In this study, the prevalence of sarcopenia was 3.6% of the total sample. In the variable skeletal muscle mass, weak associations were verified inversely proportional to age, both in men and in women. Regarding manual grip strength, a moderate and inversely proportional association was observed in men, weak and also inversely proportional in women. In functional performance, associations between test time and age were verified, being strong in men and weak in women.

As the population ages, the need to study the factors associated with sarcopenia increases, since better and more effective prevention and treatment strategies and interventions can be developed to minimise disability and optimise the independence of the elderly, thus improving their quality of life.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.25208

Perceived motor competence in children from two different perspectives: children and family

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ABSTRACT

Perceived motor competence (PMC) is fundamental in early childhood because of its relationship with motor competence (MC) development. Therefore, the aims of the present research were: to analyse children's PMC from their own and their parents' perspectives, to test for gender differences, and to assess the possible association between children's PMC and their parents' perception. The sample consisted of 22 children in the third kindergarten year (*M*= 5.27, *SD*= 0.45) and their respective parents. The results showed higher scores for girls in the scales' patterns, except for object control. The girls also scored higher on all dimensions from parents, with significant differences in parents' perception of fine motor skills in their favour. No relevant data were found on the relationship between the children's PMC and parents´ perception. It can be concluded that girls' perception is higher than boys' and that girls are perceived as more competent by their parents. However, the lack of correspondence between children's and parents' perceptions makes it necessary to be cautious and consider that participants may not be accurate in their assessments due to their age.

KEYWORDS: self-perception; foundational motor skills; preschool; gender; parents' perception.

INTRODUCTION

In recent years, numerous studies have determined that motor competence (MC), understood as the ability to combine and execute movement skills, requires emotional regulation, perceptual skills and a high degree of knowledge and understanding of the task to be performed (Rudd et al., 2020), and perceived motor competence (PMC) are closely related in healthy children, adolescents and adults, as well as with Physical Activity (PA) and self-concept (De Meester et al., 2020; Jaakkola et al., 2019).

PMC, defined as a person's perceptions, awareness and beliefs about their actual movement abilities (Robinson et al., 2015), is identified by Stodden et al. (2008) as one of the determinants of motor development and MC, which encourage children to participate and persist until mastery of a skill is achieved, in turn fostering adherence to PA. Thus, PMC can be considered a mediating factor between MC and PA, being also an important predictor of PA levels (Babic et al., 2014).

By contrast, children with low PMC seem more likely to avoid PA settings because they do not feel competent (Stodden et al., 2008). In this sense, in the study conducted by Estevan et al. (2021c), which aimed to analyse the PMC and MC of children aged 4–9 years and their PA, it was concluded that children with high values of MC and PMC were more likely to participate in activities. Therefore, it is vital to know a person's competence and to be able to influence it from early childhood, making children aware of their limits, but above all of their possibilities, as this issue can affect their life and well-being (Barnett et al., 2009).

It seems clear that what others think of oneself, and how it is conveyed or demonstrated, could affect one's abilities in some way by stopping certain actions due to fear of failure or lack of confidence in performing them (Venetsanou & Kambas, 2010). In this sense, in children aged 5–8 years, feedback from parents or teachers is very important, as they consider them important sources of information to judge one's skills (Weiss & Amorose, 2005), and therefore, it could also affect their PMC.

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Conflict of interest: nothing to declare. Funding: University Teacher Training Contract (FPU18/03339), of the Training and Mobility sub-programmers within the State Program for the Promotion of Talent and its Employability, within the framework of the State Plan for Scientific and Technical Research and Innovation 2017-2020.
Received: 07/30/2021. Accepted: 08/30/2022.

Considering that families are the first agent of children's socialisation and that parents play an important role in their children's motor development, they have been identified as a fundamental source of information regarding their children's MC (Estevan et al., 2018). Their perceptions and beliefs can be a key element in promoting the practice of physical-sport activities (Corbí et al., 2018).

Variations in parenting conditions and practices, such as whether parents provide opportunities for action, are known to be significant factors that appear to influence children's motor development during childhood (Venetsanou & Kambas, 2010). However, parents, as a consequence of subjective factors such as their character, their parenting style, or their feelings of inadequacy related to the practice of certain physical activities, may limit their children in learning experiences (Cavalcante Neto et al., 2018), avoiding exposing them to situations that they consider complex. Another reason why parents may deprive their children of positive experiences is because of a possible negative perception of their children's abilities. This lack of exposure, regardless of the cause, can make it difficult for parents to observe certain skills, making it more difficult to objectively assess their children's motor behaviour (VanDerworp & Ryan, 2016).

What is clear is that society also plays a relevant role in the study of MC. Ecosystem theory for understanding MC points to interesting correlations between child, family, and environment, suggesting that motor development is influenced by parental support and the child's immediate environment (Barnett et al., 2013). In this sense, gender differences can be attributed to stereotypical practices in the school and home environments that support PA and play patterns that facilitate the development of specific movement skills (Djordjević, 2021). For example, boys predominantly engage in motor activities involving object control during infancy, while girls prefer activities that predominantly involve fine motor skills and are more verbal than motor (Djordjević, 2021), which may influence children's and parents' PMC.

Therefore, it is essential to know children's PMC and their parents' perceptions to design appropriate learning environments so that they can successfully engage in different learning activities, both in and out of the school context, which is fundamental for their development (Brian et al., 2019). Thus, the main objectives of the present study were to analyse children's PMC from their own and their parents' perspectives, to test for gender differences, and to assess the possible association between children's PMC and their parents' perception.

METHOD

Study design

A cross-sectional study was designed with a descriptive strategy to describe a situation as it occurs, without any manipulation of variables. Participants were selected by causal sampling due to their accessibility.

Participants

This study included a natural group composed of 22 students (12 girls and 10 boys) with a mean age of 5.27 years (*SD*= 0.45). The students belonged to the third year of the Second cycle of preschool education in a public school in Bolaños de Calatrava (Castilla–La Mancha, Spain). In addition, their families also participated, a total of 20 mothers and 2 fathers, who, according to the data provided by the school, belonged to a middle socio-economic class. This research was conducted in accordance with the Declaration of Helsinki. All of the participants described above concluded the study.

Instruments

Pictorial Scale of Perceived Motor Skill Competence for Children (PMSC) (Barnett et al., 2015), whose reliability was studied in the Spanish context by Estevan et al. (2019). This questionnaire consists of 13 items subdivided into two subscales of motor skills and is designed for use with children aged 4–9 years. The first subscale assesses 6 locomotor patterns (running, galloping, hopping, jumping, skipping, sliding and striding). The second subscale assesses 7 control object patterns (over-the-shoulder throwing, under-the-shoulder throwing, catching, kicking, batting, bouncing and hitting) and, finally, the gross motor performance resulting from adding the scores obtained in two previous scales. The scale was applied individually to each participant. Participants were shown pictures with two drawings of a boy or a girl performing an action, and they were asked to select the picture that most resembled the one they had drawn. Underneath the chosen picture, there were two circles, one large and one small. In this way, the child chooses the large circle if the picture is very similar, or the small circle if it is not so similar to him/her. This ranking system results in four possible levels of competence for each skill. The scores for each skill were summed across the object control (with a possible range of scores for each subscale of 6–28) and locomotor subscales (with a possible range of scores for each subscale of 6–24), and the 13 skills (range of scores 12–52). The higher the score, the higher the perceived competence.

Pictorial Scale of Perceived Movement Skill Competence in Stability for Children (PMSC_Stability) (Estevan et al., 2021b). This questionnaire consists of 7 items and is designed for children

aged 4 to 9 years. The scale assesses patterns where the stability of the individual is crucial (balance, jumping and moving over surfaces). The scale was applied individually to each participant. Participants were shown pictures with two drawings of a boy or a girl performing an action, and they were asked to select the picture that most resembled the one they had drawn. Underneath the chosen picture, there were two circles, one large and one small. In this way, the child chooses the large circle if the picture is very similar, or the small circle if it is not so similar to him/her. The scores for each skill are added together, with a range of scores from 7 to 28 points. The higher the score, the higher the perceived competence in stability skills.

Developmental Coordination Disorder Questionnaire, 2007 (DCDQ´07), Spanish version (Salamanca et al., 2012). The DCDQ'07 is a parental questionnaire consisting of 15 items that are grouped into three subscales: control during movement (6 items), fine motor/handwriting (4 items), and general coordination (5 items). In this instrument, parents assess their child's performance in selected motor activities in comparison with other children of the same age, using a five–point Likert–type scale (1= *not at all like other children*, 2= *a little like other children*, 3= *moderately like other children*, 4= *very like other children,* and 5= *extremely like other children*. The ranges covered by the instrument indicate that parents suspect that their children may have movement problems (scores between 15–46) or, on the contrary, that parents do not detect movement problems (47–75).

Procedure

Before starting the study, and after obtaining necessary permissions from the school management and teachers involved, the families were given an informed consent form so that they could authorise their children to participate in the research and, in turn, to participate themselves. This document informed about the objective of the research, as well as the procedure to be followed. The DCDQ'07 questionnaire (Salamanca et al., 2012) and the socio-demographic questionnaire, to be completed by a family member, were attached to each consent form.

Once the information had been collected, together with the consents, approximately one week after the documents had been handed over, the implementation of the pictorical scales began for each child participant. Both scales were applied individually and to all participants since all confirmations were received from the families.

In order to present the scales to the students, a table was set up in the regular classroom away from the rest of the classmates to ensure that they could not influence their answers. The drawings were presented by asking which boy or girl they resembled when they performed these actions. If the answer was accurate, it was noted down. By contrast, if there was any doubt about the drawing, a practical example was depicted, and the action was explained in more detail with examples with which they were familiar.

The approximate time for data collection with each participant was 15 minutes, and a total time of two weeks was invested in data collection after drawing up a timetable so as not to disrupt the normal course of the classes.

Data analysis

Data analysis was carried out with the *Statistical Package for Social Science (version 24)*. Normality and homoscedasticity were obtained through the Shapiro-Wilk (n< 50 cases) and Levene statistics, respectively, and resulted in a sample that did not meet the criteria for normality. First, descriptive statistics were calculated for both groups, and then the Mann-Whitney U test was calculated to analyse the differences between genders in each tool used. The effect size was considered using the r statistic, using the formula $r= Z/\sqrt{N}$ (N= number of measurements), and interpreted according to the scale proposed by Coolican (2009) (small 0.10, medium 0.30 or large 0.50). On the other hand, Spearman's correlation coefficients were calculated between the scores obtained in the dimensions of the three instruments used, and comparative graphs were made with the scores obtained in each of them.

RESULTS

The objectives of the present study were to analyse the PMC of children from their perspective and from the family perspective, to check if there were differences between genders, and to assess the possible association between children's PMC and their parents' perception. In order to respond to these objectives, the results will be presented in relation to the instruments used.

Children's PMC

Table 1 shows the descriptive statistics of the measures in the PMC through the instruments for assessing the perception

Table 1. Means and standard deviation of the scores obtained on the Perceived Movement Skill Competence and the newly developed Stability.

Dimensión	Total	Boys	Girls
	M *(SD)*	M *(SD)*	M *(SD)*
Locomotion	20.45 (3.01)	20.30 (2.79)	20.58 (3.31)
Object control	22.18 (4.45)	22.30 (4.90)	22.08 (4.27)
Gross motor	42.54 (6.95)	42.60 (7.24)	42.67 (7.02)
Stability	20.77 (4.95)	19.40 (5.62)	21.92 (4.23)

M: Mean; *SD*: Standard deviation.

of motor skills and stability skills, both in the total sample and differentiating by gender.

No statistically significant differences were found, for $p< 0.05$ in relation to gender, in any of the dimensions of the PMSC. However, in the case of girls, there was a tendency to have a higher score in PMC in locomotion and gross motor, and generally, with lower standard deviation compared to boys. With respect to the object control dimension, boys tended to have a higher mean score than their female peers but with a higher standard deviation (Figure 1). These differences would probably have been significant if a larger sample size had been available, as it could increase the power of the statistical test used.

Similarly, no statistically significant differences were found for $p< 0.05$ in relation to gender on the PMSC_Stability. However, girls had a higher mean and lower standard deviation score than boys, suggesting that they perceive themselves as more competent in stability and balance activities than their peers (Figure 1).

Parents' perception

Table 2 shows the descriptive statistics of parents' perception, both in the total sample and differentiating according to the gender of their children.

Table 2. Means and standar deviation of Perceived Motor Competence by the parents DCDQ'07.

	Total	Boys	Girls	*p-value*
	M *(SD)*	M *(SD)*	M *(SD)*	
Control during movement	24.23 (3.54)	23.00 (3.24)	24.50 (3.89)	0.76
Fine motor / handwriting	17.05 (2.68)	15.70 (2.75)	18.17 (2.12)	0.02
General coordination	20.68 (2.49)	19.70 (2.62)	21.50 (2.15)	0.16
DCDQ'07 Total	62.68 (7.40)	60.90 (7.93)	64.17 (6.92)	0.42

M: Mean; *SD*: Standar deviation.

Statistically significant differences for $p< 0.05$ were found in fine motor/handwriting dimension of the DCDQ'07 ($Z= -2.37$, $p= 0.02$) and an effect size $r= 0.50$, indicating a large effect (Coolican, 2009), i.e., only in this dimension were significant differences found between boys and girls according to parents' perception. As for the control during movement dimension, boys scored lower than their female peers, which means that their parents perceive them as less competent in movement control. Similarly, in general coordination, boys scored lower than girls. Therefore, although there are no statistically significant differences, there is a certain tendency among fathers to overestimate the MC of their daughters (Figure 2).

Comparison between children's PMC and parents' perception

The following objective was to identify the possible association between children's PMC and their parents' perception. In order to answer this objective, Spearman correlations and comparative graphs of the instruments used were carried out. The following tables (Tables 3 and 4) show the correlations between dimensions of the three instruments used (two for children and one for parents), differentiating by gender.

In terms of the results, no correlations were observed between dimensions of the scales used in the children's perception (PMSC and PMSC_Stability) and the DCDQ'07. However, there is an association between the PMSC_Stability and the gross motor dimension of the PMSC, being a positive and significant correlation. This indicates that may exist a linear relationship between these variables, i.e., an increase in stability scores corresponds to an increase in gross motor skills scores, and vice versa.

Observing the results, no correlations were found between the dimensions of the scales used in the children's perception and the DCDQ'07. However, there were significant and positive associations between all the dimensions of PMSC and PMSC_Stability, which means that an increase in scores on

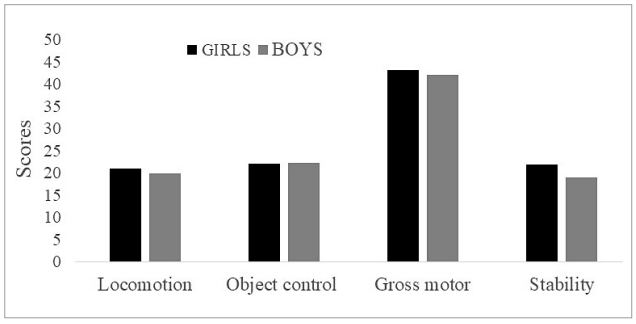

Figure 1. Graph the scores obtained on the Perceived Movement Skill Competence and the newly developed Stability.

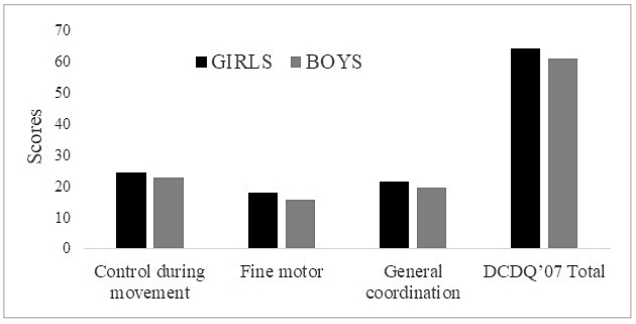

Figure 2. Graph the scores obtained on the Perceived Motor Competence by the parents DCDQ'07.

Table 3. Correlations and confidence intervals (95%) between instruments used for boys.

Correlation	R	95%CI Low	95%CI High
1-2	0.75*	0.20	0.93
1-3	0.89*	0.58	0.97
1-4	0.62	-0.04	0.89
1-5	0.35	-0.38	0.79
1-6	-0.21	-0.47	-0.75
1-7	-0.01	-0.64	0.62
1-8	-0.10	-0.68	0.56
2-3	0.96**	0.85	0.99
2-4	0.58	-0.104	0.88
2-5	0.35	-0.37	0.79
2-6	0.02	-0.62	0.64
2-7	0.15	-0.70	0.54
2-8	- 0.05	-0.66	0.59
3-4	0.63*	-0.04	0.89
3-5	0.37	-0.36	0.80
3-6	-0.06	-0.66	0.59
3-7	0.09	-0.57	0.68
3-8	-0.008	-0.67	0.58
4-5	0.24	-0.41	0.71
4-6	-0.25	-0.69	0.43
4-7	-0.05	-0.68	0.42
4-8	-0.05	-0.65	0.39
5-6	0.60	-0.036	0.85
5-7	0.80**	0.44	0.95
5-8	0.73**	0.27	0.92
6-7	0.83**	0.45	0.94
6-8	0.88**	0.52	0.95
7-8	0.89**	0.66	0.97

1: Locomotion; 2: Object control; 3: Gross motor; 4: Stability; 5: Control during movement; 6: Fine motor / handwriting; 7: General coordination; 8: DCDQ'07 Total; *p< 0.05; **p< 0.01; 95%CI: 95% confidence interval.

Table 4. Correlations confidence intervals (95%) between instruments used for girls.

Correlation	r	95%CI Low	95%CI High
1-2	0.70**	0.19	0.90
1-3	0.90**	0.66	0.97
1-4	0.75**	0.29	0.92
1-5	0.44	-0.19	0.80
1-6	0.07	-0.67	0.51
1-7	0.56	-00.4	0.85
1-8	0.45	-0.18	0.81
2-3	0.94**	0.78	0.98
2-4	0.82**	0.45	0.95
2-5	0.10	-0.50	0.64
2-6	-0.20	-0.69	0.43
2-7	0.10	0.5	0.64
2-8	0.02	-0.56	0.58
3-4	0.85**	0.52	0.95
3-5	0.27	-0.37	0.73
3-6	-0.08	-0.63	0.52
3-7	0.33	-0.31	0.75
3-8	0.22	-0.42	0.69
4-5	0.13	-0.48	0.68
4-6	0.02	-0.56	0.58
4-7	0.21	-0.42	0.69
4-8	0.14	-0.47	0.66
5-6	0.45	-0.18	0.80
5-7	0.74**	-0.27	0.92
5-8	0.93**	0.76	0.98
6-7	0.39	-0.25	0.78
6-8	0.68*	0.15	0.89
7-8	0.85**	0.53	0.95

1: Locomotion; 2: Object control; 3: Gross motor; 4: Stability; 5: Control during movement; 6: Fine motor / handwriting; 7: General coordination; 8: DCDQ'07 Total; *p< 0.05; **p< 0.01; 95%CI: 95% confidence interval.

any dimension of one of this scale has a significant probability of matching an increase on the other, and the same in the opposite direction.

The graphs of the scores obtained in the PMSC and PMSC_Stability and the DCDQ '07, differentiated by sex, are shown below (Figures 3 and 4).

Considering the results obtained in the PMSC, whose scores range between 13 and 52 points, participants were very close to the maximum score established in the instrument, with a mean of 42.60. As for the DCDQ'07, the ranges contemplated by the instrument were: the first range in which parents suspect that their children may have movement problems (15–46 points), the second range in which parents do not detect movement problems (47–75), range in which the children in the present study are found, with a mean of 60.90.

Analysing individual cases, it was observed that participant nº 7 obtained a score of 64 in the DCDQ'07, which indicates that their parents do not perceive him as having movement problems, however, the child on the PMSC and PMSC_Stability scored 28 and 9 points respectively, very close to the minimum of the respective scales. Furthermore, this child showed poor motor performance in the physical–sports

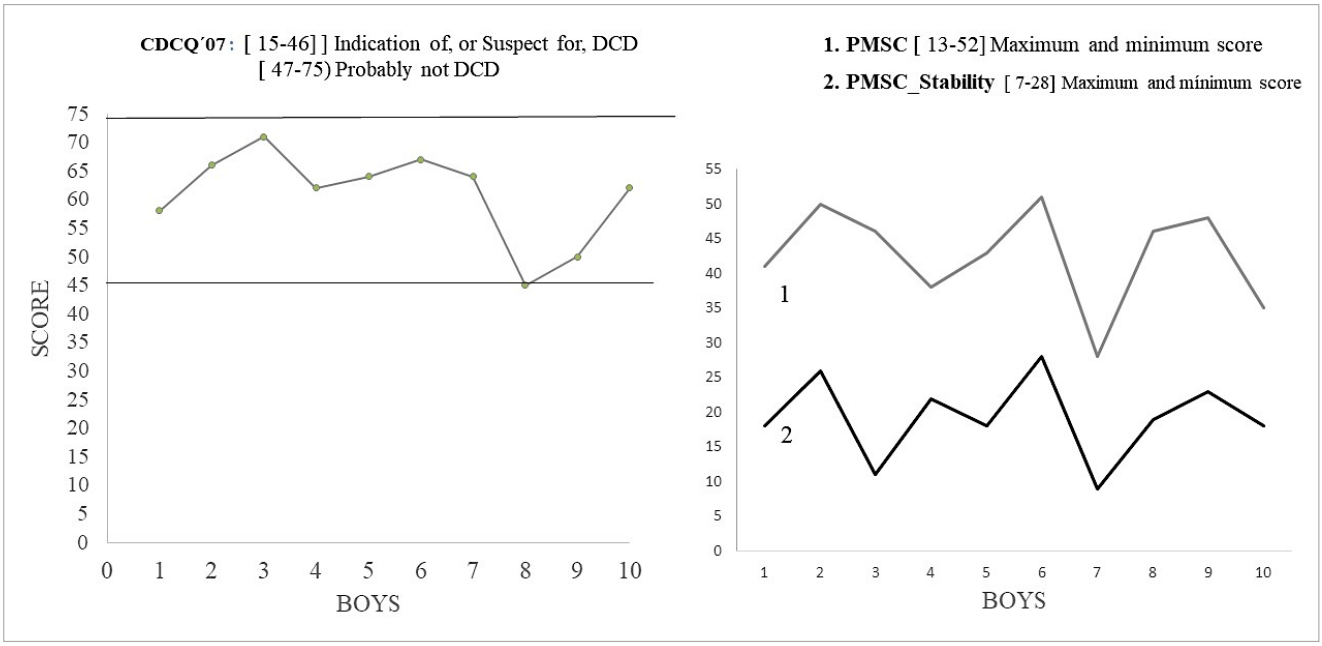

Figure 3. Graphs of the scores obtained in the PMSC, PMSC_Stability and the DCDQ'07. Boys.

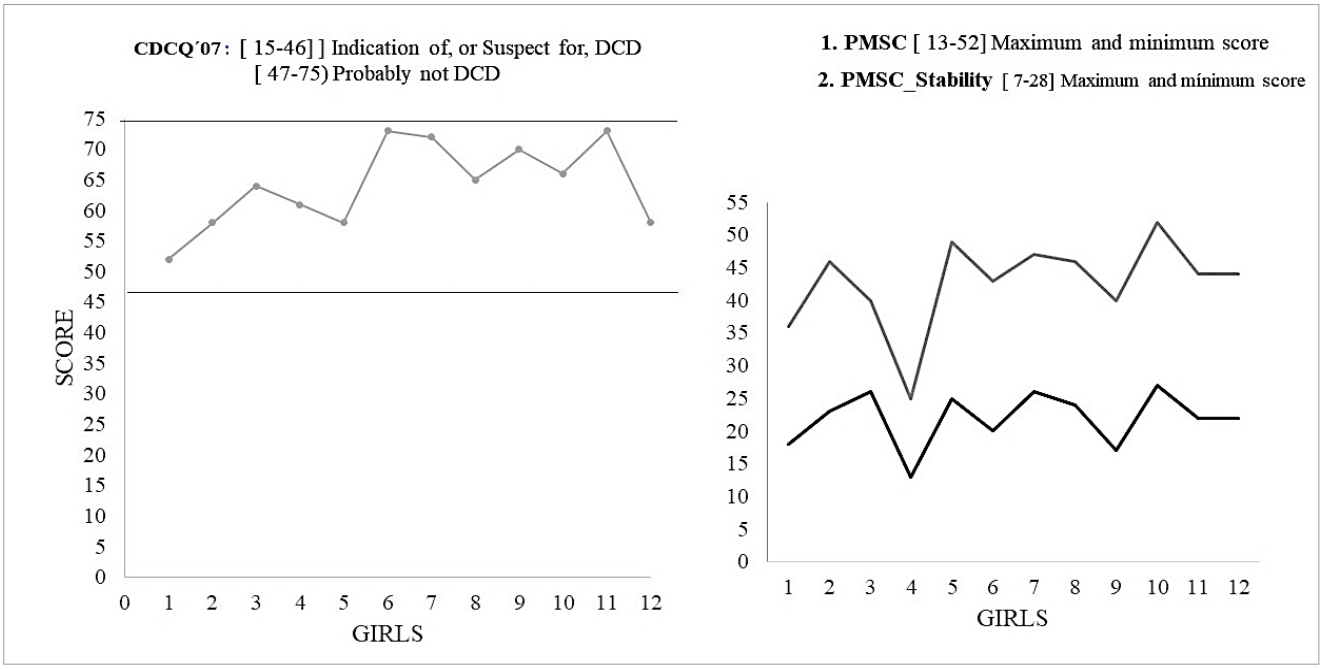

Figure 4. Graphs of the scores obtained in the PMSC, PMSC_Stability and the DCDQ'07. Girls.

activities; in fact, he did not perform running and jumping patterns in an age–appropriate manner.

Participant nº 8 scored 45 points in the DCDQ'07, which indicates that their parents perceive him as having movement problems, however, the child on the PMSC and PMSC_Stability scored 46 points and 19, respectively, figures close to the maximum score. It should be noted that the child was being evaluated for showing signs of Attention Deficit Hyperactivity Disorder (ADHD), and he showed disruptive behaviour in class.

On the other hand, participant nº 4 obtained a score of 61 on the DCDQ'07, which indicates that their parents do not perceive her as having movement problems, however, she showed a low PMC because she scored 25 points on

the PMSC and 13 on the PMSC_Stability. She was a very shy child who normally interacted with the same group of girls, showing problems relating to the rest of the students.

DISCUSSION

The main objectives of the present study were to analyse children's PMC from their perspective and from their parent's perspective, to check whether there were differences between genders, and to identify the possible association between children's PMC and their parents' perception. The data have shown that the participants, in general, perceive themselves as competent on the motor skills scale and on the stability scale. The data also show that parents perceive their children to have a good MC, except in some cases. These results are optimistic in part, as it has been shown that social support mediates between MC, PMC and PA (Estevan et al., 2021c), so in order to promote children's participation in PA, it is essential to know how they perceive themselves and how they are perceived by their parents. However, the fact that children are perceived as more or less competent than they actually are by their parents may condition their practice so that they are exposed to environments that are not adapted to their abilities.

Children's motor skill perception (PMSC)

The data showed that participants perceived themselves to be competent on the motor skills scale, in general, which is very encouraging considering the fundamental role that PMC plays in motor development and adherence to PA (Stodden et al., 2008). However, it should be noted that the role of PMC becomes more evident as children grow older and their cognition develops (Capio & Eguia, 2020) so that these types of scales should also be applied in higher grades as children will show higher cognitive abilities and greater accuracy in the assessment of their own competence.

Regarding gender difference, the results indicated that girls show a certain tendency to perceive themselves as having a higher PMC than boys in locomotor patterns and in the gross motor dimension, with boys being considered more competent in object control patterns. These results are in line with Estevan et al. (2018); Noordstar et al. (2016); Salazar and Jiménez-Díaz (2020), who found significant differences in object control patterns between boys and girls, with boys scoring higher (Djordjević, 2021; Rodríguez-Negro et al., 2021). Likewise, they coincide with the study by Brian et al. (2019), where girls excelled in motor skills such as galloping and boys in object control. However, there are other studies in which boys obtained higher mean scores than girls for all motor skill patterns, which are equalised at the age of five years (Honrubia-Montesinos et al., 2021), or other in which gender differences were found in favour of girls at ages three and four, but not in the total test or balance at ages five and six (Kokštejn et al., 2017).

The fact that the boys in the present study, like those mentioned above, obtained higher scores in object control (Djordjević, 2021; Rodríguez-Negro et al., 2021) may be due to the fact that culturally children are related to sports that involve object control such as football, handball and basketball, and they themselves perceive the effort made in practice as mastery of the task (Stodden et al., 2008). On the other hand, differences in object control, in favour of boys, have been found to remain relatively stable over time (Noordstar et al., 2016). These data are particularly relevant because MC can predict participation in PA, with those who score higher on object control being more likely to become active adolescents (Barnett et al., 2009), and children with low object control skills will be more likely to engage in unhealthy lifestyles (Estevan et al., 2021c).

Regarding the results of the locomotor and gross motor in this study, those in which girls perceive themselves to be more competent than their peers are not congruent with the results obtained in other studies that reported the same data in both genders (Noordstar et al., 2016) or higher in boys than girls (Estevan et al., 2019). These differences in our study may be due to the context and the type of play that girls engage in at school, after–school activities and leisure areas.

Children's stability perception (PMSC_Stability)

The data from this research showed that children generally perceive themselves to be proficient in stability skills (balance, jumping and moving on surfaces). The fact that participants feel competent in this type of skill is really important, as balance is an essential requirement for adequate performance in many daily activities (De Oliveira et al., 2017). Moreover, thanks to its improvement, other more complex skills emerge, such as object control (Fort-Vanmeerhaeghe et al., 2017). Feeling competent, children will participate without fear in games involving these skills, providing opportunities to develop them.

In relation to the gender difference, although not significant in this study, girls perceived themselves as more competent than boys. Regarding the balance results, there are several research in which girls obtain better scores than their peers when the ability is assessed objectively (Djordjević, 2021). For example, in the study by Gronholt et al. (2014), girls

obtained higher scores in the two balance subtests assessed. Likewise, in the research by Rodríguez-Negro and Yanci (2019), girls showed better static balance than their peers, although no significant differences were observed in dynamic balance, which was observed in a later study (Rodríguez-Negro et al., 2021). Along the same lines, in the study by Amador-Ruiz et al. (2018), in which they assessed MC in participants aged 4–6 years, girls achieved better results in balance, showing significant differences in the 6-year-old group. In contrast, Luna and Luarte (2010), with 6-year-old children, observed gender differences in balance, in this case in favour of boys.

The fact that girls perceive themselves to be more competent in terms of stability skills could be due to the activities or sports they normally practice in their daily lives, such as rope jump, dance, rhythmic gymnastics or skating, unlike boys who usually practice sports that require the handling of an object, which may be the reason for their greater competence in manipulating objects compared to girls (Álvarez et al., 2017). In summary, the data have shown that participants perceive themselves as competent in motor and stability skills. Although differences were observed between boys' and girls' scores, these were not significant. These differences in the PMC may be due to sports preferences (Álvarez et al., 2017).

Age is another important variable in children's assessment of their own MC, which can affect PA practice. Perception changes over time, i.e., children modify the idea they have about their abilities, generally considering themselves more competent and being more accurate in their assessments as they get older (Estevan et al., 2021a). In this sense, Bardid et al. (2016) found that 8-year-old children with low PMC (in this case, athletic competence) were less motivated for sport than children with high perception, even if they had high MC, so up to eight years of age they do not seem to be able to report self-judgements accurately (Estevan et al., 2018).

Parents' developmental coordination perceptions (DCDQ'07)

The data show that parents perceive their children to have good MC, which is encouraging, as both parents and PE teachers are considered to be able to report on children's MC to a much better degree than they can themselves (Estevan et al., 2018). However, as discussed in the introduction, parents may tend to overestimate their children, contrary to the parents participating in the Cordovil et al. (2010) study, or not to expose them to learning experiences that they feel they would not be able to complete successfully, so that opportunities for observation of the skills assessed in the DCDQ'07 may be greatly reduced. It would therefore be interesting to contrast the data obtained with the perception of the reference teacher, as it seems that they report better on the MC of children (Estevan et al., 2018).

In terms of possible gender differences, girls obtained better mean scores on all dimensions compared to boys, which means that their families perceive them as more competent. These results are consistent with other studies in which significant differences were found in favour of girls on the DCDQ'07 total score (Rivard et al., 2014).

When analysing the results by dimensions, these differences were not significant except for the fine motor/handwriting dimension, as in the study by Montes-Montes et al. (2020), where significantly higher scores were found for girls in fine motor dimension. According to these authors, such results could be due to cultural factors and usual daily activities (Montes-Montes et al., 2020).

Comparison of scores and associations between the instruments used

As this paper has tried to explain, children and other social agents, such as parents and educators, can provide valuable information about children's MC (Estevan et al., 2018). After analysing the results of this study and comparing children's PMC with their parents' perception, no significant associations were observed between the dimensions of the instruments used. This may be due to the fact that, although the dimensions of both instruments are very similar, they are not perfectly aligned or because parents do not have an acute perception of their child's motor competence (Cordovil et al., 2010). It may also be due to the fact that some of the assessments are not accurate, as no objective MC assessment instrument has been used.

Likewise, positive and significant correlations have been obtained between the PMSC and PMSC_Stability scale, indicating the relationship between balance and motor skills. This relationship is of utmost importance since balance is the basis of any motor activity, the primary basis of all general dynamic coordination (Luna & Luarte, 2010).

In the detailed analysis of cases, it was observed that one of the participants (8) was diagnosed with possible ADHD and obtained a low score in the DCDQ'07, which indicated that his parents perceived him as having movement problems. This fact may be due to the fact that when there is a previous health–related diagnosis by the specialist, there is a more objective perception of movement by the parents (Cavalcante Neto et al., 2018). However, the child perceived himself as competent, and this could be used to involve him/her in more individualised stimulation in order to promote appropriate motor development.

On the other hand, two other participants (7 and 4) obtained high scores on the DCDQ'07, i.e., their parents did not perceive them as having movement problems. Still, the children perceived themselves as having low MC, with a score close to the minimum. In this case, this may be due to the parents' overestimation of motor skills, be it due to the lack of objective observation of these skills or by low exposure to physical and sporting activities, as suggested by Cordovil et al. (2010), referring to the greater precision of mothers' assessment of their children's competence due to greater involvement at an earlier age.

Finally, regarding the limitations of this study, one of the problems encountered was the instrument of PMC used since, despite being validated in the Spanish context, one of the skills is not very specific (batting), and the answers should be taken with caution. On the other hand, the main problem of this research that should be pointed out was the non–use an objective instrument to measure MC. Therefore, for future research, it would be advisable to use two aligned scales to assess both MC and PMC, as well as to incorporate teachers' assessment of participants' MC.

CONCLUSION

The results of this research indicate that there are no significant gender differences between PMC, except in object control, where boys stand out, and stability skills, where higher scores are observed in girls. In relation to parents' perception, girls obtain higher scores in all dimensions, showing significant differences in fine motor skills compared to their peers. Likewise, there are no relationships between children's PMC and their parents' perception. It is, therefore, essential for parents to involve their children in motor activities, playing with them or even observing them playing.

It can be concluded that differences could be due to the PA and sports practised by the children, which are culturally more accepted for a certain gender, thus developing the prevailing motor capacities. Therefore, it is essential to treat all children equally so that they have the same possibilities to practice and are not directed to a specific type of sport based on their gender, and to encourage parents to be more involved with their children in play and sportive activities, as well as to encourage PA among young people as a resource for spending more time with the family.

ACKNOWLEDGEMENTS

To the school, children and families involved.

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ARTIGO ORIGINAL

https://doi.org/10.6063/motricidade.25930

Influência da aptidão física na perceção de bem-estar físico e qualidade de vida em indivíduos com Dificuldade Intelectual e Desenvolvimental

Influence of physical fitness on the perception of physical well-being and quality of life in individuals with Intellectual Disability

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RESUMO

As capacidades físicas, a saúde e a qualidade de vida (QV) podem ser melhoradas através do exercício físico em indivíduos com Dificuldade Intelectual e Desenvolvimental (DID). O presente estudo teve como objetivo verificar a associação da aptidão física com a perceção de "Bem-Estar Físico" e da QV em indivíduos com DID. Avaliaram-se 16 indivíduos com DID por bioimpedância, testes funcionais ("6 minutos a andar" (6MIN), "agilidade" (TUG), levantar/sentar da cadeira (L/) e arremesso de bola medicinal) e dinamómetro isocinético (flexão e extensão dos membros inferiores [MI]). Utilizou-se a Escala Pessoal de Resultados (EPR), para medir o "Bem-Estar Físico" e a "QV Total". Foram aplicadas correlações de Pearson e Spearman. Apenas se verificaram associações no género feminino, entre a força muscular na extensão/flexão dos MI (60°/s) e as respostas dos técnicos de referência nos domínios do "Bem-Estar Físico" (respetivamente, r= 0.729, p= 0.026; r= 0.802, p= 0.009) e "QV Total" (respetivamente, r= 0.706, p= 0.033; r= 0.767, p= 0.016). Observou-se que a força, a resistência e a capacidade aeróbia parecem não estar associadas ao "Bem-Estar Físico" e à QV da amostra.

PALAVRAS-CHAVE: bem-estar físico; capacidade aeróbia; força isocinética; força resistente; qualidade de vida.

ABSTRACT

Physical capacities, health and quality of life (QOL) are improved through physical exercise in individuals with Intellectual Disability (ID). The aim of the present study was to verify the association of physical fitness with the perception of physical well-being and QOL in individuals with ID. Sixteen individuals with ID were evaluated by bioimpedance, functional tests ("6-minute walk test" (6MIN), "Timed Up and Go" (TUG), "30-s Chair Stand" (L/S), and "medicine ball throw") and isokinetic dynamometer (lower limbs [LL]). The Personal Outcomes Scale (POS) was used to measure "Physical Well-Being" and "Total QoL". Pearson and Spearman correlations were applied (p< 0.05). Correlations were found only in the female gender between the muscular strength in the extension/flexion of the LL (60°/s) and the responses of the reference technicians in the domains of "Physical Well-Being" (respectively, r= 0.729, p= 0.026; r= 0.802, p= 0.009) and "Total QOL" (respectively, r= 0.706, p= 0.033; r= 0.767, p= 0.016). It was found that strength, endurance and aerobic capacity do not seem to be associated with the physical well-being and QOL of the sample.

KEYWORDS: physical well-being; aerobic capacity; isokinetic strength; resistance; quality of life.

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Conflito de interesses: Nada a declarar. Financiamento: Fundação para a Ciência e Tecnologia, I.P., no âmbito do projeto UIDB/04748/2020.
Recebido: 30/11/2021. Aceite: 19/09/2022.

INTRODUÇÃO

A Organização Mundial de Saúde (The WHOQOL Group, 1995) define a qualidade de vida (QV) como sendo a perceção que um indivíduo tem sobre o seu posicionamento na vida, dependendo do contexto dos sistemas de cultura e dos valores nos quais este está inserido, em relação aos objetivos pessoais, expectativas, padrões e inquietações. Para Schalock et al. (2002), a QV pressupõe um conjunto de fatores que englobam o bem-estar do sujeito, ou a sua perceção acerca do seu posicionamento na sociedade, no contexto e cultura no qual está inserido, contemplando valores socioculturais, expectativas, necessidades e preferências individuais. Por conseguinte, é "um fenómeno multidimensional composto por domínios centrais influenciados por características pessoais e fatores ambientais. Estes domínios nucleares são os mesmos para todas as pessoas, embora possam variar de indivíduo para indivíduo relativamente ao valor e à importância" (Schalock et al., 2011, p. 21).

A população com Dificuldade Intelectual e Desenvolvimental (DID) é caracterizada pela existência de um défice de funcionamento intelectual e adaptativo no domínio conceptual, social e prático, identificada com os graus profundo, grave, moderado e leve, que se desenvolve antes dos 18 anos de idade (American Psychiatric Association, 2014). Nesse sentido, a avaliação da QV possibilita direcionar o sujeito para a vida que valoriza e que aprova, assim como: i) compreender o seu grau de satisfação; ii) entender as suas perceções; iii) fundamentar a sua tomada de decisão; iv) avaliar a intervenção; e v) avaliar os modelos teóricos (Schalock & Verdugo, 2002).

O modelo multidimensional da QV, concetualizado por Schalock e Verdugo (2002) e validado para a população portuguesa com DID (Simões et al., 2016), é constituído por um conjunto de domínios transversais a qualquer indivíduo e que objetiva a satisfação das suas necessidades básicas de vida, através de indicadores objetivos e subjetivos, apresentados na Tabela 1. O modelo visa descrever a perceção que o sujeito tem sobre os resultados pessoais, bem como a eficácia das estratégias utilizadas e das intervenções realizadas (Schalock et al., 2002) despertando um novo paradigma assente na inclusão, participação social e equidade de todos enquanto cidadãos de plenos direitos (Verdugo et al., 2012).

Neste modelo multidimensional, o domínio do "Bem-Estar Físico" relaciona-se com a saúde no geral, nomeadamente os cuidados para com esta, a capacidade de cuidar de si próprio, a mobilidade e recreação/lazer, a nutrição e a prática de exercício físico. Enquanto a "Qualidade de Vida QV Total" diz respeito à soma de todos os valores dos oito domínios que constituem o modelo.

Para além de estilos de vida sedentários, os indivíduos com DID demonstram ter baixos níveis de aptidão física, nomeadamente baixos níveis de força, capacidade aeróbia, flexibilidade e equilíbrio (Chow et al., 2018; Wouters et al., 2020).

Em estudos com a população em geral, concluiu-se que quanto mais ativo é o indivíduo, ou quanto mais atividade física (AF)/exercício físico (EF) pratica, maiores são os valores de perceção da QV. As diferenças entre a população sedentária e ativa, observaram-se não só nos aspetos físicos, mas também em aspetos psicológicos, cognitivos e sociais (Eime et al., 2013; Svantesson et al., 2015). Estes resultados foram corroborados por Gerald e Hahn (2014), na população com DID.

As pessoas com DID manifestam estilos de vida sedentários, tendo como consequente fraca aptidão física, o que aumenta o risco de doenças cardiovasculares e metabólicas (O'Leary et al., 2018; Wyszyńska et al., 2017). Estes estilos de vida sedentários promovem ainda uma composição corporal desfavorável (Golubović et al., 2012; Hilgenkamp et al., 2012), evidente pelos níveis elevados de excesso de peso e obesidade (Winter et al., 2012). A referida população apresenta ainda valores de Ângulo de Fase (AFase) relativamente inferiores,

Tabela 1. Modelo Conceptual de qualidade de vida.

Fator	Domínio	Indicadores
Independência	Desenvolvimento Pessoal	Atividades da vida diária, Comportamento adaptativo
	Autodeterminação	Escolhas, decisões e objetivos pessoais
Participação Social	Relações interpessoais	Atividades sociais e amizades
	Inclusão Social	Inclusão social/envolvimento na comunidade
	Direitos	Humanos e legais
Bem-estar	Emocional	Proteção e segurança e ausência de stress
	Físico	Saúde, nutrição, desporto, recreação e lazer
	Material	Emprego e estatuto económico

Fonte: adaptado de Schalock e Verdugo (2002).

comparativamente aos dados reportados para população em geral (Jacinto et al., 2020; NHANES-III, 2002; Yoshida et al., 2017). O AFase é um parâmetro associado à composição corporal pelo método bioimpedância, considerado um indicador de integridade da membrana e da distribuição de água extracelular e intracelular, que revela ser um indicador do estado de hidratação, nutrição, capacitância e integridade das células (Gunn et al., 2008; Kohli et al., 2018; Sardinha, 2018; Selberg & Selberg, 2002). Por sua vez, valores reduzidos de AFase estão associados a uma deterioração da função celular e a alto risco de apoptose celular (Axelsson et al., 2018; Selberg & Selberg, 2002).

Existindo uma associação entre o EF, a aptidão física e a QV, o objetivo do estudo foi analisar a influência da aptidão física na perceção de "Bem-Estar Físico" e a QV em indivíduos com DID.

MÉTODOS

Participantes

A amostra de conveniência, foi recrutada numa Instituição Particular de Solidariedade Social (IPSS). Foi constituída por 16 sujeitos com DID (masculinos *n*= 7, idade 39.7± 9.25 anos; massa corporal 71.94± 13.15 kg; altura 164.98± 8.76 cm; femininos *n*= 9, idades 30± 10.77 anos; massa corporal 72.80± 23.94 kg; altura 155,05± 7,88 cm), dos quais 5 estão institucionalizados, 5 DID de grau grave, 5 DID de grau moderado e 6 com DID de grau leve.

Instrumentos

A bateria de testes funcionais de Fullerton (Rikli & Jones, 1999) foi utilizada com o objetivo de avaliar a aptidão física, nomeadamente através dos testes: "6 minutos a andar", para avaliar a resistência aeróbia; "agilidade", para avaliar a mobilidade física; e "levantar/sentar da cadeira" durante 30 segundos, avaliando a força e resistência dos membros inferiores. Igualmente, também se aplicou o teste de "arremesso de bola medicinal de 3 kg" (Harris et al., 2011), com intuito de avaliar a potência muscular dos membros superiores. Os testes utilizados são adequados e confiáveis para a população com DID (Cabeza-Ruiz et al., 2019; Lencse-Mucha et al., 2015).

A força dos membros inferiores foi estimada através de testes de extensão e flexão do joelho, com ação concêntrica/excêntrica e velocidade angulares de 60º, 120º e 180º através do dinamómetro isocinético Computer Sports Medicine, Inc., (CSMi) HUMAC2015®/NORM™ (HUMACNORM, 101 Tosca Drive, Stoughton, USA), validados para a população com DID (Pitetti, 1990).

Utilizou-se a Escala Pessoal de Resultados (EPR) — versão em português, da Personal Outcomes Scale (Claes et al., 2010), validada por Simões et al. (2016). Este instrumento baseia-se no modelo de Schalock e Verdugo (2002), para avaliar a QV. A EPR está dividida em duas partes: a parte de autorrelato, composta por um conjunto de itens a serem respondidos pelos próprios indivíduos com DID, e uma parte a ser respondida por um técnico de referência para o indivíduo, que o conheça e que trabalhe diariamente com ele. No presente estudo, a EPR foi aplicada aos indivíduos com DID e aos seus técnicos de referência, por um técnico certificado. Para este estudo, foram tidos em consideração especificamente os resultados do domínio do "Bem-Estar Físico" (5-15 valores) e os valores da "QV Total" (25-105 valores).

Procedimentos

A investigação foi aprovada pela Comissão de Ética da Unidade de Investigação do Instituto Politécnico de Santarém, emitindo o parecer 172019Desporto. Foi dado início ao estudo após a autorização, através do termo de consentimento informado dos tutores e/ou encarregados de educação, bem como da instituição.

Foi utilizado o equipamento bioimpedância (tetrapolar multifrequência InBody S10 BIOSPACE Co, Ltd, Seul, Corea), para avaliar a composição corporal, sendo um procedimento fiável e não invasivo (Havinga-Top et al., 2015). Recolheram-se os seguintes parâmetros: água intracelular (AIC); água extracelular (AEC); água corporal total (ACT); AFase; gordura visceral (GV); massa celular corporal (MCC); massa corporal (MC); massa isenta de gordura (MIG); e massa gorda (MG).

A massa corporal e altura foram medidas através de uma balança com estadiómetro portátil (Seca 220, Hamburg, Germany). Após a medição, determinou-se o Índice Massa Corporal (IMC) pela fórmula, peso/altura^2 (kg/m^2), sendo um procedimento fiável para estimar a gordura corporal da população com DID (Temple et al., 2010).

Análise estatística

Foram utilizados parâmetros descritivos (média± desvio padrão ou percentagem) e verificada a normalidade e homogeneidade através dos testes Shapiro-Wilk e Levene, respetivamente. Foram observadas as associações através da análise de correlações de Pearson e Spearman. O nível de significância adotado foi de $p< 0.05$. Para tratamento dos dados foi utilizado o programa informático "Statistical Package for Social Sciences" (SPSS Science, Armonk, NY: IBM Corp, versão 22.0).

RESULTADOS

Na Tabela 2 apresentam-se os dados descritivos das variáveis de composição corporal avaliadas no presente estudo. Destacam-se os valores reduzidos do ângulo de fase e os valores elevados de IMC.

Na Tabela 3 apresentam-se os resultados da avaliação da EPR. O autorrelato e relato dos técnicos revela resultados semelhantes para as respostas do domínio "Bem-Estar Físico". Todavia, verifica-se que os técnicos de referência percecionam um índice de QV inferior do que os próprios indivíduos com DID.

Existe uma correlação significativa forte entre os valores do "Bem-Estar Físico" e a "QV Total", para as respostas dadas pelos técnicos de referência (r= 0.590, p= 0.016), o mesmo já não foi demonstrado para as respostas autorrelatadas (r= 0.337, p= 0.238).

A Tabela 4 apresenta as correlações entre a EPR e as variáveis sociodemográficas. Ao analisar os resultados da EPR, não se encontram diferenças significativas entre a idade, o género, o grau de deficiência e o facto de ser institucionalizado e os valores do domínio do "Bem-Estar Físico" e "QV Total". Apesar da inexistência de diferenças significativas, parece haver uma tendência para valores mais baixos em indivíduos com graus de deficiência maior, nomeadamente: indivíduos com DID de grau mais grave têm valores mais baixos (Bem-Estar Físico), nas respostas dos técnicos de referência e dos próprios (QV Total), nos autorrelatos.

De seguida, apresentam-se as associações entre a EPR e as variáveis de composição corporal na Tabela 5. A "QV Total" percecionada pelos técnicos de referência associou-se às variáveis da composição corporal, nomeadamente AIC (r= 0.528; p= 0.035) e AEC (r= 0.532; p= 0.034), ACT (r=

Tabela 2. Avaliação da composição corporal.

	Média± Desvio Padrão
Água intracelular (L)	21.99± 5.15
Água extracelular (L)	13.19± 2.89
Água corporal total (L)	35.18± 8.03
Ângulo de fase°	6.05± 0.8
Gordura visceral (cm2)	114.77± 63.82
Massa corporal	72.8± 18.64
Massa celular corporal (kg)	31.51± 7.38
Massa Gorda (kg)	24.77± 14.43
Massa isenta de gordura (kg)	48.03± 11.01
Massa Muscular (kg)	26.7± 6.43
Índice de massa corporal (IMC)	28.6± 7.17

Tabela 3. Resultados do domínio Bem-Estar Físico e QV Total, obtidos através da Escala Pessoal de Resultados.

N	Respostas autorrelatadas		Respostas técnicos de referência	
	Bem-Estar Físico	QV Total	Bem-Estar Físico	QV Total
1	14	101	10	76
2	13	101	13	106
3	13	83	13	80
4	Sem capacidade de responder		13	87
5			12	72
6	13	99	15	109
7	13	98	13	101
8	13	108	14	106
9	14	107	13	83
10	13	107	12	96
11	13	106	14	102
12	13	93	14	92
13	13	103	13	94
14	13	99	15	102
15	13	89	15	93
16	14	103	12	99
Média	13.21	99.78	13.18	93.62
Desvio Padrão	0.42	7.24	1.32	11.24

N: Código do participante; QV: Qualidade de vida.

Tabela 4. Associação entre as variáveis da Escala Pessoal de Resultados e variáveis sociodemográficas.

	Respostas autorrelatadas		Respostas técnicos de referência	
	Bem-Estar Físico	QV Total	Bem-Estar Físico	QV Total
Idade	*r*= –0.152 *p*= 0.604	*r*= 0.012 *p*= 0.967	*r*= –0.074 *p*= 0.784	*r*= –0.008 *p*= 0.976
Género	*r*= 0.174 *p*= 0.552	*r*= –0.107 *p*= 0.716	*r*= -0.057 *p*= 0.835	*r*= –0.246 *p*= 0.358
Grau de Deficiência	*r*= 0.092 *p*= 0.754	*r*= –0.325 *p*= 0.257	*r*= –0.192 *p*= 0.476	*r*= 0.150 *p*= 0.580
Institucionalização	*r*= –0.337 *p*= 0.238	*r*= –0.019 *p*= 0.950	*r*= 0.076 *p*= 0.780	*r*= 0.381 *p*= 0.146

QV: Qualidade de vida; *p*: Significância; *r*: Correlação.

Tabela 5. Associação entre as respostas obtidas através da Escala Pessoal de Resultados e as variáveis composição corporal.

	Respostas autorrelatadas		Respostas técnicos de referência	
	Bem-Estar Físico	QV Total	Bem-Estar Físico	QV Total
Água intracelular	*r*= –0.238 *p*= 0.413	*r*= 0.006 *p*= 0.983	*r*= 0.423 *p*= 0.102	*r*= 0.528 *p*= 0.035
Água extracelular	*r*= –0.238 *p*= 0.413	*r*= –0.016 *p*= 0.957	*r*= 0.468 *p*= 0.067	*r*= 0.532 *p*= 0.034
Água corporal total	*r*= –0.238 *p*= 0.414	*r*= –0.002 *p*= 0.995	*r*= 0.440 *p*= 0.088	*r*= 0.531 *p*= 0.035
Ângulo de fase	*r*= 0.151 *p*= 0.605	*r*= 0.114 *p*= 0.697	*r*= 0.053 *p*= 0.845	*r*= 0.318 *p*= 0.231
Gordura visceral	*r*= 0.065 *p*= 0.826	*r*= –0.106 *p*= 0.719	*r*= –0.205 *p*= 0.446	*r*= –0.046 *p*= 0.864
Massa corporal	*r*= –0.399 *p*= 0.176	*r*= –0.387 *p*= 0.171	*r*= 0.500 *p*= 0.049	*r*= 0.270 *p*= 0.312
Massa celular corporal	*r*= –0.065 *p*= 0.826	*r*= 0.004 *p*= 0.989	*r*= 0.452 *p*= 0.091	*r*= 0.526 *p*= 0.044
Massa Gorda	*r*= 0.065 *p*= 0.826	*r*= –0.298 *p*= 0.301	*r*= 0.157 *p*= 0.561	*r*= –0.172 *p*= 0.523
Massa isenta de gordura	*r*= 0.065 *p*= 0.826	*r*= 0.011 *p*= 0.969	*r*= 0.432 *p*= 0.095	*r*= 0.541 *p*= 0.031
Massa Muscular	*r*= –0.238 *p*= 0.413	*r*= 0.007 *p*= 0.982	*r*= 0.425 *p*= 0.101	*r*= 0.530 *p*= 0.035
IMC	*r*= 0.194 *p*= 0.506	*r*= -0.155 *p*= 0.598	*r*= 0.227 *p*= 0.398	*r*= 0.063 *p*= 0.816

IMC: Índice de Massa Corporal; QV: Qualidade de vida; p: Significância; r: Correlação.

0.531; *p*= 0.035), MCC (*r*= 0.526; *p*= 0.044), MIG (*r*= 0.541; *p*= 0.031) e à MC (*r*= 0.530; *p*= 0.035). Apesar da amostra demonstrar valores baixos de AFase, estes não foram associados ao domínio do "Bem-Estar Físico" e aos valores da "QV Total".

A Tabela 6 apresenta os resultados da avaliação da aptidão física, com recurso aos testes funcionais. Os resultados dos testes físicos não se correlacionaram com nenhuma das variáveis da escala de QV.

Na Tabela 7 apresentam-se os resultados do Pico de Torque, avaliado com recurso ao dinamómetro isocinético. O domínio "Bem-Estar Físico" autorrelatado correlacionou de forma negativa com o teste flexão de MI esquerdo, a uma velocidade angular de 60º (*r*= –0.555, *p*= 0.039). Não existiram associações entre o género masculino e as restantes variáveis em estudo. O género feminino apresentou uma correlação forte e negativa entre as respostas da "QV Total" autorrelatada e o teste flexão do membro inferior

Tabela 6. Resultados dos testes funcionais.

N	L/S (reps)	TUG (s)	6MIN (min)	Bola Medicinal (metros)
1	11	7.63	354	2.40
2	14	7.96	559	2.30
3	15	7.39	521	3.07
4	10	9.55	402	2.60
5	12	7.13	526	1.94
6	14	6.95	475	2.50
7	13	9.1	397	2.30
8	16	5.25	617	2.80
9	15	6.52	587	2.90
10	16	7.41	538.5	2.46
11	10	10.7	536	2.30
12	9	12.65	607	2.01
13	9	8.75	521	2.20
14	10	8.22	483	2.57
15	12	6.32	516	2.74
16	14	7.63	571.5	2.61

N: Código do participante; L/S: Levantar/sentar; Reps: Repetições; TUG: Timed Up And Go; S: Segundos; 6MIN: Teste de caminhada durante 6 minutos; Min: Minutos.

direito, a uma velocidade angular de 60º (r= –0.780, p= 0.039). Adicionalmente, apresentou uma correlação forte entre as respostas do "Bem-Estar Físico" dos técnicos de referência, para o teste de extensão e flexão de membro inferior direto, a uma velocidade angular de 60º (respetivamente: r= 0.729, p= 0.026; r= 0.802, p= 0.009). As respostas dos técnicos de referência, analisando a "QV Total", também se correlacionaram com o teste de extensão e flexão de membro inferior direto, a uma velocidade angular de 60º (respetivamente: r= 0.706, p= 0.033; r= 0.767, p= 0.016).

DISCUSSÃO

Os resultados da presente investigação ilustram que a média do IMC se encontra no patamar de excesso de peso, resultados similares aos encontrados por Boer e Moss (2016) — 30,3 kg/m² e Cabeza-Ruiz et al. (2019) — média de teste: 30,75 kg/m²; média re-teste: 30,58 kg/m². À imagem dos resultados evidenciados por Jacinto et al. (2020) e Yoshida et al. (2017), o valor médio do AFase da amostra é inferior aos valores reportados por NHANES-III (2002), para o género e faixa etária na população em geral. Apesar de ser um indicador do estado nutricional do indivíduo e, consequente,

Tabela 7. Avaliação do Pico de Torque pelo dinamómetro isocinético.

N	Pico de torque (velocidade angular)											
	Velocidade Angular 60º				Velocidade Angular 180º				Velocidade Angular 240º			
	Ext. m.inf. direito	Ext. m.inf. esquerdo	Fl. m.inf. direito	Fl. m.inf. esquerdo	Ext. m.inf. direito	Ext. m.inf. esquerdo	Fl. m.inf. direito	Fl. m.inf. esquerdo	Ext. m.inf. direito	Ext. m.inf. esquerdo	Fl. m.inf. direito	Fl. m.inf. esquerdo
1	85	39	57	18	54	24	53	12	46	38	38	16
2	176	108	103	64	102	61	73	46	79	34	66	37
3	94	142	54	69	58	71	50	58	60	61	43	52
4	77	69	33	26	18	20	12	12	22	28	12	14
5	34	31	26	27	20	19	22	19	20	15	19	16
6	79	73	64	50	39	20	46	30	39	23	37	30
7	75	87	52	57	31	14	24	19	14	12	18	11
8	89	83	79	73	49	47	54	45	45	39	45	38
9	104	72	54	47	57	35	37	30	47	37	34	39
10	45	45	27	42	5	7	4	11	5	9	4	9
11	107	57	85	27	39	18	26	16	38	27	19	16
12	81	87	49	52	38	43	28	37	30	35	19	20
13	85	95	79	75	42	35	35	30	52	34	38	37
14	99	76	68	58	33	41	26	52	42	34	35	41
15	88	75	58	58	41	27	24	18	26	15	18	19
16	72	94	22	41	23	26	12	18	14	38	12	33

Ext: Extensão; Fl: Flexão; M.inf.: Membro inferior.

QV (Barbosa-Silva et al., 2005; Gunn et al., 2008; Selberg & Selberg, 2002), o AFase não se associou diretamente ao domínio do "Bem-Estar Físico" e ao valor total de QV.

Apesar de não serem estatisticamente significativos, indivíduos com DID de grau grave demonstram ter valores mais baixos de QV e de "Bem-Estar Físico" quando comparados com os outros níveis da DID. Como seria de esperar, aumentando os valores do "Bem-Estar Físico", a QV no seu total aumenta, quer seja a partir das respostas dos próprios indivíduos avaliados, quer seja através das respostas dos técnicos de referência.

Tendo em consideração que não existem valores de referência que nos permitam enquadrar os valores medidos através dos testes funcionais, conclusões mais específicas não foram possíveis. No entanto o estudo de Boer e Moss (2016) relatam que os valores obtidos no teste de 6 minutos de caminha variam entre 513 a 578 metros. Apesar do intervalo verificado no nosso estudo ser maior, a média encontra-se dentro deste. Os resultados também são semelhantes ao estudo de Guerra-Balic et al. (2015), onde o intervalo de resultados varia entre 449,6 e 531,7 metros. A média dos resultados do teste de 6 minutos de caminhada dos nossos participantes, são ainda superiores aos apresentados no estudo de Cabeza-Ruiz et al. (2019) (média do teste: 463,08 metros; médio do re-teste: 457,44 metros). Estes resultados vão ao encontro do estudo de Cabeza-Ruiz (2020), sendo o primeiro estudo a apresentar valores de aptidão física de adultos com DID categorizados em baixo, médio e grupos de AF superior. É necessário salientar que, neste estudo, não foi feita nenhuma tentativa de relacionar os indivíduos pertencentes a cada uma das categorias a um melhor estado de saúde.

Em relação aos restantes resultados dos testes funcionais, os valores médios parecem desfavoráveis quando comparados com os números do estudo de Cabeza-Ruiz et al. (2019) e de Cabeza-Ruiz (2020).

A aptidão física, avaliada pelos testes funcionais, não apresenta qualquer relação com a resposta no domínio do "Bem-Estar Físico", da EPR, nem com o seu valor total de QV, quer a amostra apresente melhores ou piores resultados. No estudo de Pérez-Cruzado e Cuesta-Vargas (2016), um programa de intervenção de 8 semanas de atividade física aumentou a aptidão física e a QV de 40 indivíduos com DID. No mesmo sentido, Carbó-Carreté et al. (2016) afirma que a atividade física atua como preditor de uma melhoria de QV.

Sabendo que a população com DID apresenta níveis de aptidão física relativamente baixos (Chow et al., 2018; Wouters et al., 2020), este estudo deixa-nos indicadores que podem não afetar a sua perceção de QV, na medida em que se verifica a ausência de associações entre as variáveis ou que apesar de uma aptidão física fraca, os indivíduos com DID percecionam uma boa QV.

Contudo, apesar de não ter sido associada à perceção de QV e à perceção dos seus técnicos de referência, a atividade física tem surgido relacionada com a promoção de aptidão física, a realização das atividades de vida diária e uma melhoria na saúde e na QV, de indivíduos com DID (Winter et al., 2012). Através de uma revisão sistemática, Pestana et al. (2018) concluíram que os programa de atividade física estão associados a uma melhoria da aptidão física, nomeadamente da força muscular, capacidade aeróbia, equilíbrio, coordenação e agilidade, bem como a melhorias do bem-estar psicológico, ansiedade, saúde, redução da gordura corporal, da pressão arterial, do colesterol e de um aumento da QV.

Os valores do dinamómetro isocinético apresentam algumas associações com as variáveis anteriormente referidas, nomeadamente para o género feminino, ainda assim, não são suficientemente robustas para afirmar que existe uma correlação negativa ou positiva entre a aptidão física, o "Bem-Estar Físico" individual e a sua QV. Não obstante, alguns estudos apontam para que a capacidade neuromuscular esteja associada, de forma positiva, à capacidade funcional e à QV, ou seja, quanto maior é a força, maiores/melhores serão os seus valores (Benton et al., 2014; Marques et al., 2019; Smedema, 2020).

Em termos de limitação do estudo, refere-se o carácter transversal e a utilização de uma amostra reduzida que poderão ter condicionado os resultados encontrados. Uma outra limitação prende-se com o fato de não ter sido quantificado a atividade física (nomeadamente com recurso ao *International Physical Activity Questionnaire*). Sugerimos ainda que futuros estudos possam avaliar o mesmo tipo de força e que realizem reteste. Serão necessários mais estudos, com maior número de indivíduos com DID, associando as variáveis mencionadas anteriormente.

CONCLUSÕES

Para a amostra deste estudo, a aptidão física, medida com base em testes funcionais não influencia a perceção de "Bem-Estar Físico" e "QV Total", como também não tem influência nas respostas dadas pelos técnicos de referência.

Utilizando um dinamómetro isocinético, para averiguar a aptidão física (capacidade física da força), existiram algumas associações. No entanto não foram suficientemente robustas para afirmar se existe uma relação entre as variáveis referidas anteriormente.

Nesta reduzida amostra, a aptidão física dos indivíduos com DID parece não estar associada à perceção de QV autor-relatada e à da perceção dos técnicos de referência.

Tendo em conta a que a literatura aponta para que esta população seja maioritariamente sedentária e que a prática da AF deriva uma melhor QV, esta deve ser promovida e disseminada pela população com DID, técnicos, cuidadores, bem como as suas famílias, através de ações de formação, workshops e de políticas educacionais, tendo por base a adoção de estilos de vida ativos e saudáveis, devendo o EF estar incorporado no dia a dia de um indivíduo com DID.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.25937

Team cohesion and group conflict in Brazilian youth athletes: study based on achievement goals theory

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ABSTRACT

The present study investigated the cohesion of teams and group conflict, based on the theory of compliance goals, in young Brazilian athletes participating in the final phase of the School Games in the state of Pernambuco. The participants were 413 young athletes, boys (n= 227) and girls (n= 186) aged between 14 and 17 years. Participants completed self-report questionnaires to assess the Youth Sport Environment Questionnaire (P-YSEQ), Group Conflict Questionnaire (P-GCQ) and Task and Ego Orientation in Sport Questionnaire (TEOSQ). The data were analyzed using hierarchical and non-hierarchical cluster analysis, chi-square test, multiple regression and multivariate variance analysis (MANOVA). The results showed that task orientation made the largest positive contribution to both task (β= 0.50, p< 0.001) and social (β= 0.31, p< 0.05) cohesion. Ego orientation made the largest positive contribution to task conflict (β= 0.49, p< 0.001) and social conflict (β= 0.67, p< 0.001), whilst task orientation made a negative contribution (β= -0.34, p< 0.05) for social conflict. Compared to the high task and low ego cluster (Cluster 3) was compared with low ego and task (Cluster 2) and high task and low ego cluster (Cluster 1), there was a significant difference between groups in task cohesion (p= 0.001), task conflict (p=0.003) and social conflict (p= 0.001). It is concluded that task orientation seems to be a positive predictor of team cohesion, while ego orientation might predict positively group conflict and negatively task cohesion.

KEYWORDS: sports psychology; youth athletes; group environment; goals; team cohesion.

INTRODUCTION

Especially in childhood and adolescence, participation in organized sports brings a variety of benefits to its participants, such as improved health and well-being, development of social skills (such as cooperation, discipline and leadership) and greater support of a physically active lifestyle (Konttinen et al., 2019). However, although a systematic review reveals that the sports context also has the potential for the development of negative experiences, this compilation of studies sheds light on the fact that this difference may be related to the environment in which this young person is inserted (Rigoni et al., 2017). In this sense, group cohesion is important to this context since it can be defined as a dynamic process, reflected by the group's tendency to unite and remain united in the pursuit of meeting the needs of its members and/or of common objectives (Carron & Brawley, 2012; Eys et al., 2019).

Group cohesion, known to be a key element for sports performance, can be seen from the perspective of task or social cohesion (Nascimento Junior et al., 2019a, 2020b). Task cohesion refers to the willingness of group members to work together to achieve a common goal, while social cohesion refers to the degree to which members are satisfied with their affective needs (Eys et al., 2019). However, it is emphasized that there is also a negative group process, related to conflict, defined by disagreements and interpersonal problems, theorized by a two-dimensional nature, composed of social (negative affects) and tasks (disagreements in relation

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Conflict of interest: nothing to declare. Funding: Conselho Nacional de Desenvolvimento Científico e Tecnológico/Coordenação de Aperfeiçoamento de Pessoal de Nível Superior.
Received: 12/01/2021. Accepted: 04/18/2022.

to objectives) conflicts (Barki & Hartwick, 2004). Given the context, understanding motivational aspects is essential to identify the factors that motivate young people to engage in training and goals within the sports context (Caruzzo et al., 2013; Nascimento Junior et al., 2019b).

Motivation is considered one of the main determining factors for successful experiences within the sports context, both in sports initiation and in high performance (Deci & Ryan, 2012; Rigby & Ryan, 2018; Ring & Kavussanu, 2018; Roberts & Walker, 2020). In addition, it is one of the psychological variables that best elucidates the reasons that lead people to present themselves as more determined than others in some activities, and essential for long-term participation in a practice, further illustrating what motivates them to start, continue or even give up an activity, whether it is sporty or not (Deci & Ryan, 2012; Rigby & Ryan, 2018).

Among the various theories that propose to understand this phenomenon stands out in the area of psychology of an under this perspective, the Achievement Goals Theory (AGT) has been widely used to understand the motivation of young people within the context of organized sport (Kallinen et al., 2019; Lochbaum et al., 2016). AGT seeks to elucidate how motivation directs young people and guides their behaviours. This makes it possible to understand how subjects achieve their goals, deal with failure and how they choose to engage in some activity (Duchesne & Ratelle, 2020).

AGT is subdivided into orientations of the type: task and ego orientation, which results in different positions of the subject facing the challenges. The first concerns the development of skills, in which the subject seeks personal improvement in the analysis of their behaviours and understands success because of their efforts (domain). On the other hand, the ego-oriented individual prioritizes the demonstration of skills and has a on social comparison, taking others as a reference. Considers success impressing people from the highlight of their skills (demonstration) (Nicholls, 1989). Both orientations can coexist in the individual, being possible the variation between orientation by the ego and orientation by the task (Nicholls, 1989).

Thus, the AGT can bring benefits when applied in environments where subjects are in the process of learning. According to Duchesne and Ratelle (2020), when developed within the school context, it was noticed that task-oriented students faced adversity satisfactorily, such as stress, given that those who enjoy the school experience more tend to become resilient and do not exhibit exhibitionist behaviour. Thus, it is suggested that individuals who are properly oriented also have a higher level of emotional control.

The overall purpose of the present study was to utilize regression and cluster analyses to investigate whether athletes' AGT development through sports impacts their perception of team cohesion and group conflict. Firstly, we investigated whether AGT predicts team cohesion and group conflict. According to past research (Eys et al., 2019; Nascimento Junior et al., 2019a; Paradis et al., 2014a), the hypothesis was that task orientation would be positively associated with team cohesion and negatively with group conflict, whilst ego orientation would be positively associated with group conflict and negatively with team cohesion. The second aim was to assess whether athletes' scores for team cohesion and group conflict would differ between different profiles of goals orientation. Based on past studies (Kallinen et al., 2019; Lochbaum et al., 2016), we hypothesized that athletes with higher scores of task orientation and lower scores of ego orientation would have higher scores of team cohesion and lower scores of group conflict. Thus, this study is relevant to the extent that the results obtained can contribute to the practical activities of athletes and coaches, as well as to the scientific community that seeks to understand more broadly how these variables are related and how they can be used to enhance athletes' performance.

METHODS

Study design and procedures

The present study involved a cross-sectional research design with all data collected at a one-time point. Ethical approval was granted by the lead researcher's university ethics and human research committee (protocol 1.648.086). Before any data was collected, permission was obtained from the organizing committee of the sports tournament where the data collection took place and the coaches of the teams involved. The data collection commenced after participants completed an informed consent form. Before completing the study questionnaire, brief instructions were provided to participants about the purpose of the research and what was required when completing the questionnaire. The questionnaire took participants 30 minutes to complete, and the order of the questionnaires was randomized among participants to avoid bias.

Participants

Participants were 413 young athletes participating in the final phase of the School Games of the state of Pernambuco, Brazil, in 2017. In this way, the participants were boys (n= 227) and girls (n= 186) aged between 14 and 17 years of the

following sports: basketball (*n*= 67), futsal (*n*= 80), handball (*n*= 135), and volleyball (*n*= 131). The athletes had a mean age of 16.04± 0.89 years, time of practice of 7.29± 1.4 years and time within the team of 3.84± 2.91 years. The participants were selected in a non-probabilistic way and for convenience, and the selection criteria were as follows: 1) to practice the sport for more than 1 year; and 2) to have participated in some regional/state level competition during the 2016/2017 seasons. Only the athletes who had the consent term signed by the coaches (responsible for the athletes in the sports event) participated in the study.

Instruments

Youth Sport Environment Questionnaire (P-YSEQ)

This instrument was developed by Eys et al. (2009) and validated for Portuguese-speaking athletes by Nascimento Junior et al. (2018). P-YSEQ assesses team cohesion in youth between the ages of 13 to 17 years and consists of 16 items that evaluate task and social cohesion and 2 spurious items that do not enter into the analysis, totalling 18 items. Task cohesion contains eight items, and a sample item is "We all share the same commitment to our team's goals". Social cohesion contains eight items, and a sample item is "I spend time with my teammates". All items are scored on a 9-point Likert-type scale anchored at the extremes of 1 (strongly disagree) and 9 (strongly agree). The literature has demonstrated the factorial validity, test-retest reliability, and internal consistency reliability of this scale in youth sport participants (Nascimento Junior et al., 2019a; Tamminen et al., 2019).

Group Conflict Questionnaire (P-GCQ)

The GCQ was developed by Paradis (2014b), and validated for the Brazilian context by Nascimento Junior et al. (2020a). P-GCQ contains 12 items distributed in two dimensions: task conflict (e.g., "The team's ability to be successful is jeopardized because of heated disagreements during competition") and social conflict (e.g., "Emotions run high in social situations over personal disagreements brought to light"). All items reference a cognition (such as disagreement), a negative emotion (such as anger), and a behavioral action (such as sabotage). Reponses are provided on a 9-point Likert-type scale, anchored at the extremes of 1 (strongly disagree) and 9 (strongly agree). Past research has demonstrated the factorial validity, test-retest reliability, and internal consistency reliability of this scale with youth sport participants (Nascimento Junior et al., 2020b; Paradis et al., 2014a).

Task and Ego Orientation in Sport Questionnaire (TEOSQ)

TEOSQ was developed by (Duda, 1989) and validated for the Brazilian context by Goulart et al. (2007). The Brazilian version of the TEOSQ consists of 8 task-related and 6 ego-related items reflecting the definitions of success in sports contexts. The items are prefaced with the heading "I feel most successful in this class when..." Young athletes rated each item on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). The literature has demonstrated the factorial validity, test-retest reliability, and internal consistency reliability of this scale in youth sport participants (Caruzzo et al., 2013; Duchesne & Ratelle, 2020).

Data analysis

The correlation between all variables was performed using Pearson's coefficient, and the following values were adopted to interpret the intensity of the correlations: 0.01 to 0.39= weak; 0.4 to 0.69= moderate; and 0.7 to 1.0= strong. A multiple regression model was used to determine if the achievement goals combined predict youth athletes' perception of team cohesion and group conflict. There were no sufficiently strong correlations between variables that indicated problems with multicollinearity (VIF range= 1.07 to 1.13). Specifically, these VIF values were below the 5 or 10 deemed acceptable by Hair Jr. et al. (2014). All analyses were performed using IBM SPSS v.23.0, adopting a significance level of $p< .05$. In addition, a post hoc statistical power analysis in G*Power 3.1.9 (Faul et al., 2007) revealed our statistical power to be 99.9% based on our sample of 177 participants, a medium effect size (.15) according to Cohen (1992) f2 criteria, and a .05 p-value.

Youth athletes were grouped/classified using hierarchical and non-hierarchical cluster analysis. Firstly, the nearest neighbour hierarchical cluster analysis was conducted using the squared Euclidian distance as a measure of dissimilarity. The R-square was used as a criterion for the retention of the number of clusters. From this analysis, three clusters were retained. For the validation and classification of the youth athletes in the three clusters retained, a k-Means non-hierarchical cluster analysis was conducted. According to the criterion of Cumming and Duda (2012), z scores below –0.5 are considered to be low levels; z scores between –0.5 and +0.5 are moderate, and z scores over +0.5 are considered high. Differences between clusters for the dimensions of team cohesion and group conflict were tested by the Multivariate Analysis of Variance (MANOVA). The magnitude of the differences between the groups analyzed was obtained through the size effect, which shows a typical measure of deviation

between group means, allowing for real quantification of the difference between them. Cohen (1992) described effect size as small (η^2= 0.01), medium (η^2= 0.06) or large (η^2= 0.13).

RESULTS

Preliminary analysis

The data was first screened for missing values. There were no missing values, as the leading researcher ensured all surveys were fully completed during data collection. The data were then screened for univariate and multivariate outliers, with no outliers found within the sample. Finally, the data were screened for normality. The skewness values ranged from –1.00 to 0.51, and the kurtosis values ranged from –0.90 to 3.35, indicating reasonable normality (Tabachnick & Fidell, 2013).

Descriptive statistics and intercorrelations

Internal consistency and mean values for all the dimensions of achievement goals orientation, team cohesion and group conflict are presented in Table 1. In general, the youth athletes reported high scores in task orientation, task cohesion and social cohesion and lower scores in ego orientation, task conflict and social conflict. Task orientation was significantly correlated with task cohesion (r= 0.20, p< 0.001), social cohesion (r= 0.11, p< 0.05). Ego orientation was significantly correlated with task conflict (r= 0.23, p< 0.001) and social conflict (r= 0.28, p< 0.001). Task cohesion was negative association with task conflict (r= –0.16, p< 0.001) and social conflict (r= –0.21, p< 0.001).

Multiple regression analysis

Standard multiple regression analysis (see Table 2) revealed that our model, which included all dimensions of achievement goals orientation (ego and task orientation), explained a significant amount of the variance of task (R^2= 0.03, p< 0.001) and social (R^2= 0.01, p< 0.05) cohesion. Task orientation made the largest positive contribution to both task (β= 0.50, p< 0.001) and social (β= 0.31, p< 0.05) cohesion.

Our results also revealed that our models, including the dimension of achievement goals (ego and task orientation), explained a significant amount of the variance of both task

Table 1. Summary of intercorrelations, scale ranges, means, standard deviations and reliability estimates.

Variables	Goals orientation		Team cohesion		Team conflict	
	1	2	3	4	5	6
1. Ego orientation	-	0.01	0.00	0.07	**0.23****	**0.28****
2. Task orientation		-	**0.20****	**0.11***	-0.03	-0.08
3.Taks cohesion			-	0.48**	**–0.16****	**–0.21****
4. Social cohesion				-	–0.02	–0.05
5. Task conflict					-	0.81**
6. Social conflict						
Mean	2.24	4.09	7.29	6.55	4.72	3.93
SD	0.93	0.57	1.41	1.59	1.98	2.22
Scale Ranges	1-5	1-5	1-9	1-9	1-9	1-9
Alpha coefficient	0.79	0.91	0.79	0.88	0.89	0.94

Pearson correlation; *p< 0.05; **p< 0.01.

Table 2. Goals orientation as predictors of team cohesion and group conflict of youth sport participants.

Predictors	Task Cohesion	Social Cohesion	Task conflict	Social conflict
	β (CI)	β (CI)	β (CI)	β (CI)
Ego orientation	–0.01 (–0.13, 0.13)	0.12 (–0.03, 0.29)	**0.49 (0.29, 0.69)*****	**0.67 (0.45, 0.89)*****
Task orientation	**0.50 (0.27, 0.74)*****	**0.31 (0.04, 0.57)***	–0.14 (–0.47, 0.18)	**–0.34 (–.070, 0.01)***
R^2	0.03	0.01	0.05	0.08
F	9.142***	3.865*	12.264***	19.822***

Note. Only the standardized regression coefficients which were less than our significance level of 0.05 are highlighted in bold. β = Standardized regression coefficient; CI: 95% confidence interval; *p< 0.05, **p< 0.01; ***p< 0.001.

(R^2= 0.05, p< 0.001) and social (R^2= 0.08, p< 0.001) conflict dimensions. Ego orientation made the largest positive contribution to task conflict (β= 0.49, p< 0.001) and social conflict (β= 0.67, p< 0.001), whilst task orientation made negative contribution (β= –0.34, p< 0.05) for social conflict.

Cluster analysis

Nonhierarchical cluster analysis confirmed the three-cluster solution, which are described in Figure 1. Athletes from Cluster 1 (n= 99) had high scores for ego orientation and moderate scores for task orientation which was called "High ego and task". Cluster 2 (n= 149) was characterized by presenting low scores for ego orientation and task orientation. Cluster 2 received the denomination of "Low ego and task". Athletes from Cluster 3 (n= 165) had high scores for task orientation and low scores for ego orientation and were called "High task and low ego".

Figure 2 shows the mean values and standard deviations used to create the clusters, and MANOVA was performed to examine the characteristics of each profile. Significant differences were found between Cluster 1 and Clusters 2 and 3 (p< 0.05) and Cluster 2 and 3 (p< 0.05) for both ego and task orientations (Figure 2).

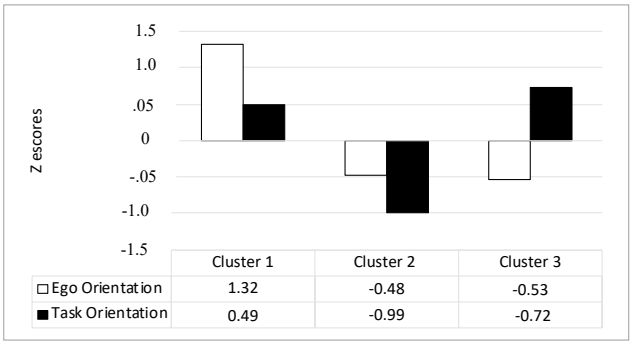
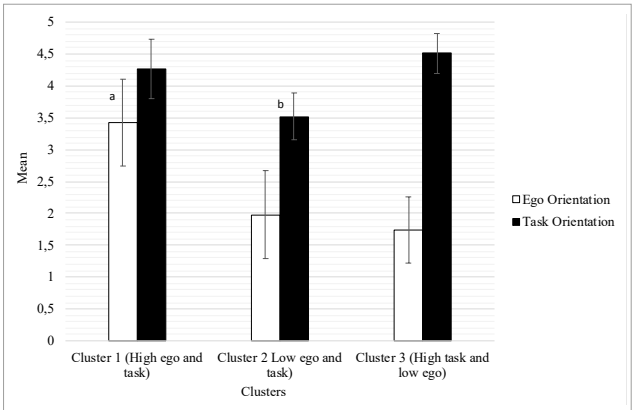


Figure 1. Graphic representation of the profiles of achievement goal of the youth athletes through cluster analysis.

When high task and low ego cluster (Cluster 3) was compared with low ego and task (Cluster 2) and high task and low ego cluster (Cluster 1) (see Table 3), there was a significant difference between groups in task cohesion (p= 0.001), task conflict (p= 0.003) and social conflict (p= 0.001). As shown in Table 3, youth athletes with high task and low ego orientations (M= 7.59, SD= 1.23) showed a higher score of task cohesion when compared to athletes with low ego and task orientations (M= 6.94, SD= 1.50). Further, athletes with high ego and task orientations showed higher scores of social (M= 4.76, SD= 2.35) and task (M= 5.29, SD= 2.00) conflict when compared to the other two clusters.

DISCUSSION

The main goal of this study was to analyze the perception of team cohesion and group conflict in Brazilian youth athletes through AGT based investigation using cluster analysis. Further, it was examined the predicting role of achievement goals on team cohesion and group conflict. The main findings



*Significant difference (p< 0.05) between: (A) Cluster 1 with Clusters 2 and 3; (B) Cluster 2 and 3.

Figure 2. Mean scores and standard deviation of ego and task orientation of the cluster's profiles. MANOVA.

Table 3. Comparison of team cohesion and group conflict between clusters.

Variables	Clusters			P-value	η^2
	High ego and task (n= 99)	Low ego and task (n= 149)	High task and low ego (n= 165)		
	M (Sd)	M (Sd)	M (Sd)		
Social Cohesion	6.70 (1.64)	6.40 (1.59)	6.60 (1.56)	0.308	0.006
Task Cohesion	7.34 (1.46)	6.94 (1.50)[a]	7.59 (1.23)	**0.001***	0.039
Social Conflict	4.76 (2.35)[b]	3.95 (2.10)	3.42 (2.11)	**0.001***	0.054
Task Conflict	5.29 (2.00)[b]	4.66 (1.83)	4.44 (2.04)	**0.003***	0.029

MANOVA. *Significant difference (p< 0.05) between: a) "Low ego and task" with "High task and low ego"; b) "High ego and task" with "Low ego and task" and "High task and low ego"; M: Mean; Sd: Standard deviation; η^2: partial eta squared.

revealed the positive predicting role of task orientation on the dimensions of team cohesion and the negative predicting role on social conflict, whilst ego orientation demonstrated a positive predicting role on both dimensions of group conflict. Further, from the profiles created through cluster analysis, it was possible to observe that youth athletes with high task and low ego orientations showed a higher score of task cohesion when compared to athletes with low ego and task orientations, whilst athletes with high ego and task orientations showed higher scores of social and task conflicts when compared to the other two clusters.

One of the main findings of this study refers to the positive predictor of task orientation on group cohesion, confirming the first hypothesis of the study. This finding shows that motivational orientation related to the development of their own skills, in addition to team spirit and cooperation, favours collective work and the engagement of athletes with team goals, in addition to facilitating the development of positive social relationships with teammates. Task orientation also provides the internalization of secondary characteristics such as perseverance, contribution to the group, constant improvement, self-assessment and the culture of effort (Montecinos et al., 2014), which are also associated with group cohesion (Eys et al., 2019). According to AGT (Sarrazin et al., 2001), achievement goals are competence-based aims those individuals target in evaluative contexts (i.e. in sports). The primary goal of a task-involved athlete is learning and mastery of the task for its own sake. Thus, task involvement appears when the athlete is intrinsically interested in the activity and judges his own self in a self-referenced manner (Duchesne & Ratelle, 2020). Task orientation has been associated with several positive outcomes, such as challenging tasks, effective study strategies, positive attitudes toward learning, enjoyment, intrinsic motivation and positive emotions (Harwood et al., 2015; Jaakkola et al., 2016; Keegan et al., 2010; Sit & Lindner, 2005).

Harwood et al. (2015) observed in a systematic review that the motivational climate focused on the task was consistently associated with a series of positive results of competence, self-esteem, performance, intrinsic motivation and positive affective states with colleagues. Elliot et al. (1999) observed that task-oriented individuals are primarily motivated by mastery or improvement of personal skills. Thus, these individuals reflect high levels of group cohesion in order to improve affective bonds (social cohesion) and desired objectives (cohesion for task). Thus, our findings corroborate the literature, demonstrating that task orientation can be considered a predictor of positive outcomes within youth sports, such as group cohesion (Harwood et al., 2015; Pineda-Espejel et al., 2017).

Furthermore, our results showed that this type of motivational orientation seems to act as a protective factor against the possible social conflicts that arise within the team, partially confirming the first hypothesis of the study. These findings show that characteristics such as the high standards of performance, organization and discipline of their capacities seem to impede the development of social conflicts within the group (Eklund & Tenenbaum, 2013; Eys et al., 2019; Paradis et al., 2014a).

Social conflicts within the group are linked to disagreements, behaviour oppositions (discussions, bullying, aggression) and seem to be inhibited when athletes have a common goal (e.g., winning a competition) (Paradis et al., 2014a). Thus, the orientation to the task seems to have an important role in protecting against the emergence of social conflicts among the young athletes surveyed since it stimulates the effort to achieve collective goals.

On the other hand, the orientation for the ego presented a positive predictor role on the dimensions of social conflicts and task within the group, confirming the second hypothesis of the study. According to AGT (Sarrazin et al., 2001), ego-oriented athletes are concerned with comparing their skills in relation to other athletes, defining their success from their own prominence, generating a social comparison, leading to group conflicts both of a social character and collective goals.

These findings reinforce the evidence already found in the literature that argues that ego orientation has been associated with negative outcomes within the sports context, such as higher levels of anxiety, development of burnout syndrome, and a greater predisposition to cheat to achieve success (Isoard-Gautheur et al., 2016; Pineda-Espejel et al., 2017), Ring and Kavussanu (2018) observed that the orientation for the ego was positively associated with the acceptance of cheating in young British athletes, as well as with the increased possibility of cheating within the scenario in which the athlete was inserted, against teammates, to achieve better personal performance.

From the three cluster profiles obtained, it was possible to verify that athletes with a high orientation for the task and low orientation for the ego (Cluster 3) reported higher cohesion scores for the task when compared to athletes with low values for orientation for ego and task (Cluster 2). These findings show that the greater the effort and interest of the athlete in their own performance parameters (task orientation), the more these athletes will be attracted to collective tasks and goals (Caruzzo et al., 2013; Duchesne & Ratelle, 2020). Such results are supported by the AGT (Sarrazin et al., 2001), which demonstrates that athletes with high task orientation scores are associated with higher levels of persistence and commitment in sports, in addition to being more interested and striving to improve their individual and collective performance. It is emphasized that athletes committed to

their respective modalities are more likely to develop positive outcomes, such as group cohesion, intrinsic motivation, well-being, and sports success (Harwood et al., 2015).

Regarding group conflicts (see Table 3), the findings show that athletes with high orientation to the ego and task (Cluster 1) presented a higher perception of group conflict (social and task) when compared to the other cluster profiles. These findings indicate that the high orientation to the ego can lead to the triggering of conflicts for both the task and the social, even if the athlete has a high orientation for the task.

Specifically, it can be inferred that efforts to develop personal skills and compare them with others seem to act as a driver of behaviours that generate situations of disagreement among group members about the tasks to be performed, including differences in views, ideas and opinions (Eklund & Tenenbaum, 2013; Eys et al., 2019; Paradis et al., 2014b), in addition to interpersonal conflicts and personality confrontations that are not directly related to the execution of the tasks (Paradis et al., 2014b). Similar results were found by Castro-Sánchez et al. (2018) in a study with young Spanish semi-professional athletes. The authors observed that high levels of orientation for the ego and task favoured the emergence of rivalry within the group, especially in individual sports, while in team sports, conflicts can be perceived as a moment of group learning.

Limitations and future research directions

Despite the results presented in this study, it is important to highlight some limitations. First, the sample consisted only of athletes from a single state, which makes it impossible to generalize the results with the national and international scenarios. However, the athletes participated in the main sports competition in the region. In addition, the study presented a cross-sectional design, evaluating athletes in just one moment of the season, which makes it impossible to analyze the cause-and-effect relationships between variables. Thus, it is suggested that future research should also be conducted with athletes from other team sports in order to compare groups, as well as the involvement of other variables and with a longitudinal design to verify the possible variance of the variables over a season.

CONCLUSIONS

The evidence suggests that, in the context of youth athletes, task orientation seems to positively predict the perception of team cohesion, whilst ego orientation seems to be a positive predictor of group conflict and a negative predictor of task cohesion. Athletes with lower scores of task and ego orientations showed higher scores in task cohesion and group conflict. From a practical point of view, this study comprehensively showed how AGT could influence the activity of youth athletes because depending on the motivation of these subjects and the way they seek to achieve their goals, they can positively or negatively influence the group and the individual. Thus, the importance of developing an interpersonal environment with athletes, coaches and physical education professionals is highlighted since such environments tend to contribute to the development of cohesion and conflict within the group among young athletes.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.26569

Lifestyle and functional fitness of elderly men and women attending a community center

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ABSTRACT

Identifying indicators that contribute to a favourable living condition becomes of great value for the diagnosis, as well as implementing preventive and health-promoting actions. The present work objective was to evaluate and compare the lifestyle, depressive symptoms and functional aptitude of elderly men and women attending a community centre. The sample consisted of 277 elderly people, 197 (71%) women and 80 (29%) men aged above 60 years. The elderly were evaluated using a questionnaire to assess lifestyle and depressive symptoms, and their functional fitness was assessed by functional autonomy tests. The differences between the parameters were analysed by the student's t-test and χ^2 whenever appropriate. Depressive symptoms were present in 35% of the elderly; however, the lifestyle analysis showed that 57.40% of the elderly had a very good classification, followed by 24.55% as good, 17.33% as excellent and 0.72% as regular. Regarding functional fitness, 19.39% of the elderly had a score related to a very good level, 15.97% good, 16.35% fair and 45.29% weak. The results found in this study suggest that the elderly attending the community centre presented low depressive symptoms with a lifestyle classification considered very good, however, with poor functional fitness with differences in some parameters between men and women.

KEYWORDS: elderly; functional aptitude; lifestyle, aging.

INTRODUCTION

The increase in population ageing is a phenomenon observed worldwide, specifically in Brazil, the growth of the elderly population has been considered exponential, with the prospect of even greater growth (Wong & Carvalho, 2006). The reason for this fact has been directed to the extension of life expectancy. This constant growth is accompanied by social changes and a high prevalence of chronic diseases, contributing to reduced functional capacity (Chodzko-Zajko et al., 2009).

Linked to other factors, such as a sedentary lifestyle, ageing makes this population a risk group, requiring greater attention since they are naturally susceptible to diseases in general and functional damage (Bocalini et al., 2012). Thus, the regular practice of physical activity as well as the adoption of a healthy lifestyle, can provide considerable physiological adaptations, impacting muscle mass gains (Gai et al., 2010), reducing anxiety and depression (Souza et al., 2014), in addition to promoting positive responses in osteo-metabolic disorders (Bocalini et al., 2012).

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Conflict of interests: nothing to declare. Funding: Fundação de Amparo à Pesquisa do Espírito Santo (grant number 1007/2022), Fundação para a Ciência e Tecnologia (grant number UID04045/2020), Conselho Nacional de Desenvolvimento Científico e Tecnológico e Faculdade Estacio de Sá.
Received: 02/25/2022. Accepted: 09/08/2022.

Thus, strategies for improving, developing and implementing healthcare actions for the population, regardless of age group, have been disseminated. Senior centres, also commonly known as elderly centres, seniors' clubs or community centres, offer a wide variety of programs and services. By offering opportunities for social interaction and friendship, senior centres have traditionally had a central role in easing loneliness, increasing social integration and reducing isolation (Bøen et al., 2010; Bøen et al., 2012; Rosenberg, 2015). Currently, the community centre also gained relevance as promoters of physical activity and successful ageing (Marhánková, 2014; Marquet et al., 2017; Marquet & Miralles-Guasch, 2015).

Among these strategies, that with the creation of the National Policy for the Elderly (Law nº 8.84 2/1994) regulated by decree nº 1.948/1996 and in the IV paragraph of the elderly care policy of the statute of the elderly (Law nº 8.842/ 1994) enabled numerous social assistance programs to promote better assistance to the elderly population, aiming to provide full assistance to the elderly. Studies (Beneditti & Petroski, 1999; Paulo et al., 2012; Tomicki et al., 2016) have often shown satisfactory results considering strategies offered in community centres for the elderly care in morpho-functional (Beneditti & Petroski, 1999), behavioural (Paulo et al., 2012) and psychological parameters.

Although the community centre has been considered an effective strategy to improve physical activity participation (Sarkisian et al., 2007; Porter et al., 2011), there is a lack of research devoted to measuring and objectively assessing the lifestyle and functional fitness gain from their visits to senior centres. Moreover, comparisons between the genders of elderly people attending these centres are still inconclusive. Therefore, the aim of the study was to evaluate and compare the lifestyle, depressive symptoms and functional aptitude of elderly men and women attending a community centre.

METHODS

The research was characterised as descriptive, exploratory, transversal and quantitative approach was carried out with 277 elderly people (197 women and 80 men) aged over 60 years who are physically independent and were recruited in a community centre and participated voluntarily in this study. The community centre serves approximately 800 elderly people in the region, being assisted in various activities, such as: water-based exercise, adapted volleyball, walking groups and various types of dance. They also have a literacy assistance service, computer rooms, and psychological support. In addition, the space also offers activities aimed at leisure, such as meetings scheduled for simple interaction between those interested.

After approval of the study by the Ethics and Research Committee of the Universidade Federal do Espírito Santo (nº: 4,131.396/2020), all elderly people attending—a community centre of Venda Nova do Imigrante (ES, Brazil) were invited to randomly participate in the study. All the elderly who participated in the project started the procedures only after providing a free and informed consent term signed according to the Declaration of Helsinki. The following exclusion criteria were adopted: recent hospitalisation, symptomatic cardiorespiratory disease, hypertension or uncontrolled metabolic syndrome, severe kidney or liver disease; cognitive impairment or progressive and debilitating conditions, obesity accentuated with incapacity for physical activity; recent bone fractures or any other medical contraindications for physical exercise.

Parameters evaluated

Lifestyle assessment

Lifestyle assessment was performed using the fantastic lifestyle questionnaire validated for the Brazilian population by Rodriguez-Añez et al. (2008). The instrument takes into account behaviours presented by individuals in the last month and the results obtained after the association between lifestyle and health itself. The tool has 25 questions, divided into nine domains, which were presented above, which are: 1) family and friends; 2) physical activity; 3) nutrition; 4) cigarettes and drugs; 5) alcohol; 6) sleep, seat belt, stress and safe sex; 7) type of behaviour; 8) introspection; 9) work.

The 25 questions that comprised the body of the questionnaire were arranged on the Likert scale so that 23 of these have five possible alternatives as answers, and 2 are presented in dichotomous ways. In order for the questionnaire to be applied in a simple way and later more easily to have the answers tabulated, the alternatives were arranged in column format, and progressively, from left to right, the choices were related to a healthier lifestyle. After completing the questionnaire, the results were obtained through the sum of this score, where the column, when marked, represents 1 point, and the column farthest to the right represents a score of 5 points on the scale. After the sum of the 25 columns, a score was obtained, in which individuals were classified into 5 categories, which are: "Excellent" (85 to 100 points), "Very good" (70 to 84 points), "Good" (55 to 69 points), "Regular" (35 to 54 points) and "Needs improvement" (0 to 34 points).

The interpretation of the scale is the following: "Excellent" rating is established as people who have a lifestyle with great influences on health; "Very good" means they have a lifestyle that provides an adequate influence on health; "Good" means that the lifestyle provides many health benefits; "Regular" means that somehow the lifestyle provides some health benefit, however, health risks will also be present; "Needs improvement" represents the lowest score, which means that several changes will be needed, as this lifestyle has many risk factors for the individual.

Functional fitness

Functional aptitude was assessed by the protocol of functional autonomy of maturity of the Latin American development group (GDLAM) being proposed by Dantas and Vale (2004) and used by other studies of our group (Suzuki et al., 2018). The protocol consists of carrying out the following tests: walking 10 m (W10m), getting up from a sitting position (LPS), rising from the prone position (LPDV) and getting up from the chair and moving around the house (LCLC). All tests were performed in the order described above, in a single day, using a 3-minute break between them to allow for good recovery between tests. According to Dantas and Vale (2004), the GDLAM General Index was calculated with the results considering Equation 1:

$$IG = \frac{((\mathrm{C10m} + \mathrm{LPS} + \mathrm{LPDV}) \times 2) + \mathrm{LCLC}}{3} \quad (1)$$

The functional classification followed the recommendations suggested by Dantas and Vale (2004), being distributed in indicators such as low (+28.54 points), regular (28.54 to 25.25 points), good (25.24 to 22.18 points) and very good (–22.18 points).

Depression

After applying the socio-demographic questionnaire, the assessment of depressive symptoms was analysed using the geriatric depression scale proposed by Yesavage et al. (1982). The instrument consists of 15 items with dichotomous responses. The score varies between 0 and 15 points and aims to include the following points: less than 5 points meaning a normal individual or without depressive symptoms; above or equal to 5 points, individual with depressive symptoms. For this study, the cutoff point was used for the summed results that result in a score equal to or greater than five, as indicative of symptoms of depression and in cases where the value obtained is less than five, it is established that there is no evidence of symptoms of depression.

Statistical analysis

The variables in this study are qualitative-quantitative. The data underwent statistical treatment with a descriptive approach, using resources of absolute (n), relative (%) frequency for qualitative variables and measures of central tendency (mean) and dispersion (standard deviation) for quantitative variables. To compare the differences between the groups of women and men, the χ^2 test was used for qualitative variables and the Student-t test for quantitative parameters. The effect size (ES) calculation and interpretation were based on the values established by Cohen: < 0.01= small effect; 0.06= moderate effect; and ≥ 0.14= large effect.

Analyses were performed using GraphPad Prism software (v. 6.01; GraphPad Software, USA) with a significance level of $p < 0.05$ with data presented as mean± standard deviation.

RESULTS

The general characteristics of the sample are presented in Table 1. A total of 277 elderly people participated in the study, 197 (71%) women and 80 (29%) men. Among them, 57.40% of the elderly were aged between 60 and 70 years, with 43.68% having the 4th grade in elementary school and 35.38% illiterate, and the vast majority being retired, with 89.17% of the general sample. Additionally, significant differences (x^2; $p = 0.0002$) were found in age between women and men, however, no differences between them were found in scholarship (x^2; $p = 0.1202$) and in occupation (x^2; $p = 0.1176$).

As seen in Table 2, 57.40% of the elderly had a very good lifestyle, followed by 25% good and 17% excellent. Comparing the parameters as well as the classification of lifestyle between women and men, significant differences ($p < 0.001$) were found in the family, alcohol, behaviour and introspection domains of the lifestyle as well as in the classification of the lifestyle where a higher prevalence ($p < 0.0001$) was found.

As shown in Table 3, significant differences ($p < 0.001$) were found in all tasks and in the classification of functional fitness between women and men. Variations of 52.43% and 13.51% among women and 38.46% and 33.33% among men in the classification between weak and very good, respectively. Although the lifestyle was considered very good, 45.29% of the elderly had a low level of functional fitness.

In Figure 1, it is possible to visualise the scores of depressive symptoms as well as the prevalence considering the presence or absence of symptoms. After analysing the scale, the mean total score of the elderly was 4.34± 2.60, reaching a prevalence of 35% of elderly people with depressive symptoms. Statistical differences ($p < 0.001$) were found after analysis by sex, with 42% of women presenting depressive symptoms with a mean score of 4.88± 2.66 points and 18% of men with 3.10± 2.04 points.

DISCUSSION

The aim results of the present study indicate that depressive symptoms were present in 35% of the elderly attending a community centre, however, the lifestyle analysis showed that 57.40% of the elderly had a very good classification followed by 24.55% as good, 17.33% as excellent and 0.72% as regular. With regard to functional fitness, 19.39% of the elderly had a score related to a very good level, 15.97% good, 16.35%

Table 1. Socio-demographic characteristics of elderly.

Parameters	Overal		Women		Men		p-value
	F	%	F	%	F	%	
Age (years)							
60 to 70	159	57.40	128	64.97	31	38.75	0.0002
71 to 80	100	36.10	62	31.47	38	47.50	
81 to 90	16	5.78	6	3.05	10	12.50	
91 and more	2	0.72	1	0.51	1	1.25	
Schoolarship							
Up to 3years	98	35.38	62	31.47	36	45.00	0.1202
4 years	121	43.68	93	47.21	28	35.00	
9 years	20	7.22	12	6.09	8	10.00	
11 years	21	7.58	17	8.63	4	5.00	
Graduate	17	6.14	13	6.60	4	5.00	
Ocupation							
Employed	6	2.17	4	2.03	2	2.50	0.1176
unemployed	11	3.97	10	5.08	1	1.25	
Retired	247	89.17	174	88.3	73	91.25	
Early retired by medical reason	7	2.53	3	1.52	4	5.00	
Housewife	6	2.17	6	3.05	0	0.00	

F: frequency.

Table 2. Life style parameters of elderly people.

Parameters	Overall	Women	Men	MD [95%CI]	ES	p-value
Family and friends	6.35± 1.80	6.13± 1.91	6.88± 1.38	0.75 [0.28 – 1.21]	0.39	0.0016
Physical activity	5.00± 2.02	4.89± 2.04	5.25± 1.95	0.35 [–0.17 – 0.88]	0.17	0.1878
Nutrition	8.65± 2.13	8.75± 2.09	8.40± 2.25	0.35 [–0.90 – 0.20]	0.16	0.2157
Cigarettes and drugs	14.18± 1.38	14.25± 1.35	14.01± 1.45	0.24 [–0.60 – 0.11]		0.1885
Alcohol	11.73± 1.34	11.95± x.48	11.18± 2.30	0.77 [–1.11 – –0.43]	0.17	< 0.0001
Sleep, seatbelts, stress, and safe sex	14.61± 2.40	14.49± 2.33	14.90± 2.57	0.40 [–0.22 – 1.03]	0.18	0.2024
Type behavior	4.55± 2.10	4.38± 2.16	4.97± 1.88	0.58 [0.03 – 1.14]	0.27	0.0376
Introspection	8.58± 2.40	8.33± 2.44	9.20± 2.10	0.86 [0.24 – 1.48]	0.35	0.0006
Work and satisfaction with profession	3.56± 0.73	3.58± 0.75	3.53± 0.67	0.07 [–0.26 – 0.11]	0.06	0.4327
Total score	76.91± 7.49	76.50± 7.49	77.91± 7.44	1.41[–0.54 – 3.36]	0.18	0.1561
Classification	F (%)	F (%)	F (%)			
Excellent	48 (17.33)	24 (12.18)	24 (30.00)			< 0.0001
Very good	159 (57.40)	138 (70.05)	21 (26.25)			
Good	68 (24.55)	34 (17.26)	34 (42.50)			
Regular	2 (0.72)	1 (0.51)	1 (1.25)			
Needs improvement	0 (0)	0 (0)	0 (0)			

Values expressed in mean± SD; MD [95%CI]: mean difference [95% confidential interval]; ES: effect size; F: frequency.

fair and 45.29% weak. Studies dedicated to investigating the influence of socioeconomic indicators, demographics, lifestyle as well as level of physical fitness are important, mainly due to their association with health. So, with the accumulation of knowledge generated by the studies, it is possible to generate improvements in implementing healthcare strategies for the population, regardless of age.

In Brazil, based on the creation of the National Policy for the Elderly (Law No. 8.84 2/1994) regulated by Decree No. 1.948/1996 and the IV paragraph of the elderly care policy of the Statute for the Elderly (Law No. 8.842/1994) and programs of social assistance, strategies were disseminated in order to promote better care for the elderly population. In this context, in 2001, through the ordinance MPAS/SEAS No. 7, the creation of community centres for the elderly emerged in a regulated manner, with the aim of promoting interaction between the elderly, family and community.

Studies (Guimarães et al., 2020; Nóbrega et al., 2015) have already dedicated themselves to investigating the influence of these spaces in different perspectives of elderly care, emphasising problems associated with depression. Considering that depression is considered one of the major public health problems (Strawbridge et al., 2002), as it affects about 17% of the world population, understanding the possible indicators associated with the disease is considered essential for applications and interventions for the treatment and prevention of this disease. Currently, it is known that, although the disease can affect people at any stage of life, the elderly population is frequently affected by the disease, with variations between 15 and 30%, especially in institutionalised populations (Stella et al., 2002).

According to Pinton et al. (2006), among the classic factors identified in the depressive condition, it is possible to consider that three domains are primarily affected, namely: the affective domain, identified through crying, apathy and sadness; the cognitive domain, which manifests itself through feelings of worthlessness, lack of hope, guilt and finally the somatic domain, which is related to pain, lack of energy and sleep disorders. Considering the level of depressive symptoms, the prevalence (35%) of the present study was similar to that in other studies carried out by our group (Guimarães et al., 2020; Valadares et al., 2019) in a different city of the same region (which found a variation between 35 and 37% of depressive symptoms in the elderly). Similar data were also found in other Brazilian cities, with values corresponding to 30.6% (Nogueira et al., 2014). Many factors can influence these results, such as socioeconomic factors, retirement, decreased self-esteem, low education, low income, high drug consumption, reduced ability to perform daily activities, and loss of close people, such as spouse, children or friends. All these factors are considered triggering for the onset of depressive symptoms (Irigaray & Schneider, 2007).

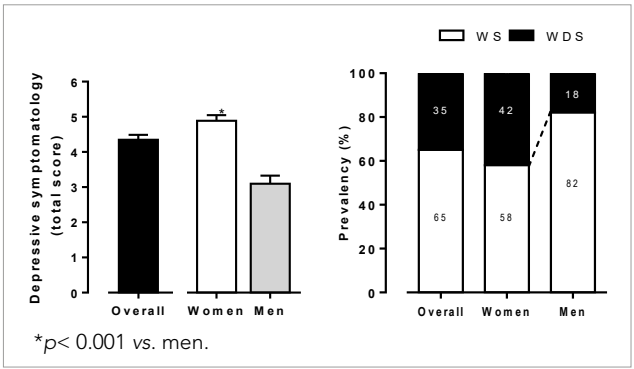

Figure 1. Values expressed in mean± SD of (A) total score to depressive symptomatology and (B) prevalence of symptomology of elderly people without (WS) and with depressive symptoms (WDS).

Table 3. Functional fitness of elderly people.

Parameters	Overall	Women	Men	MD [95% CI	ES	p-value
W10m (sec)	6.37± 1.94	6.51± 2.85	5.87± 2.08	0.63 [–1.14 – –0.13]	0.22	0.0137
LPS (sec)	11.31± 3.29	11.58± 3.19	10.67± 3.47	0.90 [–1.77 – –0.04]	0.28	0.0385
LPDV (sec)	4.29± 2.81	4.58± 3.12	3.61± 1.76	0.97 [–1.70 – –0.23]	0.31	0.0095
LCLC (sec)	43.29± 11.53	44.40± 11.88	40.70± 13.65	3.69 [–6.98 – –0.43]	0.31	0.0267
GS (score)	29.06± 8.09	29.92± 7.79	27.04± 0.8.48	2.87 [–4.97 – –0.76]	0.36	0.0076
Classification	F (%)	F (%)	F (%)			
Very good	51 (19.39)	25 (13.51)	26 (33.33)			0.0030
Good	42 (15.97)	31 (16.76)	11 (14.10)			
Regular	43 (16.35)	32 (17.30)	11 (14.10)			
Low	127 (45.29)	97 (52.43)	30 (38.46)			

Values expressed in mean± SD. Walking 10 m (W10m), getting up from a sitting position (LPS), rising from the prone position (LPDV) and getting up from the chair and moving around the house (LCLC) and GDLAM score (GS); MD [95%CI]: mean difference [95% confidential interval]; ES: effect size; F: frequency.

Another important component frequently investigated in the ageing process is functional fitness, mainly due to its association with an independent lifestyle. Blay et al. (1991) demonstrated that elderly women with poor health were associated with lower functional capacity as well as low social status. In our study, 45.39% of the elderly were classified as weak, with the same phenomenon found in men (52.43%) and women (38.46%). There is evidence that indicators of functional independence are associated with depressive symptoms, for example, Guimarães et al. (2020) and Branco et al. (2015) demonstrated a positive correlation between the scores of depressive symptoms and functional capacity, indicating that impairments in functional fitness can contribute for a higher incidence of depressive symptoms. Using the functional fitness indicator, the value presented in the present study (29± 8) was lower than that found by Guimarães et al. (2020), who presented 36.23± 28.75 of elderly people without depressive symptoms.

Branco et al. (2015) demonstrated that elderly people who present decreased exercise intensity, physical activity, and physical fitness tend to exhibit more depressive symptoms compared to those who remain active throughout life. Additionally, it is known that impairments in physical mobility can promote low self-esteem, decrease participation in the community and reduce the circle of social relationships that can naturally affect the increase in cognitive, behavioural and physical complications (physical fitness) that together intensify the ageing process.

Thus, the information presented collectively in the literature is consensual in considering that physical fitness directly affects functional capacity. In this sense, adopting a healthy lifestyle is considered decisive to promote improvements in the perception of quality of life and functional independence of the elderly (Ferreira et al., 2012). Valadares et al. (2019) demonstrated that lifestyle is an important parameter for the increase of depressive symptoms, with the group with depressive symptoms classified as having a good and regular level. In our study, the classification values of lifestyle varied between good and excellent, with the highest prevalence classified as very good (57.40%). In addition to considering the total lifestyle score, the values found in the present study (77± 8) were similar to those found by Valadares et al. (2019) in the group without depressive symptoms (79± 8).

The individual lifestyle indicators in our study were similar to the values found by Valadares et al. (2019) for elderly people without depressive symptoms. Indeed, there are studies showing that psychiatric disorders are associated with family problems such as lack of contact with family members (Teston et al., 2014), lack of physical activity (Moraes et al., 2007), high practice of physical activity and the predisposition to adopt healthy habits (Hua et al., 2015).

Considering the differences between men and women, our data agree with those by Gomes et al. (2007), showing that women tend to be more involved in community programs and more concerned with health than men. Additionally, it is worth mentioning that although sex differences were found in the lifestyle indicators, the classifications ranged from good and very good to excellent.

Therefore, the behaviours adopted by people can influence the quality of their ageing, namely healthy eating behaviour and involvement in personal, social, and physical activities that can positively influence physical function, mental function and also the individual's engagement with life (Oliveira et al., 2007).

Although lifestyle was considered adequate, the indicators of functional fitness in the present study were considered low for both sexes. Thus, our findings are not in agreement with information available in the literature indicating that more active lifestyles are related to higher levels of functional fitness (Cardoso et al., 2008). Hypotactically, although the activities of the community centre are efficient in promoting positive behavioural changes, they were not sufficient to promote the improvement of physical fitness parameters (dose-response relationship).

Some limitations should be indicated in the present study and serve as guidelines for future studies, with emphasis on the non-assessment of the level of physical activity according to its type (physical activity at home, displacement, occupational, leisure and recreational physical activity). In addition, because the study proposes to investigate the lifestyle and its indicators, objective evaluation considering caloric intake, food choice, and distribution must also be accounted for in future studies. Finally, additional clinical and psychological assessments using multivariate analyses may also help to evaluate the influence of actions offered in community centres.

CONCLUSION

In conclusion, the results found in this research suggest that the elderly assisted in the community centre had low depressive symptoms and classification of lifestyle considered very good, yet with poor rated functional fitness. Additionally, the family and friends, alcohol, behaviour, and introspection parameters of lifestyle differ between women and men, with similar results in all functional parameters and depressive symptoms. Altogether, these results point to some possible applications, such as the activities of the community centre that were shown to be efficient in promoting positive behavioural and functional changes may be further optimised, aiming for increment in these parameters. Alternatively, other activities less prone to show positive changes may be less frequent.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.26611

Reliability of maximum oxygen uptake on an Air Bike arm- and leg-ergometer

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ABSTRACT

Air Bike ergometers have recently appeared and become popular among fitness. These ergometers combine the use of upper or lower limbs while remaining seated. Its characteristic is that of a system of external load imposed through air resistance which increases with the cadence imposed on the equipment. The present study aimed to evaluate the reliability of the ramp test and standard leg-cycle ergometer to assess maximum oxygen uptake (VO_2max). For this purpose, 18 physically active young men, aged between 19 and 29 years (mean ± standard deviation= 21.78± 2.44), performed three maximal incremental ramp tests in random order: one test on a cycle ergometer and two tests on an Air Bike arm- and leg- ergometer (test and re-test) with cardiorespiratory measurements throughout the tests. VO_2max and maximum heart rate (HRmax) were significantly higher in the Air Bike compared with the cycle ergometer (53.06± 8.72 vs 47.38± 9.15 mL/min/kg), 181.93± 10.20 vs 176.07± 5.28 bpm, p< 0.001; 95%CI 3.41–7.95; ES= 0.30 and p= 0.01; 95%CI 1.44–10.29; ES= 0.34, respectively for VO_2max and HRmax). There were no differences between the two ergometers in the maximum respiratory exchange ratio (RER) and test duration (1.21± 0.13 vs 1.21± 0.13, 598.06± 37.28 vs 612.22± 86.40 s, p= 0.9; IC95% –0.05 – –0.05; ES= 0 and p= 0.4; 95%CI –46.12–17.79; ES= –0.11, respectively for RER and test duration). Both VO_2max and HRmax showed to be reliable when assessed with the Air Bike ergometer. The maximal test carried out on the Air Bike is a reliable ergometer to assess VO_2max and probably enables a higher VO_2max as compared with a standard leg-cycle ergometer.

KEYWORDS: VO_2max; leg-ergometer; arm- and leg-ergometer.

INTRODUCTION

Air Bike leg- and arm- ergometers recently emerged in the fitness industry, especially in CrossFit®, and it became of common use in fitness centres. Air Bike Revolution is a cycle ergometer that allows the use of the upper and lower limbs simultaneously while seated. Its characteristic is that of a system of external load imposed through air resistance which increases with the cadence imposed on the equipment. This equipment is used both in aerobic low-intensity and anaerobic interval high-intensity training programs.

To our knowledge, there are no studies on cardiorespiratory measures with this equipment, probably due to its novelty. Nevertheless, there are several validated protocols in equipment with similar electromagnetic or air resistance (Balmer et al., 2000a; 2000b). There are major differences in heart rate (HR), oxygen uptake (VO_2), lactate and respiratory exchange ratio (RER) when they are compared in these equipment (Lindenthaler et al., 2018).

To assess cardiorespiratory fitness, maximal tests with incremental load performed in an ergometer are typical (Stevens & Dascombe, 2015). Data from these tests are either used as a fitness measure or a tool in exercise prescription, enabling a more precise, safe and effective exercise intensity. Physiological measures commonly involved in maximal testing are oxygen uptake (VO_2), ventilatory thresholds, HR and rate of perceived exertion (RPE) (Mielke et al., 2009).

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Conflict of interests: nothing to declare. Funding: Fundação para a Ciência e Tecnologia (grant number UID04045/2020).
Received: 03/01/2022. Accepted: 09/05/2022.

Thus, it is relevant to investigate whether cardiorespiratory measures in a maximal test in the leg- and arm- Air Bike ergometer matches those with a standard leg- cycle ergometer. Once the Air Bike Revolution has never been tested regarding its reliability, we herein assess this. Moreover, once standard cycle ergometer VO_2max protocols are designed to be applied in leg-only ergometers, e also compared the Air Bike response to that in a leg cycle ergometer. Hence, it is relevant to investigate whether cardiorespiratory measures in a maximal test in the leg- and arm- Air Bike ergometer matches those with a standard leg- cycle ergometer. Therefore, the present study aimed to evaluate the reliability of a ramp test and standard leg- cycle ergometer to assess maximum oxygen uptake (VO_2max). We hypothesised that a maximum test on the Air Bike Revolution enabled us to assess the VO_2max and that cardiorespiratory measurements are reliable in this ergometer.

METHODS

Participants

Eighteen physically active young men, aged 21.78 ± 2.44 years, 1.77± 0.05 m in height and 75.78± 8.39 kg of body mass, volunteered to participate in the present study. The participants met the following inclusion criteria: they had to be involved in regular exercise for at least 12 months with a frequency of at least twice a week; they could not present any medical condition able to impair maximal exercise tolerance; they could not use any drug during the experiment (including alcohol, tobacco and caffeine); they could not answer positively in any item of the PAR-Q questionnaire. The sample's representativeness was *post hoc* adjusted by the sample size calculation, with G-Power software (Faul et al., 2007) requiring an effect size of 1.12 (Cohen, 1988) for a 95% statistical power. After a complete explanation of the methods, each participant filled out and signed a free and informed consent prepared in accordance with the declaration of Helsinki (World Medical Association, 2013). The study was approved by the University of Trás-os-Montes e Alto Douro research ethics committee (Doc25-CE-UTAD-2020).

Experimental design

A prospective compared single-centre study. On the first visit to the laboratory, the participants were submitted to anthropometric measurements, followed by the first experimental session with cardiorespiratory testing. Each participant performed three experimental sessions of maximal testing on a ProTrainer cycle ergometer (Wattbike, Nothingham, UK) and an Air Bike Revolution ergometer (BoxPt, Póvoa de Varzim, Portugal), through an incremental load ramp protocol. The three experimental sessions were separated by 72 hours and performed in random order at the same time of the day. From the three sessions, two were held with Air Bike Revolution (test and re-test) and one with the cycle ergometer. Figure 1 displays the experimental design. The participants were instructed to maintain an identical food and water intake prior to the 3 experimental sessions. To assure proper hydration, a minimum of 330ml of water were required to be ingested in the 2 hours preceding each experimental session.

Anthropometric measurements

A stadiometer (Sanny ES 2030, American Medical do Brasil, Ltda, São Paulo, Brazil) was used for height measurement. The height was defined as the distance, in a straight line, between the uppermost point of the skull and the lowest point (in this case, the floor where the feet were placed), with the subject in an anthropometric (erect) position. That is, by drawing an imaginary line (using an object as a linear example: ruler) that passes through the lower point of the lower edge of the right eye orbit and the highest point on the upper side of the corresponding external auditory meatus. The subjects stood barefoot, with the heels together, forming a "V" with the feet and the coccyx, a dorsal column, and a posterior part of the head in contact with the stadiometer. The reading was expressed in centimetres to the tenths and recorded after a deep inspiration.

An electronic scale was used to assess the body mass (Tanita BF-562, Tanita Europe B. V., Yiewsley Middlesex, United Kingdom), where subjects wore only shorts and stood barefoot in the centre of the platform of the scale and remained immobile until stabilisation of the scale digits. Body mass was expressed in kg to the nearest tenths.

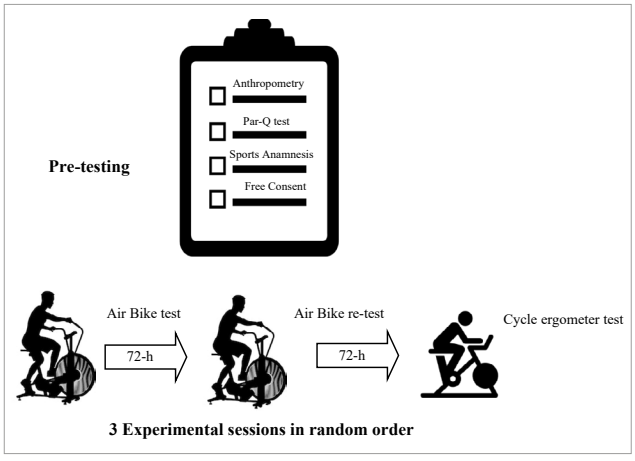

Figure 1. Experimental design.

Maximal testing

Two cycle ergometers were used, a ProTrainer cycle ergometer which required standard leg-only cycling and an Air Bike Revolution ergometer which required lar- and arm-cycling exercise. The individual adjustment of the vertical saddle of the ergometers was standardised by the point where the individual presented a knee extension as close as possible to full extension. The protrainer cycle ergometer is an ergometer that calculates the energy production through an individual load cell for each pedal, thus distinguishing the force performed independently by the left lower limb and the right lower limb. It is a reliable instrument, well studied, validated and with reliable values and tests concerning the measured power (Hopker et al., 2010; Wainwright et al., 2016).

Due to the differences between the cycle ergometers in terms of their relationship between cycle cadence and power output, we conducted several pre-testing with 5 subjects. These pre-tests were performed from lower exercise intensity up to an exercise intensity at the second ventilatory threshold. The pre-tests were designed to standardise the cycle cadence in the two ergometers; in order to attempt to have a similar power output while maintaining standardised constant-intensity increases. While in the leg- cycle ergometer, the load imposed by the electromagnetic mechanism is used to increase power output, in the Air Bike ergometer, power output can only be increased by increasing cycle cadence.

Table 1 presents the standardised protocols applied, from the lowest to the highest intensity attained during the experimental sessions. In both ergometers, the test started with the participants resting seated on the ergometer for 2 minutes (Haapala et al., 2018). In the leg-cycler ergometer, the test started with a load of 25 Watts, with a cadence of 60 rpm, with an increase of 25 W of load every minute (Carey & Richardson, 2003; Hopker et al., 2010). On the other hand, with the Air Bike ergometer, the test started at 30 rpm, with an increase of 5 rpm every minute. The tests were performed until exhaustion, being interrupted when the subject was unable to maintain cadence and/or power output.

Table 1. External load during the tests.

Stage	Air Bike ergometer		Cycle ergometer	
	Cadence (rpm)	Power (watt)	Cadence (rpm)	Power (Watt)
1	30	27	60	25
2	35	44	60	50
3	40	65	60	75
4	45	89	60	100
5	50	121	60	125
6	55	156	60	150
7	60	205	60	175
8	65	306	60	200
9	70	377	60	225
10	75	466	60	250
11	80	558	60	275
12	85	778	60	300
13			60	325

Physiological measurements

The ventilation and expired gases were measured using a portable open circuit system (COSMED® K4b2, Rome, Italy). This device was used in a breath-by-breath analysis during all sessions, with subsequent averaging in 20-s intervals (Haapala et al., 2018). The gas analyser was previously switched on 45 minutes before use until it reached the internal temperature of 36°C of the device (McLaughlin et al., 2001). Subsequently, the device was calibrated before each session with a mixture of ambient gas and a mixture of gas of the known calibration (16.00% oxygen and 5.00% carbon dioxide). The device turbine was also calibrated with a 3-litre syringe (McLaughlin et al., 2001) supplied by the manufacturer. Room air and delay calibrations were also performed. HR was obtained through a strap (Wireless Double Electrode, Polar®, Kempele, Finland) placed on the participants' chests in all experimental sessions. The electrodes were moistened and placed at the level of the xiphoid appendix. The HR values were obtained beat by beat. The OMNI CYCLE rate of perceived exertion scale of 10 values (Robertson et al., 2004) was used during all experimental sessions,

The VO_2max was the highest 20-s average value of relative VO_2 obtained during the maximum tests. Criteria to declare VO_2max included: i) VO_2 plateau; ii) respiratory exchange ratio≥ 1.10; iii) HR≥ 90% of the predicted maximum HR (Poole & Jones, 2017); iv) inability to maintain power output; v) rate of perceived exertion≥ 8 on the OMNI (Mezzani, 2017). At least 4 of the 5 criteria were required to declare the VO_2max.

The analysis of all data was performed using the IBM SPSS Statistics for Windows (Version 25) predictive analytics software. Exploratory data analysis was performed where normality and homoscedasticity assumptions were verified. The Intraclass Correlation Coefficient was used to test the reliability between the maximum VO_2 measurements in the Air Bike ergometer (test and re-test), and t-tests were performed to compare measurements between the two ergometers. In these comparisons, data with the Air Bike ergometer were the average of both measurements. Bland-Altman

plots (Bland & Altman, 2010) were also used to investigate the agreement between the 2 ergometers and simple linear regression between vales with the two ergometers showed the standard error of the estimate. The level of significance was set at 5%.

RESULTS

An excellent intra-class correlation (ICC) was observed for VO_2max measures in the two tests with the Air Bike ergometer (r= 0.96), and good correlations were found in all other variables that were analysed, HR (r= 0.75), RER (r= 0.87) and test duration (r= 0.86).

The values in Table 2 VO_2max and maximum heart rate (HRmax) were significantly higher in the Air Bike compared with the cycle ergometer (53.06± 8.72 vs 47.38± 9.15 mL/min/kg), 181.93± 10.20 vs 176.07± 5.28 bpm, p< 0.001; 95%CI 3.41–7.95; ES= 0.30 and p= 0.01; 95%CI 1.44–10.29; ES= 0.34, respectively for VO_2max and HRmax).

There are no significant differences between ergometers in RER and test duration, as confirmed by the Bland Altman plots (see Figures 2 and 3).

Table 2. Means (± standard deviation) in the two ergometers and standard error of the estimations with Air Bike ergometer.

	Air Bike	Cycle Ergometer	SEE	Relative SEE (%)
VO_2max (mL/min/kg)	53.06± 8.72	47.38± 9.15**	4.42	9.3
HRmax (bpm)	181.93± 10.20	176.07± 5.28*	8.21	4.7
RER	1.21± 0.13	1.21± 0.14	0.1	8,3
Time (s)	598.06± 37.28	612.22± 86.40	26.12	4.3

VO_2max: maximum oxygen uptake; HRmax: maximum heart rate; RER: respiratory exchange ratio; Time: total duration of maximum test; SEE: standard error of the estimate; **P< 0.001; *P= 0.01.

DISCUSSION

The present study investigated whether cardiorespiratory measures in a maximal test in the leg- and arm- Air Bike ergometer are reliable and if they match those with standard leg- cycle ergometer. We hypothesised that a maximum test on the Air Bike Revolution enabled the measure of VO_2max and that cardiorespiratory measurements are reliable in this ergometer. To the best of our knowledge, this is the first study to investigate maximal testing on a leg- and arm- cycle ergometer as the Air Bike herein.

The main results of this study show that the maximum test performed on the Air Bike ergometer enabled higher VO_2max and HRmax as compared with the standard cycle ergometer. Moreover, the maximum test performed on the leg- and arm- ergometer proved to be reliable for VO_2max and HRmax.

Cycle ergometers are often used either in a recreational or competitive context, more often to carry out efforts of longer duration and moderate intensity (predominantly aerobic). However, these are also used in high-intensity exercise, at intensities that enable the VO2max. Hence, maximal cardiorespiratory testing is often performed with standard leg- cycle ergometers. Different ergometers are expected to yield different maximal cardiorespiratory measures. Indeed, different VO_2, HR and ventilation have been shown by the study of (Lindenthaler et al., 2018), who compared a Wattbike cycle ergometer /the same as used in the present study) with the Concept II Rower ergometer at various and similar power outputs. In addition, the later study describes that when the VO_2 values were equal between ergometers, differences in HR and ventilation were observed, reinforcing the specificity of each ergometer. In another study (Egan et al., 2016) performed the same comparison, cycle ergometer vs. rowing ergometer, and observed differences in VO_2 and HR, both at sub-maximal intensities (50% VO_2max) and at maximal

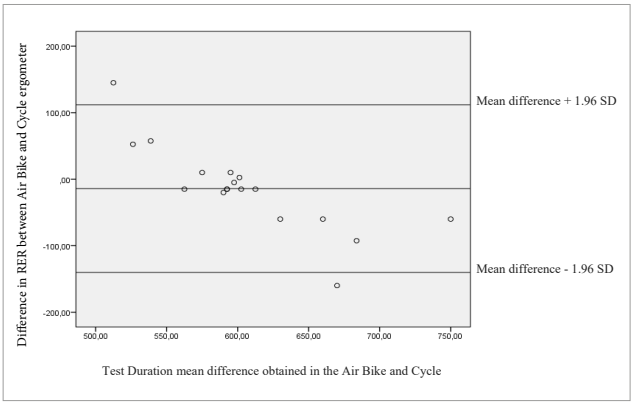

Figure 2. Bland Altman plot of Respiratory Exchange Ratio.

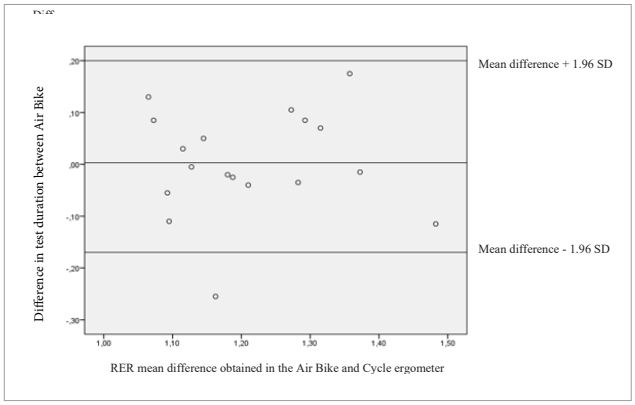

Figure 3. Bland Altman plot of test duration.

exertion. In fact, differences in cardiorespiratory measures between lower limb vs upper limb exercise were longtime established (Schneider et al., 2002). Our data confirm all these, as leg- and arm- cycle exercise did enable higher cardiorespiratory output (VO_2 and HR), though this was the first study to conclude the Air Bike ergometer in comparison against standard cycling.

Maximum VO_2 in the Air Bike ergometer was more than 10% above that measured in the cycle ergometer. Generally, large muscle mass involvement is the main reason to explain higher VO_2 and HR (Reis et al., 2017), as seen by Egan et al. (2016) and by Lindenthaler et al. (2018) in cyclical exercise of durations from 4 to 20-min. Also, the same phenomenon has been described in exercises with anaerobic predominance, for example in resistance training (Farinatti et al., 2016). Moreover, the fact that the power output was much higher in the Air Bike for the similar protocol stages and exercise duration can also help to explain the larger VO_2max.

Although the training status and subsequent adaptations to specific ergometers have also been presented as explanations for differences between the physiological response to different ergometers (McNarry et al., 2011), this was not the case in the present study, as the subjects were regularly active but not involved in specific training with either of the two ergometers herein.

Even when ergometers with similar movement are compared, differences may result from differences in the loading system, which can be imposed either by electromagnetic or air resistance (Balmer et al., 2000a). Additionally, the manufacturers of the ergometers are not the same, so the magnitude and/or kinematics may differ, which can increase the bias of internal load markers (Balmer et al., 2000b; Mahony, 1999). The two ergometers used in the present study had different loading systems. Therefore, a thorough pre-testing was warranted to establish a ramp protocol that would be as close as possible to the two ergometers. Still, though implementing concomitant relative increases in the load, clear different power output was observed when the Air Bike ergometer exercise cadence surpassed 60 rpm (see Table 1). The most fit subject attained stage 13 in both tests. The majority of subjects attained around 10 min in both ergometers, resulting in a power output of 466w in the Air Bike ergometer and 250w in the cycle ergometer.

Some possible limitations of the current study include the sample size and the fact that the VO_2max protocol used as reference was performed on a watt bike ergometer, whose mechanics are slightly different from that of standard le cycle ergometers.

CONCLUSION

It is concluded that a maximal ramp test carried out on the Air Bike is a reliable tool to assess VO_2max and enables a higher VO_2max as compared with a standard leg- cycle ergometer. Since leg- and arm cycle ergometers are currently found in most gyms and fitness centres, the results herein show that this ergometer may be used to test maximal aerobic power and to be used as an alternative to leg-only cycle ergometers.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.26620

Factors associated with perceived quality in Turkish fitness centres: a qualitative perspective

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ABSTRACT

This study aimed to define the general factors affecting the quality of fitness centres from the point of view of the members' opinions and the relation densities of the features within these factors. The study was carried out using the qualitative method. Data coding was done utilising MAXQDA, a qualitative data analysis program. MAXQDA's code co-occurrence model feature is employed to visualise code relationships. According to the research findings, the most intense relationship that the factors affecting the staff quality perception of fitness centres have with each other was defined as "Willing to help-Friendliness". When looking at the results obtained in other factors, codes of "Expertise-Communication" for the quality of the trainer, "Facility Atmosphere-Air conditioning" for the quality of the physical environment, and "Meeting the need-Program variety" for the program quality were associated with each other. Findings from this study provide implications for facility managers who need to closely monitor fitness centres' physical environment, staff, instructors, program quality and implement remedial measures as needed.

KEYWORDS: fitness centres; staff quality; program quality; instructor quality; qualitative method.

INTRODUCTION

Regular participation in physical activity plays an important role in helping people have healthier, balanced, productive, and happy lives (Vlachopoulos & Karageorghis, 2005). Before the coronavirus pandemic, the global health club industry finished the decade with record performance (Deloitte, 2021; IHRSA, 2020). In fact, today, thanks to the increase in awareness of healthy living, the interest in fitness centres has also increased. However, though the number of members of fitness centres decreased in 2020 by –15.4 million to 54.8 million, fitness is still considered to be the number one sports activity in Europe. The total income of fitness centres increased to 18.9 billion Euros (Deloitte, 2021).

Despite this growth in fitness centres, the fitness industry continues to be characterised as an industry where members can easily leave (Alexandris et al., 2022; Clavel San Emeterio et al., 2019; Gonçalves & Diniz, 2015). According to research, when customers are dissatisfied with the service quality, only 4% report this to the business management, while disappointed customers terminate their fitness membership (Zarotis et al., 2017). A customer dissatisfied with service quality informs seven potential customers about bad service (Bly, 2003; Tsitskari et al., 2006). Fitness businesses spend large sums to find new customers to replace those lost. In fitness centres, meeting expectations and differentiating from others in the eyes of the member is related to service quality (Rieger, 2012). The increase in the number of fitness centres in the last decade has raised competition and changed customer expectations. This change has led fitness centre managers to better understand their customers and meet their expectations at the maximum level (Jasinskas et al., 2013; Kriegel, 2012).

Service quality is a widely discussed concept in businesses, especially fitness businesses. When the body of literature is examined, it can be seen that the relationship between service quality in fitness centres with attitudes such as satisfaction, commitment, and behavioural intent has often been revealed (Fernández-Martínez et al., 2020; García-Fernández et al., 2018). At the same time, many scales related to service quality in fitness centres have been developed (Chang

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Conflict of interests: nothing to declare. Funding: none.
Received: 02/03/2022. Accepted: 09/20/2022.

& Chelladurai, 2003; Lam et al., 2005). However, all these developed scales were limited to certain dimensions of service quality. For example, Lam et al. (2005) evaluated the service quality in fitness centres on the SQAS scale (Service Quality Assessment Scale) in six dimensions: staff, program, locker room, physical facility, workout facility, and childcare.

Chang and Chelladurai (2003) defined the quality of service in three dimensions and nine sub-dimensions as input (Service Climate, Management Commitment to Service Quality, Programming), throughput (Interactions persona/task, physical environment other clients' service failure/recovery) and output (Perceived service quality). When this and similar studies are evaluated, it can be seen that the scales of service quality in fitness centres have been systematically developed, and service quality has been gathered under certain dimensions. However, in these scales, the fact that even a single sub-dimension of service quality can contain many sub-dimensions may have been ignored.

Many researchers in the literature have identified the quality of the physical environment (Papadimitriou & Karteroliotis, 2000) and staff (Chang & Chelladurai, 2003) as a dimension of quality. However, in many scales, the fact that these dimensions may have sub-dimensions has not been taken into consideration. What is missing here is the multidimensionality of quality. For example, trainers can emerge as a dimension of quality in fitness centres when measured by the positivist paradigm. Yet, the important point is which trait of the trainers will grant them quality in the member's eyes. For example, elements such as the appearance or communication of the trainer can be a factor in the evaluation of the trainer's quality, and more factors may arise in relation to this quality. In this context, the quality of other dimensions determined in the theoretical structure of the service quality in the fitness centre may be related to many factors. It may not be possible to learn this through the positivist paradigm. Nonetheless, it may be possible to learn the subject in more depth, thanks to qualitative research.

Fitness centres have become reference sports facilities for the spread of sports in society and the elimination of physical activity (Baena-Arroyo et al., 2020). But the growing interest in fitness services demands optimal service management and operation (León-Quismondo et al., 2020). Therefore, one of the most important elements for the success of fitness centres is a detailed understanding of quality elements. It is noteworthy that there is a paucity of qualitative studies that will fill this gap and give more details about what quality includes.

As evidenced, the traditional approach to the current problem in the sports and fitness industry has been through quantitative research. However, the closed nature of quantitative questions can be enriched with qualitative data (Felipe et al., 2013). This research, on the other hand, will fill this gap and will help us to understand the quality of fitness centres in more detail (Brady & Cronin, 2001; Lam et al., 2005) by completing the elements of personnel, the physical environment and program quality in more detail than has been identified in the literature to date. Therefore, the aim of this research is to determine the general factors affecting the quality of fitness centres in terms of the opinions of their members and the relationship intensities of the features within these factors.

Methodological framework

Service quality

Service quality is defined as the difference between consumers' expectations about service performance before service is provided and their perception of service after consumption (Lehtinen & Lehtinen, 1991). It is also expressed as the level of service provided to meet the expectations of consumers (Parasuraman et al., 1985). Grönroos (1984, p. 37) defined "Service quality as a general impression or attitude related to the excellence of service". Providing quality service is one of the main strategies for success in a fiercely competitive environment. It is an important factor for businesses that want to increase their customer volume, maintain continuity, get ahead in the fight against competitors and provide the continuity of the income that they obtain from their customers (Yu et al., 2014). Researchers have paid intense attention to service quality because of its importance.

One of the first models in service quality was developed by Grönroos (1984). In this model, he proposed three dimensions -technical, functional and image- for the evaluation of the service quality. Technical quality is the evaluation of what the customers achieve as a result of their interaction with the business service. Functional quality is about how the customer receives the service, apart from technical quality. While functional quality is about the delivery of the service, technical quality is a review of what is offered. Image is the dimension appearing as a result of the technical and functional quality of the service (Grönroos, 1984).

Another approach to service quality is the disconfirmation paradigm proposed by Parasuraman et al. (1985). According to this paradigm, the quality perception of the service is determined by comparing the expectations of the customer and the actual performance of the service provided by the supplier. If the expectation is higher than the perceived service quality, the perception towards quality will not appear satisfactory. If the expectation is equal to or lower than the perceived service quality, a satisfactory perceived quality will

be obtained (Parasuraman et al., 1985). Researchers have developed the SERVQUAL model for use in the assessment of service quality in many industries. According to this model, the service experience is measured by the dimensions of reliability, responsiveness, empathy, assurance, and tangibility (Parasuraman et al., 1985).

The SERVQUAL model has come in for criticism over time (Yıldız, 2012). Cronin and Taylor (1992) developed the SERVPERF scale by claiming that this model has shortcomings. They stated that this scale encompasses much more diversity and that it is not satisfaction-oriented like SERVQUAL but performance-oriented. In addition, the researchers criticised that the SERVQUAL model is accurate in only two of the four industries. In short, although both models have strengths and weaknesses, they are still being used, and there is no consensus on which model is more appropriate (Yıldız, 2012).

Service quality in fitness centres

When the literature on the service quality of sports and fitness centres is examined, it is seen that the researchers have revealed general and specific quality model structures. Scales such as An Instrument for Evaluating Service Quality of Health/Fitness Centers (SQAS) by Lam et al. (2005), The scale of service Quality for Participant Sport (SSQPS) by Chang et al. (2005), A Hierarchical Model of Service Quality for Recreational Sport Industry (SSQRS) by Ko and Pastore (2005), Scale of Quality in Fitness Services (SQFS) by Chang and Chelladurai (2003), Factor Quality Excellence of Sports Centers (QUESC-4) by Papadimitriou and Karteroliotis (2000), Center for Environmental and Recreation Management-Customer Service Quality (CERM-CSQ) by Howat et al. (1996), Quality Excellence of Sports Centers (QUESC) by Kim and Kim (1995), Evaluation of Perceived Quality in Sports Services (CECASDEP) by Morales Sánchez et al. (2009), and Service Quality in Fitness Centers Scale by Sevilmiş and Şirin (2019) have been developed. Similar and different dimensions were used in each measurement tool to evaluate the service quality in fitness centres. In particular, programs, instructors, staff and physical environment attract attention as the most important structures used in measuring service quality in fitness centres (Jasinskas et al., 2013; Yıldız, 2011). Today, due to its importance in fitness centres, many authors are researching and analysing the quality of service (De Farias et al., 2021; Eskiler & Altunışık, 2021; Peitzika et al., 2020; Polyakova & Ramchandani, 2020; Pradeep et al., 2020; Xu et al., 2021; Yıldız et al., 2021).

The dimensions used in the service quality assessment of fitness centres are generally defined by the quantitative research paradigm. This paradigm is criticised for ignoring the effects and consequences of social and cultural infrastructures, which are becoming more and more prominent due to the developing and changing world conditions (Potter, 1996). The qualitative paradigm gives a chance to examine the overall quality of fitness centres with a more holistic perspective by paying attention to the social and cultural influences, the perspectives of the participants and the fact that the participants represent different classes (Gioia, 2021; León-Quismondo et al., 2020). Hence, this study aims to determine the elements related to the overall quality of fitness centres from the perspective of the participants using the qualitative research paradigm.

The factors associated with service quality in fitness centres

The service quality in fitness centres is formulated as the consumer's judgment about the overall excellence or superiority of the enterprise. Fitness members pay more attention to some factors (such as the physical environment) when evaluating the quality of service in their centres (Polyakova & Ramchandani, 2020). In many studies of fitness centres, the physical facility, staff (instructor, other employees) and program have been identified as elements of quality (Chang & Chelladurai, 2003; Ko & Pastore, 2005; Lam et al., 2005).

The quality of instructors and staff

Staff who manage to shape and give attention in a customer-oriented manner have an important place in the customer's commitment. Qualified employees play a key role in the success of fitness businesses. Employing qualified employees in line with the understanding of customer-oriented staff management will enable the training processes to be shaped appropriately. Personnel involvement and employee competence are the basis for the success of the customer's training (Rieger, 2011). The presence of qualified employees in the fitness centre allows using the staff in a customer-oriented manner and shaping the training processes in a customer-oriented manner. Achieving training goals and solid performance in sports is not only related to having adequate or quality equipment but also to the personnel involvement and the employees' competence (Brady & Cronin, 2001). Hence, the instructor is the key factor in achieving the member's goals in fitness centres. Many scales developed in the context of fitness considered staff as a dimension of quality (Brady & Cronin, 2001; Lam et al., 2005).

Morales Sánchez et al. (2009) identified one dimension of the Evaluation of Perceived Quality in Sports Services (CECASDEP) scale as "trainers". In other words, they found that the trainers are a sub-dimension related to fitness service quality. Some studies have found a significant positive relationship between staff and satisfaction (Zopiatis et al., 2017). However, all these studies have considered the staff or trainers as an element of quality. When the related body of the literature is examined, it can be seen that the question of which feature produces trainer and staff quality, in other words, what are the qualities that bring about instructor and staff quality, is not discussed much.

The quality of the physical environment

The quality of the physical environment of the fitness centre points out the existence of certain physical elements that will increase the individual's preference for using it. This includes elements such as spatial design and usability, symbols and signs, and the atmosphere (Firmansyah & Mochklas, 2018). The physical environment is defined by customers as the way machinery, equipment and furniture are arranged, the distance between the equipment and the tangible visible elements that facilitate the achievement of these goods' customer and employee goals. Most scales in the context of service quality developed for fitness centres have considered the physical environment quality as a dimension of quality in fitness centres (Chang & Chelladurai, 2003; Chang et al., 2005). At the same time, the physical environment quality has been associated with many variables. Zopiatis et al. (2017) found a positive, meaningful relationship between the physical environment quality and satisfaction in their research. Wu and Ai (2016) detected a positive relationship between the physical environment quality and experience quality. There are many studies indicating that the physical environment quality in fitness services is a component of quality (Ko & Pastore, 2005; Lam et al., 2005). Brady and Cronin (2001) determined that the physical environment quality consists of sub-dimensions such as ambient conditions and design. León-Quismondo et al. (2020), as a result of interviews with 23 fitness managers, determined the importance of the tangible quality elements required to provide good customer service. The most important factors related to the physical environment were the changing rooms and cleanliness. Though all this research remains valid, more information is needed on the dimensions associated with the quality of the physical environment in fitness centres.

The quality of the program

The services provided by fitness centres differ from the services of other organisations (Wei et al., 2010). One of the reasons for this difference is the program quality. Pulling in new customers and maintaining customer loyalty effectively and efficiently occurs thanks to an interesting program design (Firmansyah & Mochklas, 2018). Scales developed in the context of service quality in fitness centres identified program quality as a dimension of service quality (Kim & Kim, 1995; Lam et al., 2005). Papadimitriou and Karteroliotis (2000) reviewed the quality excellence of the sports centre (QUESC) scale presented by Kim and Kim (1995) and revealed an 11-dimensional structure. One of these dimensions is program availability. León-Quismondo et al. (2020) highlighted the importance of group programs in their research with fitness centre managers. They expressed the view that the abolition of these programs will clearly affect the long-term sustainability and economic balance of fitness centres. While the scales developed consider program quality as a component of quality, there is not much in the related body of literature about the features that determine it.

METHODS

Participants

The participants of the research consist of 26 individuals who are members of different fitness centres in Turkey. Twenty-six fitness members were interviewed and chosen using purposeful sampling. The participants participated voluntarily and gave their consent. In recent discussions, a consensus has been reached that the basic sample size for ideal qualitative research is related to the quality of the data obtained from the sample (Sevilmiş & Yıldız, 2022). An important misconception that is often encountered in the literature and that qualitative researchers fall into is that larger samples can give more details and better reflect the universe. However, in qualitative research, the quality of the sample, not the quantity, is important (Mertens, 2014). For this reason, in this study, people who have experienced fitness services for at least one year were interviewed for research purposes. At the same time, attention was paid to the saturation point in the themes formed. The interviews ended when the saturation point was reached (West, 2001). At the same time, many studies carried out in the sport context have worked on a sample that has a lower number of interviewees than our sample and can give more details (De Lyon & Cushion, 2013; Dixon & Warner, 2010; Fowler et al., 2019; Winand et al., 2022). The personal characteristics of the interviewees are presented in Table 1.

Table 1. Participant information.

Demographics	Sample	Percentage
Female	7	26.9
Male	19	73.1
Single	20	76.9
Married	6	23.1
30 years old and less	8	30.7
31 years old and more	18	69.2
High School	3	15.6
Bachelor's Degree	13	50.0
Postgraduate	10	38.4

Procedure

In this study, the qualitative research paradigm was utilised to collect, analyse, and interpret the data. The research data were collected using a semi-structured interview technique. Semi-structured interviews are one of the most widely used data collection methods in qualitative research (Bradford & Cullen, 2013). The reason why this method is included in the study is wishing to understand the experiences of fitness members in an in-depth way (Flick, 2018). During the interviews, the participants were asked four questions that were structured to learn about their personal variables and five questions that were semi-structured to achieve the purpose of the research. The collected data were analysed using a thematic analysis method widely used in sports (Evans & Lewis, 2018). Interviews were conducted by the researchers face-to-face or via Zoom. Both audio recordings and notes were taken during the interviews. The researchers informed the interviewees about the purpose of the research before in order not to deviate from the research aim. Each interview lasted approximately 45 minutes. The four semi-structured questions asked within the scope of the research purpose are presented below.

Q1: During the process of receiving a fitness service, what features do you think are important for the quality of the fitness centre for the people you interact with (everyone you interact with: office workers, other members)? Why?

Q2: Who do you think is a qualified trainer in a fitness centre? What makes trainer quality?

Q3: When the physical elements of the fitness centre are evaluated, what physical component should a fitness centre have to provide them with quality?

Q4: When the programs of the fitness centre are evaluated, which features of the programs offered in a fitness centre make up program quality?

Service quality researchers have not found a consensus as to the most objective model of the assessment of service quality. Despite this, many researchers in fitness services have used certain dimensions (such as the physical environment, the program, and the personnel quality) in the evaluation of fitness service quality. That's why these questions were asked (Jasinskas et al., 2013).

Data analysis

In this study, designed with a qualitative method, overlapping coding was performed on the interview texts in order to derive the relational analysis of the quality elements of the fitness centre according to the opinions of the members. Overlapping coding refers to the presence of more than one code in the same text and the overriding of them (Kuckartz & Rädiker, 2019). It is quite possible for two coders to assign codes with the same name to the same passages in the document. This is called relationship coding. Associated coding occurs when the interviewee expresses more than one theme in her /his sentence. What makes a fitness centre have quality? The respondent can refer to more than one factor in a single sentence. For example: "a fitness centre is of good quality if it has qualified personnel and a sufficient physical environment." can form a sentence. Here, since this sentence is related to more than one factor (personnel and the physical environment), related coding is done. While coding this research data, related coding was performed.

The data were analysed with the licensed MAXQDA program. The MAXQDA is a widely used program for sports research in general (Walseth, 2008) and management research in particular (Niazy & Nazari, 2020). MAXQDA, a qualitative data analysis program, is a program with many possibilities, such as fast coding, naming the encoded data and showing code relationships with options (Sevilmiş & Yıldız, 2021). This is why this program was preferred. A code relations scanner was used while visualising the data. The code associations browser serves to view the co-occurrence of two codes in a section or document.

Validity and reliability

Some precautions were taken regarding the validity and reliability of the study. Validity in qualitative research is whether the research fits with the reality in the outside world (Silverman, 2020). Attention was paid to the correct execution of the data collection process, and sufficient participation was achieved. Saturation point has been taken into account while continuing to observe the research. The saturation point is where the codes appear to repeat the same things (Sim et al., 2018). At the same time, for the validity of

the research, the data were coded by considering the body of literature and the data collection process was carried out by the researcher. Hereby, the validity framework of the research was tried to be provided.

When "reliability" is discussed in qualitative research, it generally refers to the level of agreement between coders (Joffe & Yardley, 2004). Inter-coder agreement is a numerical way of negotiating between different coders regarding how the same data should be encoded (O'Connor & Joffe 2020). The reliability of this study was provided by the agreement between the coders, as well. The MAXQDA qualitative data analysis program was used to support the inter-coder agreement calculation. It is common to use qualitative data analysis programs in inter-coder agreements (Nili et al., 2020). Hereunder, four interviews were coded by two independent coders, and the coded interviews were examined with the program's inter-coder reliability calculation option. If a poor result is obtained, it means that the code or theme has been discussed and re-coded. After an acceptable level of inter-coder reliability, the final results of the agreed "code occurrence in the document" and "code frequency in the document" were determined.

In the case of the code occurrence in the document, it was seen that 29 codes were agreed upon and 3 codes were not. The agreed and disagreed codes were calculated over the Matches/ (Matches+ Non-Matches) formula. Accordingly, the agreement between coders was calculated as 26/ (26+ 3)= 0.89. By multiplying this number by one hundred, the agreement between coders was determined as 89%. When the final results of "code occurrence in the document" were assessed, it was seen that the agreement percentages between coders were at a sufficient level (Sevilmiş & Yıldız, 2021).

RESULTS

The participants interviewed evaluated the perceived quality in fitness centres in terms of the fitness centre's staff, physical environment and program quality. According to the answers given to the questions asked, the participants considered the quality elements in fitness centres as follows. The thickness of the lines between the concepts in the figures shows the density of the relationship.

As seen in Figure 1, fitness centre participants evaluated the staff quality as a combination of eight sub-themes. These sub-themes are coded as "Friendliness", "Knowledge", "Willing to help", "Communication", "Respectful", "Personal care", "Responsible", and "Considerate".

In addition, when the relationship density of the codes was examined, it was revealed that the participants perceived the elements of "Knowledge-Friendliness" and "Communication-Friendliness" as the factors that most intensely affect the quality of the staff. They expressed their opinions on staff quality as follows:

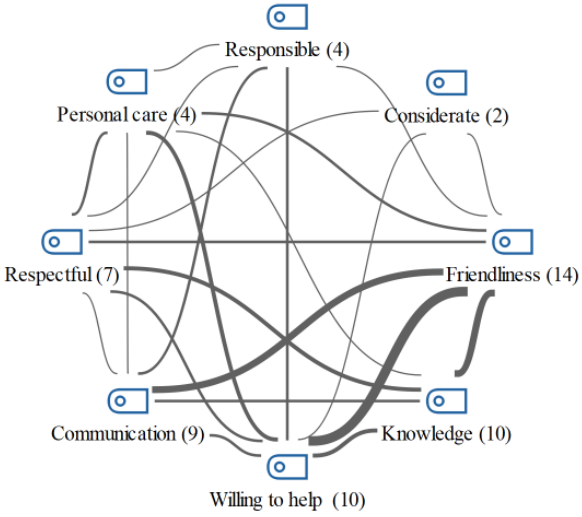
> *Willingness to help-Friendliness (Associated code: 7): "I think it is important for the quality of the fitness centre that all the personnel, without exception, be willing to meet the member's wishes and at the same time have a friendly interaction (P-3)."*

> *Knowledge-Friendliness (Associated code: 5): "The most important factor is friendliness and diction. When it comes to the person who cannot communicate with the other person, this is like trying to run a horse without feet. As I mentioned in the previous questions, the level of knowledge of the trainers should also be good (P-10)."*

> *Communication-Friendliness (Associated code: 5): "The employees of the fitness centre should have a good, friendly and positive personality in communication. This feature is indispensable for businesses as they are in the service sector (P-15)."*

> *Respectful-Knowledge (Associated code: 3): "Must be able to meet the information needed by the members, and have a sincere and respectful approach (P-7)."*

As seen in Figure 2, fitness centre participants evaluated the instructor quality under five different elements. These



*The line thicknesses show the intensity of the relationship between the sub-themes.

Figure 1. The map of code relationship for staff quality*.

elements are coded as "Expertise", "Communication", "Training interest", "Experience", and "Appearance". In addition, when the relationship densities of the codes were examined, it was revealed that the participants considered the "Expertise-Communication" and "Training interest -Communication" elements as the most intense factors affecting the quality of the trainer. They expressed their opinions regarding the quality of the trainer as follows:

> *Expertise -Communication (Associated code: 13): "If they have sufficient knowledge, skills and experience in his field, they can design personal workout programs considering personal differences, and if they can direct by considering the request of the member and the deficiencies of the trainer, they are qualified trainers (P-1)."*

> *Training interest-Communication (Associated code: 8): "Trainers must be open to innovation, constantly educating themselves, strong in communication with people, and appealing to the eye in terms of health and appearance (P-6)."*

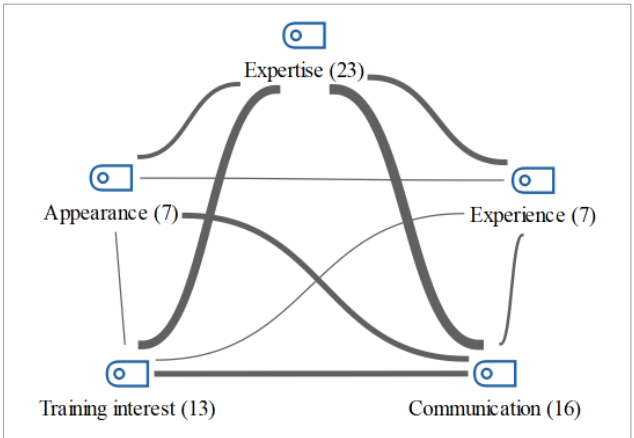
> *Communication-Appearance (Associated code: 7): "Qualified trainers are people who have a proper physique that gives an athletic appearance, and also have coaching qualifications, for example, their diction and rhetoric must be absolutely decent because they will be in constant communication with people ... (P-10)."*

> *Expertise-Experience (Associated code: 7): "If fitness trainers have the experience related to their job and the qualification certificates given to them in return for this experience, and if they can convey this knowledge to them in accordance with the needs of the members, they are qualified (P-13)."*

As seen in Figure 3, fitness centre participants considered the physical environment quality as a combination of eleven different elements. These elements are coded as "Air conditioning", "Facility atmosphere", "Accessibility", "Music", "Ceiling height", "Presence of social area", "Parking facilities", "Amount of equipment", "Locker rooms", "Equipment modernity", and "Equipment variety". In addition, when the relationship density of the codes was examined, it was revealed that the participants see the factors of "Facility atmosphere-Air conditioning", "Facility atmosphere-equipment variety" as the most intense factors affecting the physical quality of the fitness centre. They expressed their views on physical environment quality as follows:

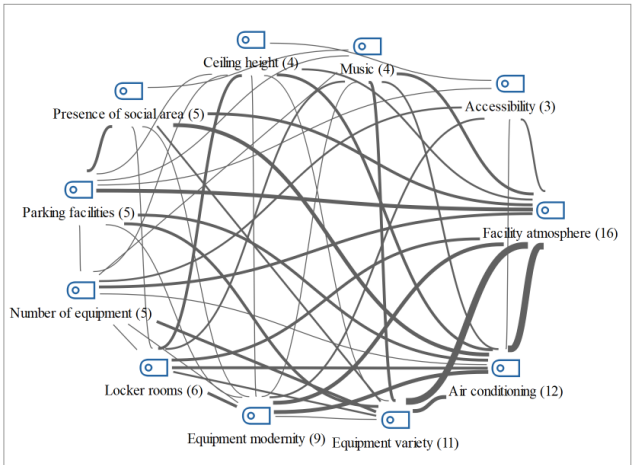
> *Facility atmosphere - Air conditioning (Associated code: 8): "Whether a fitness centre is physically qualified or not is related to its location, being easily accessible, the size of the gym and adequate lighting (P-2)."*

> *Equipment variety - Facility atmosphere (Associated code: 8): "Being a quality fitness centre in terms of physical elements means having the necessary number and variety of equipment for cardio, strength and group workout. In addition, the training areas in the centre should be of sufficient width and the members who are there at the same time should be able to train comfortably (P-3)."*



*The line thicknesses show the intensity of the relationship between the sub-themes.

Figure 2. The map of code association for the quality of the fitness instructor*.



*The line thicknesses show the intensity of the relationship between the sub-themes.

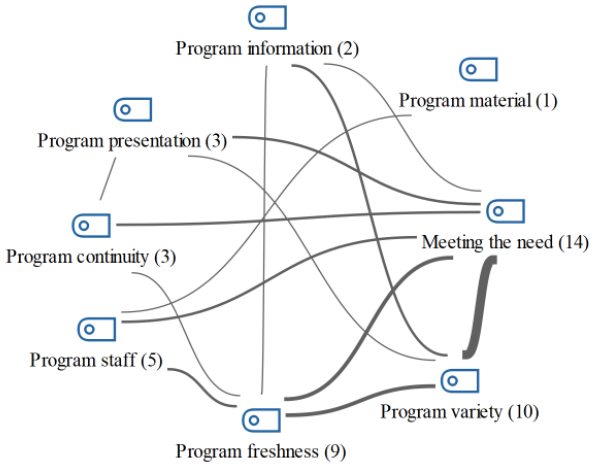
Figure 3. The map of code relationship for the physical environment*.

Equipment variety - Air conditioning (Associated code: 5): "It is important to have richness in terms of sports equipment and wide and comfortable working areas. In addition, the fact that the fitness centre is bright, accessible and has a balance of price/service and sound/silence in the use of music gives the fitness centre quality (P-17)."

Equipment modernity-Facility atmosphere (Associated code: 4): "Having modern equipment, being large, spacious, and centrally located gives the fitness centre quality (P-11)."

As seen in Figure 4, fitness centre participants evaluated the quality of the program as a combination of eight different elements. These elements are named as "Meeting the need", "Program variety", "Program freshness", "Program staff", "Program continuity", "Program presentation", "Program information", and "Program material". In addition, when the relationship densities of the codes were examined, it was revealed that the participants saw the elements of "Meeting the need-Program variety" and "Program freshness -Meeting the need" as the factors that most intensely affect the fitness centre's program quality. They expressed their views on program quality as follows:

Meeting the need-Program variety (Associated code: 8): "The programs of fitness centres should be diversified in order to meet the demands. For example, if I want to lose weight, there must be a fitness program for it (P-3)."



*The line thicknesses show the intensity of the relationship between the sub-themes.

Figure 4. The map of code association for program quality*.

Program freshness-Meeting the need (Associated code: 3): "Programs must be current and appropriate for the training objectives of the person. Current training types such as crossfitt, zumba, and spinning can be included (P-14)."

Program freshness -Program variety (Associated code: 3): "Diversity, that is, a wide range of up-to-date services should be available. Timing, in other words, the start and end of the program on time is also an important issue (P-17)."

Program freshness -Program personnel (Associated code: 2): "First of all, lessons should be held in the presence of an expert trainer. In addition, it should be with lessons that are innovative and brings out continuous improvement and awareness (P-9)."

DISCUSSION

Existing studies on quality in fitness centres conclude that research should continue from the consumer's point of view and from different types of methodologies (García-Fernández et al., 2020; Loranca-Valle et al., 2021; Polyakova & Ramchandani, 2020). The main findings of this study have shown the importance for consumers in terms of the quality of the trainer, the quality of the physical environment and the quality of the program. In particular, in the context of the qualitative paradigm, sub-themes of personnel, trainers, the physical environment and program quality were determined, and then the relationship intensities between these sub-themes were ascertained. We distinguished the quality of staff into eight sub-themes: *"Friendliness", "Knowledge", "Willing to help", "Communication", "Respectful", "Personal care", "Responsible", and "Considerate"*. The most intense relationship among these sub-themes was between "Willingness to help-friendliness". Considering these findings suggests that whether the staff have the knowledge, are willing to help and are friendly is the most prominent factor that determines the quality of the fitness centre's staff. Here, it turns out that fitness members attach importance to a friendly staff above all else. In other words, fitness members describe employees who are happy to see themselves as qualified (León-Quismondo et al., 2020). McMillan (2012) reported that one of the ten precursors of quality service in fitness services is friendly employees. At the same time, he defined the friendly, knowledgeable, helpful, responsible, polite and respectful behaviour of the personnel as the features that positively affect the quality of the fitness centre (Lam et al. 2005). Chang et al. (2005) found

that staff behaviour affects the perception of staff quality. Xu et al. (2021) and Riseth et al. (2019) identified staff support as the reason why long-term members keep the fitness centre. These results contribute to the literature and support the findings of this study. We distinguished the quality of the instructor into five sub-themes: *"Expertise"*, *"Communication"*, *"Training interest"*, *"Experience"*, and *"Appearance"*. The most intense relationship among these sub-themes was between "Expertise-Communication". Based on these findings, we can say that the expertise and interaction of fitness trainers will give them quality, as stated by Xu et al. (2021). Instructors play an important role in achieving their sportive goals. An important part of this role is expertise. For this reason, fitness trainers should be closely interested in information that includes both physical activity areas and beyond (Gavin, 1996) because this feature is an important element in their quality perception (Afthinos et al., 2005; Glaveli et al., 2021; Yildiz et al., 2021).

Afthinos et al. (2005) identified one of the most important dimensions of the quality of fitness centres as "professional knowledge". Chang and Chelladurai (2003), who conducted one of the studies to evaluate the service quality of fitness centres, stated that "task interaction" is a dimension of quality. At the same time, many studies have underlined the importance of interaction quality for the success of service businesses (Ekinci & Dawes, 2009; Glaveli et al., 2021; Gremler & Gwinner, 2000). These findings emphasise the sub-elements of trainer quality and are in line with our research.

We distinguished the quality of the physical environment in eleven sub-themes: *"Air conditioning"*, *"Facility atmosphere"*, *"Accessibility"*, *"Music"*, *"Ceiling height"*, *"Presence of social area"*, *"Parking facilities"*, *"Amount of equipment"*, *"Locker rooms"*, *"Equipment modernity"*, *and "Equipment variety"*. The most intense relationship among these sub-themes was between *"Facility atmosphere-Air conditioning"*. Based on these findings, we can say that the "Facility atmosphere" and "Air conditioning" sub-themes make the physical environment quality of a fitness centre of a higher quality. Participants think that the variety of equipment in a fitness centre and the ideal air conditioning features, such as ambient temperature, humidity, ventilation, and pleasant atmospheric elements, such as decor, layout, and interior design, are facility aesthetics which will make that facility physically be of high quality.

The physical environment of the fitness centre is an integral part of promoting physical activity. Fitness centres are largely based on the physical environment of their services. Therefore, the competencies offered by the physical environment to meet customer expectations are important (García-Fernández et al., 2020; Kim et al., 2016; León-Quismondo et al., 2020). One of them is the facility atmosphere (Oztaş et al., 2016). This includes many features, such as the facility design and ambient condition. All these features affect the quality perceptions of the participants (Chang & Chelladurai, 2003; Cheung & Woo, 2016; Howat et al., 1996; Ko & Pastore, 2005). These studies are in parallel with our research.

We distinguished the quality of the program into eight sub-themes: *"Meeting the need"*, *"Program variety"*, *"Program freshness"*, *"Program staff"*, *"Program continuity"*, *"Program presentation"*, *"Program information"*, *and "Program material"*. According to the results of the research, the participants think that the *"meeting the need-program variety"* features of the program will give it quality.

The program quality dimension indicates the purpose of the fitness centre members coming to these centres and the content and quality of the programs and activities offered to them in these centres. The features of meeting the needs of fitness programs are related to creating programs suitable for members. For this reason, it is important for a fitness centre to plan programs in which members can achieve their sportive goals (De Farias et al., 2021). Participants' views consider shaping the contents of the programs in the club in accordance with the objectives as the most important program quality element. For this reason, it is important for fitness centres to consider meeting the needs as their primary goal in the program that they include in the fitness centre. At the same time, as stated by Eskiler and Altunışık (2021), the diversity of the programs and activities offered in the fitness centre, in other words, the fact that the programs are up-to-date following the innovations, are important for the fitness participants to perceive the programs as being of high quality.

The results of previous studies on the quality of the program are similar to the results of this study. For example, Afthinos et al. (2005) identified one of the most important dimensions of the quality of fitness centres as "Convenient schedule". Chang et al. (2005) identified "comprehensiveness/diversity of the program" as a sub-dimension of program quality. Lam et al. (2005) evaluated the variety and appropriateness of the program as factors affecting the quality of the program. Thus, it can be said that the results obtained in this study and previous studies are in parallel.

CONCLUSIONS

In this research, sub-themes of personnel, trainers, the physical environment and program quality, which have until now been put forward as sub-dimensions of quality by certain researchers, were determined, and then the relationship between these sub-themes was established intensely. The results of the research

revealed that quality dimensions such as personnel, trainers, the physical environment and program quality have many more sub-themes in the context of the qualitative paradigm.

Undoubtedly, the coding frequencies of the sub-themes and the intensity of the relationship between the two themes show the elements that we should pay more attention to in terms of personnel, trainers, the physical environment and program quality. In summary, when we evaluate the research, it is necessary to give importance to quality sub-themes such as Friendliness and Willing to help for the personnel quality, and expertise and communication for the instructor quality, The facility atmosphere and Air conditioning concern the physical environment quality, Meeting the need and Program variety correspond to the program quality, and these elements are important for members. It should not be forgotten that they may affect the perceptions of quality more.

Limitations and future investigations

As in many studies, this study has some limitations. One of them is that the process was conducted with a qualitative research paradigm, and the relationship densities between the codes reflect the common view density of the participants. Since the findings are individual interviews, they cannot be generalised. For this reason, future research can achieve a deeper understanding of the relationships by using quantitative or mixed methods. Apart from this, when the literature is examined, there are limited studies on the relation of fitness centre quality elements (personnel, general quality, output quality, and the physical environment quality). Each element defined in fitness centres' service quality sub-dimensions can be included in other studies. Researchers can compare high- or low-priced fitness centres in these studies. Whether the intensity of relationships changes in fitness centres in different price segments can be examined. Therefore, possible research to be carried out in the future will reveal more in-depth knowledge about which features fitness centres members evaluate as being of quality.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.26680

Supine-to-stand task performance and anthropometric characteristics in children and adolescents

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ABSTRACT

The performance of getting up from the floor from a supine position (Supine-to-Stand task, STS) can be considered a milestone in motor development and a potential indicator of motor competence in global terms. However, the knowledge about the performance of STS task and anthropometric characteristics is limited. This study examined the relationship between STS task performance and anthropometry in youth and the differences between the sexes, range age and nationality. Participants (*n*= 397; 45% girls) from Spain and Brazil (*M*= 9.13 years; *SD*= 3.79) had the following variables measured: timed STS task, mass, height, chronological age, hip, and waist circumference; Body Mass Index (BMI), Waist/Hip Ratio (WHR), Waist/Height Ratio (WHtR) were calculated. The analysis included ANOVA, Pearson's correlation test and Stepwise multiple regression analysis in four age groups. Age was the variable that obtained statistically significant associations with timed STS task in the youngest age group; the BMI in the children group corresponded to the second childhood phase, and the WHR and the WHtR in the oldest age group. The timed STS task decreased as age groups were increasingly older, confirming that timed STS is strongly associated with growth and maturation processes; there were little differences between sexes or nationalities.

KEYWORDS: psychomotor performance; development; body mass index; childhood; adolescence.

INTRODUCTION

The term motor competence (MC) describes goal-directed movements that involve control and coordination of the human body (Robinson et al., 2015; Stodden et al., 2008; Utesch & Bardid, 2019). The role of MC in the development of health-related physical fitness (AFRS) (Cattuzzo et al., 2016; Utesch et al., 2019), obesity prevention (D'Hondt et al., 2009), and as a predictor of continuing PA practice in adulthood (Lloyd et al., 2014) has been emphasized in the last years. On the other hand, a low MC, characterized by the inability to perform motor skills at an age-appropriate level (Ré et al., 2018a; 2020), adversely affects the human life cycle. World health agencies and researchers have published alarming results regarding obesity and physical inactivity in children and adolescents, highlighting the global increase in both (Guthold et al., 2020; WHO, 2022). Thus, the development of MC can be essential in promoting an active and healthy lifestyle in children and adolescents (Lubans et al., 2010).

Several assessments are available to measure children's MC (Cools et al., 2009; Robinson et al., 2015). Such tests have been developed for young children, preventing the assessment of MC in later life stages since it affects the tests' ability to differentiate the increasing levels of MC, the well-known ceiling effect (Robinson et al., 2015; Stodden et al., 2008). Measures based on motor tasks, such as the task of getting an upright position from the supine position on the

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Conflict of interests: nothing to declare. Funding: International Mentoring Foundation for the Advancement of Higher Education (IMFAHE) (AGR); São Paulo Research Foundation (FAPESP) Grant 2021/03385-7; Foundation for the Improvement of Higher Education Personnel (CAPES) – Funding Code 001; CAPES/UPE funding number 88887.633885/2021-00 and CAPES/UPE funding number 88882.435727/2019-01. Received: 03/13/2022. Accepted: 07/18/2022.

floor (Supine-to-Stand Task, STS), getting up from a chair, and walking for three meters, among others, are based on motor tasks that explain functional capacity and have been used in populations during ageing, as well as in subjects with motor disabilities (Volpato et al., 2011). These functional measures of MC, in essence, measure gross coordination and global control over the body and can be defined as an ability to coordinate and control the centre of mass and extremities in a gravity-based environment to achieve a task goal effectively and objectively (Robinson et al., 2015). Furthermore, these assessments indicate specific developmental milestones through ageing; because they are, by nature, tasks that undergo adjustments throughout life (Nesbitt et al., 2017).

Among the assessments of functional capacity, the STS task offers both product-oriented measures, *i.e.*, quantitative (*e.g.*, the time it takes a child to get up and touch the wall) and process-oriented measures, *i.e.*, qualitative (*e.g.*, movement pattern to get up), both indicators of human MC. In particular, the timed STS task (product-oriented measure) could be used as an efficient test for functional MC examination since it is simple, fast, and affordable. In fact, a systematic literature review examined studies about the STS task performed by subjects in all life phases; it was concluded that the timed STS task would be a universal lifespan test for functional motor competence and musculoskeletal fitness for clinical or research aims (Cattuzzo et al., 2020).

The present study is focused on the STS test performed by youth (children and adolescents), and, historically, the first studies on this subject were engaged in describing the STS task's sequence of movements in early and later childhood (Marsala & VanSant, 1998). Subsequently, such knowledge was extended to not typical development populations (Mewasingh et al., 2002; Mewasingh et al., 2004). After that, the STS performance started to be related to health measurements through product-oriented measurement (time) (Beenakker et al., 2005) or both measurement types (Duncan et al., 2017; Hsue et al., 2014a; Hsue et al., 2014b; Nesbitt et al., 2017; Nesbitt et al., 2018; Ng et al., 2013). However, considering the later phases of youth, only one study has investigated STS performance and health measurements in children and adolescents (Tadiotto et al., 2021).

Especially when it comes to investigating anthropometric measures and youth performance on the timed STS task, the results of Duncan et al. (2017) and Ng et al. (2013) suggested that time on the STS task follows a developmental course according to chronological age: the older the children, the better their results (less time in performing the task), regardless of other anthropometric measures. However, the study by Tadiotto et al. (2021) with adolescents added one more point to the study of this functional task: excess body adiposity was negatively related to the performance of the timed STS task.

So, considering that the STS task can be considered a milestone in motor development and a potential indicator of motor competence in global terms and that the knowledge of the relationship between the performance of STS task and anthropometric characteristics is, however, limited, this study aimed to verify the relationships between performance on timed STS task and the anthropometric characteristics of children and adolescents; and examine differences between the sexes, age groups, and nationality of these children and adolescents.

METHODS

As described in Table 1, two convenience samples of healthy children and adolescents of two nationalities (Brazilian-Spanish), between 3 and 17 years of age (M= 9.13, SD= 3.79), were recruited to participate in this study. The Brazilian participants (n= 130) came from a public elementary school and a community program oriented to the practice of PA for young people, both located in a community of low socio-economic status on the east side of the city of São Paulo. The Spanish sample (n= 289) came from a private kindergarten and three sports clubs (Club Amigos del Baloncesto, Club Tenis Mercantil, and Club Triatlón), where access to activities is paid; these institutions belong to the provincial city of Pontevedra.

Subjects included met the following criteria: a) aged between 3 and 17 years; b) be a volunteer to participate in the research; c) have the Free and Informed Consent Term (TCLE) signed by the parents or guardians d) have no diagnosis of physical or mental health problems. The Ethics Committee approved the study of the School of Sciences, Arts and Humanities of the University of São Paulo with the code CAAE: 92599518.1.0000.5390.

Table 1. Participants in the sample by nationality, sex, and age group of the Brazilian and Spanish youth (2021).

Age range (years)	Boys BRA	Girls BRA	Boys ESP	Girls ESP
3 to 4.99	18	18	15	12
5 to 6.99	29	39	10	7
7 to 8.99	0	0	31	27
9 to 10.99	0	0	34	28
11 to 17	13	16	78	52
Total	60	70	175	114

Design and procedures

The study design was cross-sectional and descriptive. The participating institutions were selected by convenience, depending on the existing possibilities to carry out the data collection, which was carried out between February 2017 and June 2018. The product of STS (time in seconds) was measured, and the anthropometric variables measured were age (years), body weight, height, and waist and hip circumference. These data were calculated: the Waist-Hip Ratio (WHR), the Waist-Height Ratio (WHtR), and the Body Mass Index. Data collection began with anthropometric measurements, and then the STS test was performed.

Anthropometric measurements

Anthropometric data were collected following a standard protocol (Norton, 2018). Height and body mass measurements were used to calculate the Body Mass Index (BMI). The child's height was measured using a tape measure (Cescorf 2m, São Paulo, Brazil) supported on the wall at 90º from the floor, with an accuracy of 0.1 cm. For measuring body mass, a precision scale with a capacity of 100 kg and a sensitivity of 0.1 kg was used (EB2000, Esselton, China). The waist circumference was taken between the last rib and the iliac crest, while the hip circumference was obtained by calculating the maximum circumference in the area of the joint formed between the iliac crest and the femur. Both circumferences were taken in a standing position, with arms crossed at chest level. Waist and hip circumferences were measured in the standing position with the same tape measure (CESCORF 2m, São Paulo, Brazil), with an accuracy of 0.1 cm. From the measurements of waist and hip circumference, the waist-hip ratio (WHR) [waist circumference (cm) / hip circumference (cm)] was calculated, and the measurements of waist circumference and height were used for the calculation of the waist-to-height ratio (WHtR) [waist circumference (cm) / height (cm)].

All anthropometric measurements were performed by the first author of the research, who is certified by the International Society for Advancement in Kinanthropometry level II.

Motor competence measure

The STS task was used as an indicator of the MC (Cattuzzo et al., 2020; Nesbitt et al., 2018). The test starts from a supine position. The feet were aligned with the rest of the body at 0.5 meters from the wall. Participants were filmed with a camera positioned under a tripod at 45º from the right side. Children were individually tested by instructing them based on an oral explanation of the task and a single demonstration of the task by the author. Five attempts were made per participant, with only the shortest time computed. (Nesbitt et al., 2017; Nesbitt et al., 2018).

After the "go" command, the children should get off the floor and touch a marked point on the wall, located approximately at the participants' shoulder height (Cattuzzo et al., 2020; Nesbitt et al., 2017). In line with Nesbitt (Nesbitt et al., 2017), individuals were encouraged to complete the task as quickly as possible. The participants themselves selected the time between trials to minimize fatigue. The total time (seconds) was calculated from the frame where the first movement took place to the frame where the individual was touching the wall (hands/fingers touching the wall), using the video analyzer software Dartfish-7 (Dartfish USA, Alpharetta, GA).

Statistical analysis

The assumptions of normal data distribution and equality of variance were confirmed using the Kolmogorov-Smirnov and Levene tests, respectively (Hair et al., 1998). Descriptive tables were constructed with the mean values of performance on the STS task with age and anthropometric characteristics, based on two-way analysis of variance (ANOVA) (age group and sex) to verify the possible differences between groups. To verify the differences between nationalities, the one-way ANOVA test was used. Correlations between measured variables were tested using Pearson's correlation test. The strength of the correlation coefficient was based on Vincent (2005): values up to 0.5 = low; between 0.5 and 0.7 = moderate, and above 0.7 = high. Stepwise multiple regression analysis to verify the set of anthropometric variables that predict the time in the STS task by sex and range age group; the time on the STS task as a dependent variable and range age, BMI, ICQ, and WHtR as independent variables. When necessary, Bonferroni's test was used to locate statistically significant differences. Statistical analyzes used SPSS v20.0 software (SPSS Inc., IBM, USA), and the significance level was set at 5%.

RESULTS

Timed STS task, age group, and sex

The mean and standard deviation of the timed STS task and the anthropometric characteristics of the sample are in Table 2. In general, there was a significant decrease in the timed STS task as age groups got older. Boys showed better performance than girls up to the age group of nine to 11 years; girls matched the STS performance of boys in the age group of the oldest participants (11 to 17 years); this group is represented only by Spanish participants. However,

there were no significant differences in the performance of the timed STS task between sexes in any age group studied.

Anthropometric variables, age group, and sex

Regarding the anthropometric variables, it is noteworthy that both boys and girls exhibited a persistent increase in BMI, while the other anthropometric variables, such as WHR and WHtR, decreased significantly in the older age groups. It is worth mentioning that from seven to 11 years of age, the data obtained belonged only to Spanish participants, observing the statistically significant differences in the WHtR from nine to 11 years of age; in the older age group, with both nationalities represented again, the differences in terms of sex in the WHtR increased.

Timed STS task, anthropometric variables, and nationality

The main results of the timed STS task and the anthropometric characteristics between Brazilians and Spaniards were represented by the significant decrease in the timed STS task in both nationalities as age groups got older. Descriptively, Spanish participants performed better on the timed STS than Brazilians in all age groups, except for seven to 11-year-olds, where the Brazilian sample was not represented. Despite this, there were no significant differences in STS time performance

Table 2. Mean (M) and standard deviation (SD) for timed STS task and anthropometric characteristics according to sex and age group of the Brazilian and Spanish youth (2021).

Age range	Boys BRA	Boys ESP	Girls BRA	Gils ESP
	M± SD	*M± SD*	*M± SD*	*M± SD*
3 to 4.99 yrs				
Time STS (s)	2.42± 0.08^{be}	2.29± 0.89^{bcde}	2.76± 0.63^{be}	2.07± 0.25$^{bcde\#}$
BMI (Kg/cm^2)	16.64± 0.66^{e}	15.87± 1.46^{cde}	16.17± 1.31^{e}	15.87± 0.72^{ce}
WHR (cm)	0.89± 0.04^{e}	0.89± 0.05^{cde}	0.89± 0.03^{be}	0.92± 0.04^{de}
WHtR (cm)	0.49± 0.03^{be}	0.48± 0.03^{e}	0.50± 0.03^{be}	0.49± 0.03
5 to 6.99 yrs				
Time STS (s)	1.89± 0.06^{a}	1.73± 0.28^{a}	2.01± 0.29^{a}	1.87± 0.11$^{ad\#}$
BMI (Kg/cm2)	16.20± 0.52^{e}	16.34± 1.18^{d}	15.77± 2.10^{e}	16.98± 0.89^{de}
WHR (cm)	0.87± 0.05^{e}	0.87± 0.04^{de}	0.85± 0.05^{ae}	0.87± 0.05^{de}
WHtR (cm)	0.47± 0.04^{ae}	0.47± 0.02^{e}	0.46± 0.03^{ae}	0.46± 0.04
7 to 8.99 yrs				
Time STS (s)		1.73± 0.32^{a}		1.65± 0.06^{a}
BMI (Kg/cm2)		16.78± 4.18^{a}		18.69± 4.18^{a}
WHR (cm)		0.86± 0.04^{a}		0.84± 0.04^{de}
WHtR (cm)		0.48± 0.05^{e}		0.47± 0.04^{e}
9 to 10.99 yrs				
Time STS (s)		1.75± 0.27^{a}		1.76± 0.06^{a}
BMI (Kg/cm2)		19.04± 2.68^{a}		18.73± 2.76^{e}
WHR (cm)		0.83± 0.05^{ab}		0.80± 0.05^{abc}
WHtR (cm)		0.44± 0.04^{a}		0.44± 0.04
11 a 17 yrs				
Time STS (s)	1.72± 0.78^{a}	1.62± 0.18^{a}	1.78± 0.20^{a}	1.62± 0.04$^{a\#}$
BMI (Kg/cm2)	19.43± 3.38^{ab}	20.17± 3.06^{ab}	18.29± 2.36^{ab}	20.97± 3.03$^{abd\#}$
WHR (cm)	0.81± 0.02^{ab}	0.82± 0.05^{ab}	0.76± 0.04^{ab}	0.78± 0.05^{abc}
WHtR (cm)	0.43± 0.04^{ab}	0.44± 0.04^{abc}	0.41± 0.03^{ab}	0.44± 0.04$^{\#}$

*(p< 0.05); **(p< 0.01); M: average; SD: standard deviation; Time STS: Time to get up from a supine position; BMI: Body Mass Index; WHR: Waist Ratio Hip; WHtR: Waist to Height Ratio; [a]Significant differences between the age group of 3 to 5 years; p< 0.05; [b]Significant differences between the age group of 5 to 7 years; p< 0.05; [c]Significant differences between the age group of 7 to 9 years old only for Spaniards; p< 0.05; [d]Significant differences between the age group from 9 to 11 years old only for Spaniards; p< 0.05; and Significant differences between the age group of 11 to 17 years; p< 0.05; [#]Significant differences between sex; p< 0.05.

between nationalities in the age groups studied. Regarding anthropometric characteristics, BMI increased significantly in older age groups, although there were no significant differences between male nationalities. WHR and WHtR decreased significantly in the older age groups, noting no significant differences in any studied groups.

The main results of the timed STS task and anthropometric characteristics among Brazilian and Spanish children and adolescents were represented by the significant decrease in time on the STS task in both nationalities as the age groups got older. Spanish girls significantly performed better in the timed STS task than Brazilian girls in all age groups, except for seven to 11 years of age, where there was no representation of the Brazilian sample. As with the male anthropometric characteristics, BMI increased significantly as age groups became older, and WHR and WHtR decreased with increasing age (advanced age groups) in both nationalities. There were significant differences in BMI and WHtR between both nationalities from 11 to 17 years of age in females.

Correlations between timed STS task and anthropometric characteristics

As shown in Table 3, Pearson's coefficients indicate that the timed STS task is related to anthropometric variables in this sample of children and adolescents. Age was the variable that obtained inversely significant correlations with timed STS time in boys (r= –0.41; p< 0.05) and girls (r= –0.31; p< 0.05) aged 3 to 5 years. BMI was significant in girls aged 5 to 7 (r= 0.33; p< 0.05) and aged 9 to 11 years (r= 0.45; p< 0.05), and WHR and WHtR related significantly with the timed STS task in boys (r= 0.21; p< 0.05) and girls (r= 0.32; p< 0.01) of the oldest age group in this sample.

The regressions in Table 4 presented the contribution of age, BMI, WHR, and WHtR, together and individually, with the timed STS task in children and adolescents. Taken together, having timed STS as a dependent variable and the others as independent, they contributed significantly to the explanation of the variability in the time of the STS task in the older participants of this sample of both sexes. Specifically, age and selected anthropometric characteristics accounted for 13.7% of STS task time variability in boys and 25.2% in girls aged 11 to 17.

Individually, age was the variable that had the most remarkable contribution to the timed STS task in boys aged three to 11 years. WHtR was a statistically significant variable that predicted the timed STS task from five to seven years of age. Among the older participants in this sample, age was the only independent variable that proved to be a statistically significant predictor of the timed STS task, these being found in girls. It should be noted that BMI was excluded from the analysis due to collinearity problems and because the WHtR had a higher common variance with the timed STS task.

DISCUSSION

The first purpose of this research was to verify the relationship between the performance in getting up from the floor from a supine position and the anthropometric characteristics, according to sex and age group, in children and adolescents of two different nationalities (Brazilians and Spaniards). In general, data analysis revealed significance between age group and anthropometric variables of children and adolescents, excluding the age group from seven to 11 years old, in which there were only Spanish children.

The results provided evidence of positive relationships between timed STS task and BMI, WHR and WHtR, and

Table 3. Pearson's coefficient for timed STS and anthropometric characteristics by sex and age group of the Brazilian and Spanish youth (2021).

Age range (yrs)	Dependent variable	Age	BMI	WHR	WtHR
3 to 4.99	Timed STS Boys	–0.41*	0.00	0.17	0.12
	Timed STS Girls	–0.31*	0.00	–0.02	0.14
5 to 6.99	Timed STS Boys	0.02	0.29	–0.04	0.24
	Timed STS Girls	–0.00	0.33*	–0.11	0.09
7 to 8.99	Timed STS Boys	0.05	0.04	0.01	0.17
	Timed STS Girls	0.40	–0.28	–0.47	–0.37
9 to 10.99	Timed STS Boys	0.21	–0.05	0.06	–0.05
	Timed STS Girls	–0.17	0.45*	–0.08	0.26
11 to 17	Timed STS Boys	–0.08	0.18	0.21*	0.10
	Timed STS Girls	0.25*	0.20	0.20	0.32**

*p< 0.05; **p< 0.01; BMI: Body Mass Index; Timed STS: Time to get up from a supine position; WHR: Waist Ratio Hip; WHtR: Waist to Height Ratio.

participants' lifetime, except for the negative associations found between anthropometric characteristics and timed STS task in the 7- 9 years-old age group in females. Age had statistically significant correlations with time on the STS task (r= –0.41; p< 0.05) in the younger age group. Ng et al. (2013) found similar results in three to 8-year-old children, allowing them to create charts showing normal age-related values. So, our results support that the STS task appears to be a valuable tool for tracking MC for clinical or research purposes (Cattuzzo et al., 2020; Ng et al., 2013).

The present study results showed that BMI was not associated with the youngest children's performance in our sample of both sexes. On the other hand, the lack of interaction between time performance on the STS task and BMI, both in boys and girls, complements the results of another study, where BMI had a low correlation (r= 0.15; p< 0.05) with American, early childhood children (Nesbitt et al., 2017). Additionally, the stepwise regression coefficients showed that age proved to be the statistically predictive variable of time in the STS task, decreasing the variability of time in the STS by 0.45 seconds in boys of the younger age group.

Correlations showed that BMI proved to be a statistically significant variable and positive direction with the performance of the STS task in boys in the age group corresponding to second childhood. Such a result can be explained by the increase in body mass expected by linear growth in the middle years of childhood (from six to 11 years of age) (Rogol et al., 2002). Negative associations were found in the nine-11 age group between time on the STS task, BMI, WHR, and WHtR in girls. A recent study's results (Tadiotto et al., 2021) showed correlations moderate and direct between BMI with timed STS and inverse with STS-MC (p< 0.01) in 10- and 16-years old children; they concluded that excess fat and low physical fitness inhibit STS-test performance. In tasks where all or most of the body mass is projected, the negative relationship between BMI and MC could be partially explained by the increase in fat mass, which can be detrimental to the performance of the CM (Lopes et al., 2012). Similarly, previous study results showed that girls have a higher body fat percentage than boys during childhood (Arfai et al., 2002). Thus, we hypothesized that this body fat mass could be related to a longer time in the STS task and prevent girls from performing better in the general MC.

Continuing with the analysis of the relationship between anthropometric characteristics and time on the STS task, WHR and WHtR were confirmed to be statistically significant indicators with timed STS task in the age group of the oldest participants in our sample, which included adolescents. Such a result may be because adolescents increase both size and body composition (Ré, 2011). Previous studies have highlighted that one of the main phenomena of puberty is the height growth peak, a visible result of biological maturation that also causes improvement in metabolic and muscle functions (Thomas & French, 1985). In this way, the physical changes represented in body composition could explain the improved performance on the STS task. It is well known that boys become bigger in general, highlighting the widening of the shoulders, the legs becoming longer in relation to the chest, and the forearms becoming longer in relation to the arms and height. While in girls, the increase in body fat percentage stands out (specifically, in the breasts and hips).

Coinciding with some previous results (Cattuzzo et al., 2016; Nesbitt et al., 2018) where the connection between MC and fitness level from childhood to adolescence was demonstrated, timed STS task and the anthropometric characteristics of the sample were also shown to increase associations consistently in increasingly older age groups (Table 3).

The second purpose of this study was to examine the differences in STS task time and anthropometric characteristics between the sexes and age groups of the sample of children and adolescents. Time on the STS task was significantly shorter in older age groups, and there were no significant differences between sexes in the time of the STS task in children and adolescents. However, the stratification of the samples by nationality showed significant differences between the sexes, being found only in girls from Spain.

Regarding the significant decrease in time in the STS task, previous studies have described how the different age groups investigated in the present study are strongly associated with the growth and maturation processes; and it is possible to affirm that childhood is a period represented by rapid neurological development and greater neural plasticity (Ré, 2011). Nesbitt et al. (2017) were the first to validate STS task timing and developmental sequences, suggesting that the effective control of the centre of mass is essential for getting up faster. In this sense, the present study expanded the findings of this previous study (Nesbitt et al., 2017) according to sex. Our results offered performance (time) on the STS task (cf., Table 1) in Spanish and Brazilian children aged three to 17. In general, the mean times obtained in the STS task of this study coincide with the mean times found in other studies (Nesbitt et al., 2017; Ng et al., 2013) in populations represented by different nationalities — e.g., American and English children - and Brazilian (Cattuzzo et al., 2019), such as those in the present study.

Understanding the assessment of the STS task as a test that combines flexibility, locomotion, and balance (Duncan et al., 2017) and that many previous studies have observed superior performance in males compared to females in tests of strength (Bäckman & Henriksson, 1988), speed (Thomas & French, 1985) and coordination (Levy & Hobbes, 1979),

it would be expected in the present investigation, boys to perform better on the STS task; this fact did not occur in any age group. In this sense, our results are compatible in not having found statistically significant differences in psychomotor performance between boys and girls during childhood and adolescence (Thomas & French, 1985). Another way of interpreting the results could be that the differences in mass gain and maturation of muscle functions during puberty between boys and girls might not be sufficient to provide these significant differences between the sexes in this task.

Considering that socio-economic factors particular to a region/country can impact the level of physical activity and MC (Fu & Burns, 2018) and that in economically developed places, this impact is likely to be lower than in places of greater social vulnerability, especially in large urban centres such as the city of São Paulo (Ré et al., 2018b), may explain the statistically significant difference between the times in the STS task of Spanish girls compared to Brazilian girls. Understanding the different contexts of the samples compared in this study and the need to develop valid assessments in samples from different countries (Robinson et al., 2015), the timed STS task could be a valid instrument to fulfil this need.

To our knowledge, this is the first research that studies the relationships between STS task performance and the anthropometric characteristics of children and adolescents aged three to 17 and how these anthropometric characteristics affect STS task time in increasing age groups. As limitations of this study, we can note that it did not include the measurement of skinfolds to observe the interaction of the time of the STS task with these body composition variables, anthropometric characteristics strongly associated with growth and development (Thomas & French, 1985). Also, we did not research the socio-economic context of the participants in this study. However, if any of these factors had induced advantages, it is worth thinking that a global effect on the assessed motor performance could be found. Some caution must be taken with our results since the design is cross-sectional, preventing any conclusion relative to lifespan change. Further studies could examine the relationship between biological age and physical activity practice with STS task performance.

CONCLUSIONS

In the investigated sample, we conclude that there were consistently associations between the STS task and the anthropometric variables from three to 17 years of age. Specifically, our results verified that age was the variable that obtained statistically significant associations with timed STS task in the children of the youngest age group in the sample, which corresponds to the preschool phase, as well as the BMI in children corresponding to the second childhood phase and, the WHR and the WHtR variables, in the oldest age group of the sample, corresponding to the adolescence phase.

The first interactions between timed STS task and anthropometric variables occur from 3 to 5 years of age. Thus, the present investigation extends previous findings (Nesbitt et al., 2017), where no association was found between BMI and STS task time, in both sexes, in early childhood children.

Regarding the decrease in time on the STS task as age groups are increasingly older, they confirm that time on the STS task is strongly associated with growth and maturation processes; there were little differences between sexes.

Finally, comparing the times of the STS task between nationalities and considering the specific socio-cultural and socio-economic factors, we observed similar times for males but statistically significant differences for females.

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ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.26937

Influence of sedentary behaviour on the practice of physical activity in climacteric women

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ABSTRACT

The purpose of the present study was to evaluate the influence of sedentary behaviour on the practice of physical activity in climacteric women. This was a cross-sectional study with a random sample of 873 women assisted in Family Health Strategy units in the city of Montes Claros, Minas Gerais, Brazil. A structural equation model was tested to assess the influence of sedentary behaviour on the practice of physical activity. The results revealed that sedentary behaviour has a negative effect on light, moderate and vigorous activities, explaining 8, 2 and 6%, respectively, of the variability of these variables. It was also observed that the increase in sedentary behaviour has a negative effect on light (β= –0.04), moderate (β= –0.10) and vigorous (β= –0.17) activities. Sedentary behaviour negatively affects the performance of light, moderate and vigorous physical activity in climacteric women assisted by the Family Health Strategy.

KEYWORDS: climacteric; lifestyle; epidemiology; primary health care.

INTRODUCTION

The female life cycle is marked by hormonal changes, and reproductive ageing is a continuous process that begins at the beginning of female life and gradually leads to the final phase, menopause (Hemalatha et al., 2019). This transitional phase between the reproductive and non-reproductive phases of women characterises the climacteric period, when there is a decline in ovarian function manifested by a marked decrease in estrogen production (Birkhaeuser, 2018; El Hajj et al., 2020).

Climacteric symptoms include physical and psychological changes, the typical ones being vasomotor symptoms, which refer to hot flashes, sweating, palpitations and a feeling of intense internal heat (Birkhaeuser, 2018). Other symptoms often experienced by climacteric women include sleep problems, mood swings, memory and concentration difficulties, somatic complaints, and concerns about sexual functioning (El Hajj et al., 2020).

In addition to hormonal changes, this phase can be influenced by genetic, social and behavioural habits (El Hajj et al., 2020). Among the behavioural habits, regular physical activity can play a protective role in alleviating the symptoms of menopause and, consequently, improving women's quality of life (El Hajj et al., 2020; Godinho-Mota et al., 2019).

However, the literature points out that with ageing, behavioural habits have been modified, and the population has replaced the practice of physical activity with sedentary behaviour (Dallal et al., 2016; Mattioli et al., 2019; Silva et al., 2012), namely in women in the climacteric period, a stage of life in which there is a high prevalence of sedentary behaviour, there is a compromised quality of life and an increased risk for diseases, including cardiovascular ones (Dallal et al., 2016; Godinho-Mota et al., 2019).

Currently, studies have pointed out sedentary behaviour as an important public health problem since this practice is inversely associated with physical activity performance (Oliveira et al., 2018). In this context, studies that assess the influence of sedentary behaviour on the level of physical activity, especially in climacteric women, become relevant so that care strategies for this public, lacking public policies,

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Conflict of interests: nothing to declare. Funding: nothing to declare.
Received: 04/05/2022. Accepted: 08/09/2022.

are planned in health services (Godinho-Mota et al., 2019; Silva et al., 2012), in order to reduce sedentary behaviour and encourage the practice of physical activity, taking into account the level of activities and the profile of the target audience (Dallal et al., 2016). Given the above, the aim of this study was to evaluate the influence of sedentary behaviour on the practice of physical activity in climacteric women.

In this context, a hypothesised theoretical model was created, considering that sedentary behaviour influences the practice of light activity, moderate activity and vigorous activity (Oliveira et al., 2018). In this model, the variables sedentary behaviour, light activity, moderate activity, and vigorous activity were treated as constructs. The sedentary behaviour construct was defined by the variables time sitting during the week and time sitting on the weekend; the light, moderate and vigorous activities construct was defined as days per week, time per day and time per week (Figure 1).

METHODS

This is an excerpt from a cross-sectional population-based study entitled "Health conditions of climacteric women: an epidemiological study", whose population comprised 30,018 women aged between 40 and 65 years, registered in 73 units of Family Health Strategy (FHS) from the city of Montes Claros (urban and rural areas), Minas Gerais, Brazil, carried out between August 2014 and January 2015.

Sample

As this is an epidemiological survey that sought to estimate the prevalence of various health problems for women during menopause, the sample size was established in order to estimate population parameters with a prevalence of 50%. The admitted sampling error was 5%, and the confidence level was 95%. The final value was multiplied by a correction factor for design effect (deff) equal to 2, and a 10% increase for

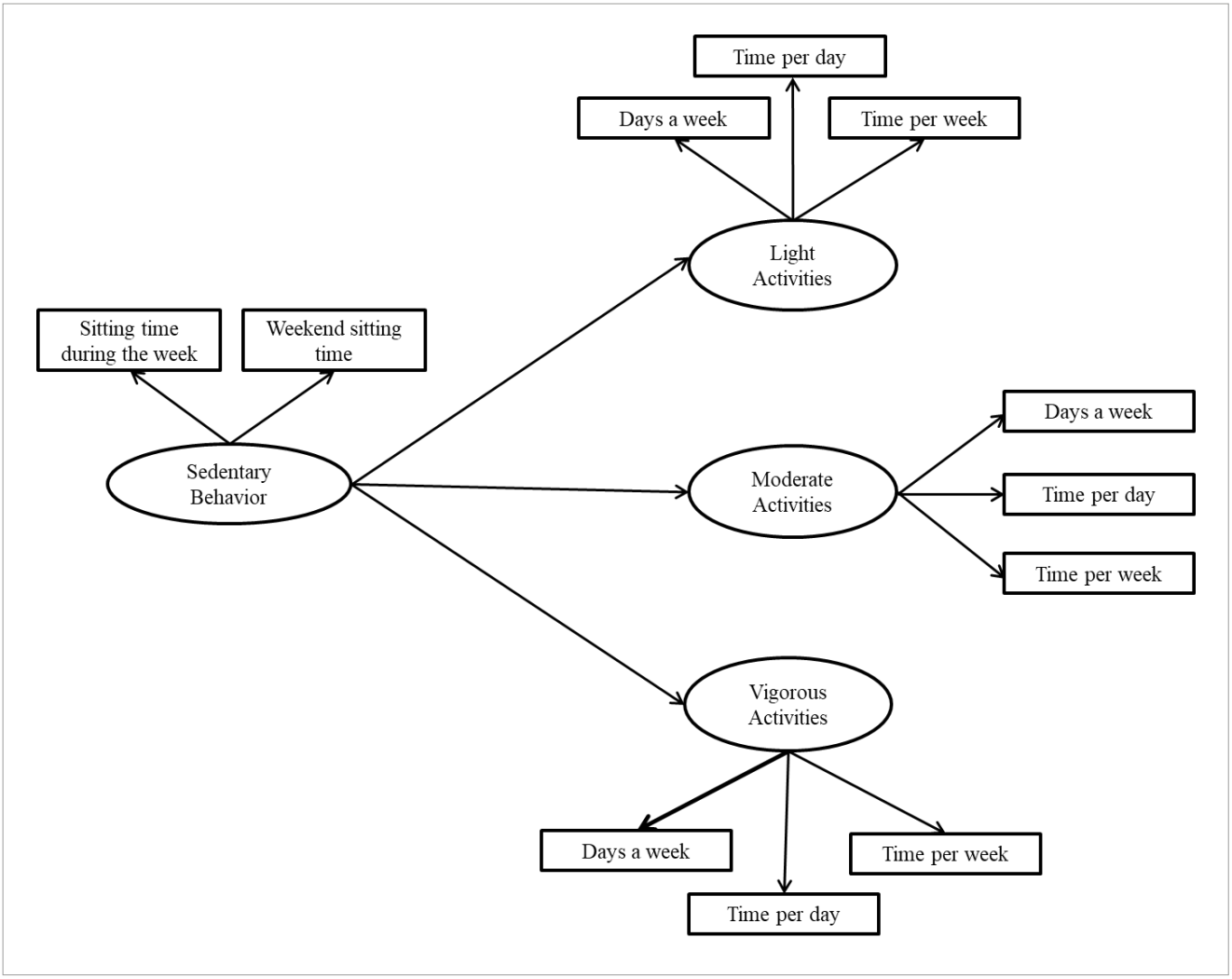

Figure 1. Hypothetical model of the effect of sedentary behaviour on the practice of physical activity in climacteric women.

the non-response rate, thus obtaining a minimum number of 836 women needed to be evaluated to have a representative sample of the population. It is important to highlight that this sample size met the premises for structural equation modelling (Maruyama, 1998). Climacteric women who were in the gestational period, puerperium and those who were bedridden were not included in the study sample.

The sampling process was probabilistic, and sample selection took place in two stages. The method of drawing by conglomerates, with sharing proportional to size, was adopted in the first stage, where 20 FHS units were drawn, covering urban and rural areas for data collection. The second stage consists of the random selection of a proportional number of women according to the climacteric stratification criteria (pre, peri and post-menopause) established by the Brazilian Society of Climacteric (American Menopause Society, 2013). For each FHS, 48 women were selected and invited to participate in the study (number based on the sample calculation so that a representative sample of women could be reached, considering the probable losses).

Instruments

To characterise the study population, a questionnaire was applied that addressed sociodemographic, economic and menopausal status: age group (40 to 45 years old; 46 to 51 years old; 52 to 65 years old); marital status (with a steady partner; without a steady partner); skin colour (not white; white); education (high school/university; elementary school I; elementary school II); formal work (yes; no); family income (≤ 1 minimum wage; > 1 minimum wage); and climacteric stages (pre-menopause, peri-menopause and post-menopause).

The level of physical activity and sedentary behaviour of the women was assessed using the short version of the International Physical Activity Questionnaire (IPAQ). The IPAQ is a questionnaire validated in a general sample of the Brazilian population (Matsudo et al., 2001). It was recently validated for the population of climacteric women assisted by the Family Health Strategy (Freitas et al., 2021) and has been used in some studies in the country (Cardoso et al., 2020; Pitanga et al., 2018), even with climacteric women (Colpani et al., 2014). To assess the level of physical activity, the instrument has questions related to the frequency and duration of physical activities such as walking and activities of moderate and vigorous intensity. Sedentary behaviour was evaluated through the mean time sitting on a weekday and on a weekend day (Matsudo et al., 2001). The questions in the questionnaire are related to activities carried out in the last week prior to its application.

Statistical analysis

Response records were manually reviewed for errors and inconsistencies. Data were entered and stored in the software Statistical Package for the Social Sciences (SPSS), version 22. Initially, an exploratory descriptive analysis of the data was performed, with frequency distribution of the variables characterising the study population. The normality of continuous variable distribution was assessed using the Kolmogorov-Smirnov test. Spearman's correlation (non-parametric) was used to verify the relationship between the variables.

Subsequently, the assumptions described in the hypothetical model (Figure 1) were tested by using the structural equation model (SEM), verifying how sedentary behaviour affects the practice of physical activity in climacteric women. The goodness of fit of the model was analysed according to the fit indices. The Maximum Likelihood estimation method was used to estimate the model parameters. The model adequacy indicators were: χ^2, absolute index χ^2/df (values< 5 are considered satisfactory), the Comparative Fit Index (CFI) and the Tucker-Lewis index (TLI) (> 0.90), Root Mean Square Error of Approximation (RMSEA) (inferior to 0.08), Standardized Root Mean Square Residual (SRMR) (inferior to 0.08), Akaike Information Criterion (AIC) and Bayes Information Criterion (BIC) (Rosseel, 2012). Data were analysed using the R statistical software (version 3.6.1) (R Core Team, 2020) and RStudio (1.3.959) (R Core Team, 2020) (https://cran.r-project.org /) through the lavaan package (Rosseel, 2012).

This research was approved by the Ethics Committee for Research with Human Beings (CEP), through opinion nº 817.666/2014, in accordance with Resolution nº 466/12, of the National Health Council (NHC). The women who agreed to participate in the research signed a free and informed consent form containing the study objective, evaluation procedure and voluntary nature of participation.

RESULTS

The study included 873 climacteric women aged between 40 and 65 years old [51.0(± 7.08)], and most interviewees were aged between 52 and 65 years (45.5%). There was a prevalence of women with a steady partner (64%), non-white (82.4%), who did not complete high school (67.7%), do not have formal work (60.4%) and family income ≤ 1 minimum wage (55.85). Regarding the menopausal status, it was noted that a considerable portion of women is post-menopausal (45.5%) (Table 1).

Table 2 presents the descriptive values of the variables related to sedentary behaviour and physical activity,

in addition to the values of the correlations between the variables. Sedentary behaviour showed the following correlations with the practice of physical activity: time sitting during the week with days of walking (*rho*= –0.11); minutes of walking per day (*rho*= –0.09), minutes of walking per week (*rho*= –0.11); days of moderate activity (*rho*= –0.16); minutes of moderate activity per day (*rho*= –0.16); minutes of moderate activity per week (*rho*= –0.15); days of vigorous activity (*rho*= –0.24); minutes of vigorous activity per day (*rho*= –0.28); and minutes of vigorous activity per week (*rho*= –0.24). There was also a correlation between time spent sitting on the weekend and days of walking (*rho*= –0.11); minutes of walking per day (*rho*= –0.11); minutes of walking per week (*rho*= –0.14); days of moderate activity (*rho*= –0.14); minutes of moderate activity per day (*rho*= –0.13); minutes of moderate activity per week (*rho*= –0.13); days of vigorous activity (*rho*= –0.19); minutes of vigorous activity per day (*rho*= –0.23); and minutes of vigorous activity per week (*rho*= –0.19) (Table 2).

Table 1. Characterization of climacteric women according to sociodemographic, economic and menopausal status.

Variables		Frequency	
		n	%
Age group	40 to 45 years old	236	27.0
	46 to 51 years old	240	27.5
	52 to 65 years old	397	45.5
Marital Status	With steady partner	559	64.0
	No steady partner	314	36.0
Skin Color	Not white	719	82.4
	White	154	17.6
Education	Middle/Upper	281	32.3
	Elementary II	231	26.4
	Elementary I	361	41.3
Formal Work	Yes	346	39.6
	No	527	60.4
Family Income*	≤ 1 minimum wage	487	55.8
	> 1 minimum wage	386	44.2
Climacteric Phases	Pre-Menopause	236	27.0
	Peri-Menopause	240	27.5
	Post-Menopause	397	45.5

*Minimum salary in the year 2014/2015, the period of data collection, was equivalent to R$ 724.

Through the analysis of the hypothetical model, which sought to verify whether sedentary behaviour affects the practice of light, moderate and vigorous physical activities of climacteric women, the results showed satisfactory adjustment indicators [χ^2= 532.44; *p*= 0.001; χ^2/df= 9.68; *CFI*= 0.90; *TLI*= 0.93; *RMSEA*= 0.04 (IC 0.02–0.05); p (RMSEA< 0.05)= 0.001; *SRMR*= 0.08; *AIC*= 857.5; *BIC*= 987.3].

The sedentary behaviour presented in the model has an impact on the latent variables of light, moderate and vigorous physical activities in 8, 2 and 6%, respectively (Figure 2). In the direct relationship established between Sedentary Behaviour and Light Activities, Moderate Activities and

Table 2. Correlation between the variables of sedentary behaviour and physical activity.

	Sedentary Behaviour		Physical Activity Practice								
	1	2	3	4	5	6	7	8	9	10	11
1. Sitting time during the week		0.70*	-0.11*	-0.09*	-0.11*	-0.16*	-0.16*	-0.15*	-0.24*	-0.28*	-0.24*
2. Weekend sitting time			-0.11*	-0.11*	-0.14*	-0.14*	-0.13*	-0.13*	-0.19*	-0.23*	-0.19*
3. Walking days				0.70*	0.88*	0.39*	0.37*	0.38*	0.38*	0.38*	0.38*
4. Walking minutes per day					0.92*	0.29*	0.28*	0.29*	0.27*	0.25*	0.26*
5. Walking minutes per week						0.34*	0.31*	0.33*	0.32*	0.31*	0.32*
6. Days of moderate activity							0.93*	0.98*	0.71*	0.73*	0.73*
7. Minutes of moderate activity per day								0.96*	0.66*	0.70*	0.68*
8. Minutes of moderate activity per week									0.70*	0.72*	0.72*
9. Days of vigorous activity										0.95*	0.97*
10. Minutes of vigorous activity per day											0.98*
11. Minutes of vigorous activity per week											
Average	5.82	44.5	463.5	7.0	42.8	775.6	8.19	28.1	775.8	185.4	240.6
Standard deviation	16.1	64.4	1572.0	22.4	92.5	2638.1	26.4	68.1	2065.0	66.4	71.9
Median	3.0	30.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0	240.0

*Significant Spearman correlation: < 0.05.

Vigorous Activities, the effects were weak (β= –0.04 β= –0.10 and β= –0.17), indicating that for each increase of 1 standard deviation in the Sedentary Behaviour unit there is a reduction of 0.04 standard deviation in the Light Activities unit, a reduction of 0.10 standard deviation in the Moderate Activities unit and a reduction of 0.17 standard deviation in the Vigorous Activities unit.

DISCUSSION

The study sought to assess the influence of sedentary behaviour on the practice of physical activity in climacteric women through the analysis of structural equations, an important statistical tool to assess complex relationships in various areas of knowledge, including epidemiology (Barillari et al., 2021). The sedentary behaviour construct was negatively associated with the practice of light, moderate and vigorous physical activity, suggesting that as the sedentary behaviour of climacteric women increases, the practice of physical activity decreases.

The scientific community has highlighted that too much time spent on sedentary behaviour is associated with the occurrence of cardiovascular diseases, type 2 diabetes, obesity, metabolic syndrome, and increased risk of death from cardiovascular diseases, regardless of the level of physical activity (Carter et al., 2017; Gao et al., 2017). Mental health damage, such as stress, dementia and sleep problems caused by sedentary behaviour, has also been reported in the literature (Ashdown-Franks et al., 2018; Falck et al., 2017).

Concern about the increase in sedentary behaviour during the climacteric period intensifies (Silva et al., 2012), as during this phase, women are already predisposed to health problems due to hypoestrogenism, ageing and deleterious behavioural changes (Hemalatha et al., 2019), impacting the quality of

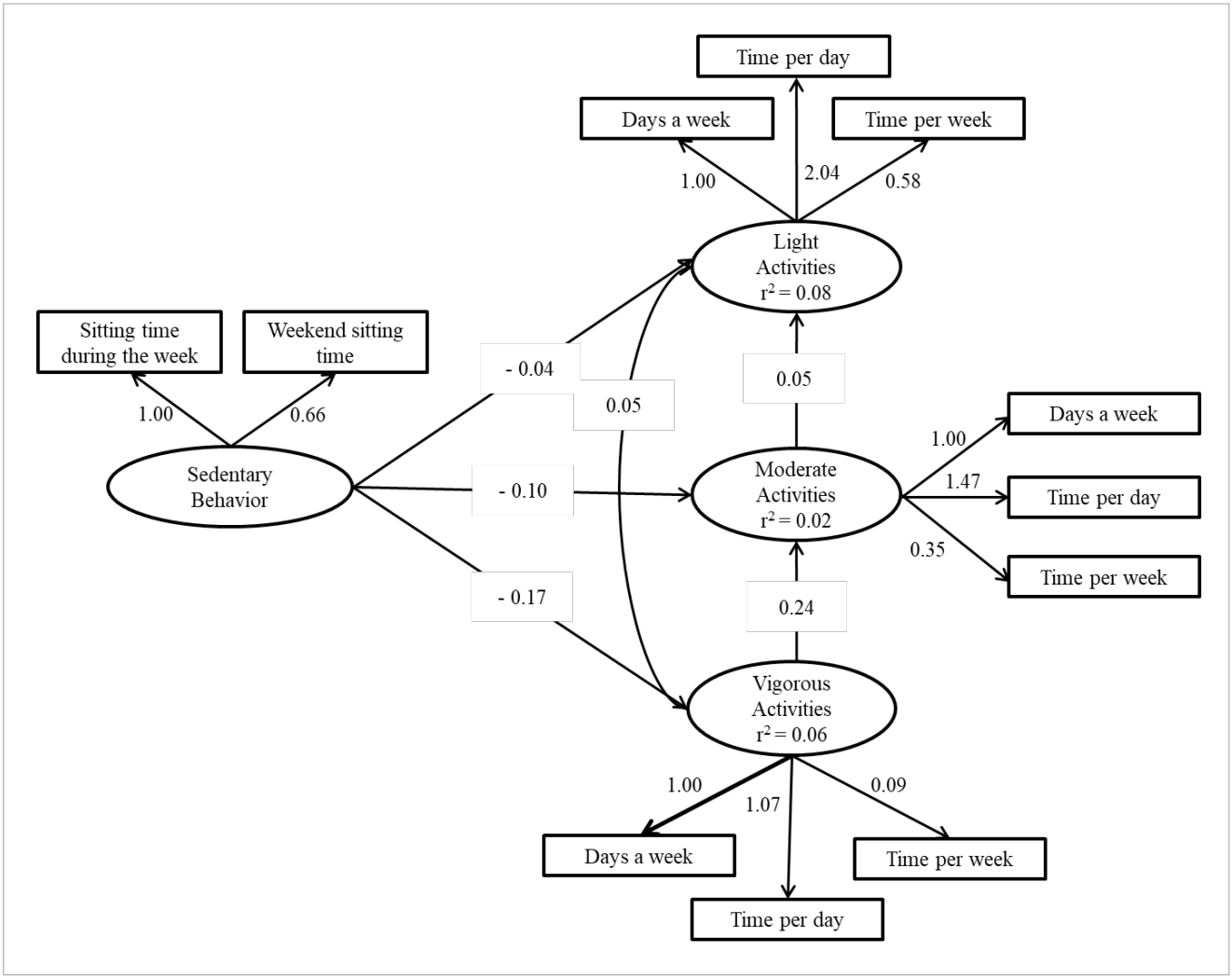

Figure 2. Structural model of the effect of sedentary behaviour on the practice of physical activity in climacteric women.

life and increasing the risk of morbidity and mortality (Leite et al., 2022; Mansikkamäki et al., 2015).

Regarding the increase in sedentary behaviour and reduction of physical activity during the climacteric period observed in this study, it is already evidenced in the literature that with advancing age, the levels and intensity of physical activity practice decrease (Andrade-Gómez et al., 2018; Kim & Lee, 2019; Silva et al., 2012). Sedentary behaviour assumes higher proportions after the fourth decade, affecting about 53% of women between 45 and 65 years old, who spend and perform activities characterised by low energy expenditure, not exceeding 1.5 metabolic equivalents (Pitanga et al., 2019).

During the climacteric period, women perform, more often, walks and housework, which are considered low-calorie activities (Lomônaco et al., 2015; Pitanga et al., 2014). Thus, the results of this study contribute to the evidence of sedentary behaviour and its negative influence on the practice of light physical activity.

The results also showed an inverse relationship between sedentary behaviour and the practice of moderate and vigorous physical activity. It is suggested that these findings are related to the progressive neurogenic process that becomes evident after the age of 50, especially in women, due to hypoestrogenism, which can influence the performance of activities that require muscle strength, flexibility and aerobic endurance, stimulating an increase in sedentary behaviour and a reduction in the practice of moderate and vigorous physical activity (Cooper et al., 2008; Silva et al., 2012). In addition, socioeconomic aspects are also associated with an increase in sedentary behaviour and a decrease in the practice of medium/high intensity physical activity (Molina-Garcia et al., 2019).

As a consequence of increased sedentary behaviour and ageing, during and after menopause, there is a reduction in the basal metabolic rate, where women experience a loss of skeletal muscle mass, with a negative change in the proportion of body fat, a process characterised as sarcopenia (Mattioli et al., 2019). Sarcopenia is muscle wasting and is defined using a combination of appendicular muscle mass, muscle strength, and physical performance measures. Its pathogenesis depends on a balance between positive and negative muscle growth regulators (Woo, 2017).

This process of muscle mass loss reduces mobility, increases the risk of falls, fractures, use of hospital services, prolonged rehabilitation, and institutionalisation, and decreases the individual's quality of life (Larsson et al., 2019; Woo, 2017). Non-pharmacological strategies for treatment consist of improving nutritional status (Kim & Kim, 2020) in addition to regular physical activity of moderate and intense intensity (Diniz et al., 2015). A study by Diniz et al. (2015) suggests that the practice of regular moderate-vigorous physical activity with a weekly volume of 150 minutes or more can help to alleviate the loss of total lean body and leg mass in climacteric women, in addition to the stimulation of 2 to 3 days of resisted training (Jiménez-Pavón et al., 2020).

In this context, the study's findings call attention to the need to create strategies that encourage climacteric women to adopt active behaviours and regular moderate and vigorous activity practices since this delays muscle loss and contribute to the conservation of functional capacity (Kim et al., 2022; Ramnath et al., 2018). Furthermore, there is scientific evidence on the importance of creating public policies to reduce sedentary behaviour, which would consequently impact general health and improve well-being, on the prevention of diseases and health problems, as well as on the treatment of pathologies, since behavioural health interventions, such as physical activity, have benefits in so many medical areas (Pascoe et al., 2020; Shinn et al., 2020; Teychenne et al., 2018).

Taking into account the target audience of this study, climacteric women assisted by Primary Health Care (PHC) through the FHS, and considering that sedentary behaviour negatively influences the practice of physical activity of these women, primary health care, by proximity, due to accessibility, knowledge of the family and community, by intervention in prevention and continuity of care, have an important and decisive role in counselling and in promoting physical activity in this population (Shinn et al., 2020).

This study has limitations, and some items of the questions that constituted the data collection instrument can be highlighted. Even if they were validated, they might have been answered distortedly. Another limitation is the study design, as cross-sectional studies are subject to causality bias, which makes it possible to estimate the associations between the variables but not allowing the establishment of cause-and-effect relationships.

However, this is a relevant study that contributes to investigating the influence of sedentary behaviour on physical activity in climacteric women in a representative sample of climacteric women assisted by PHC in a large Brazilian centre, constituting a risk group and lacking public policies specific assistance. In addition, data collection was performed using an instrument validated for this specific population (Freitas et al., 2021).

It should also be noted that further studies are needed to focus on physical activity and sedentary behaviour, especially to investigate the cause and effect relationship between these constructs.

CONCLUSION

It is concluded that sedentary behaviour negatively affects the performance of light, moderate and vigorous physical activity in climacteric women assisted by PHC. In this context, taking into account that the practice of physical activity improves the quality of life and prevents risks and symptoms typical of ageing, and since the climacteric is a period in a woman's life marked by adherence to sedentary behaviour, actions that encourage this public to change behaviour if necessary.

In this context, the findings of the present study may contribute to the creation of public policies aimed at the orientation and adherence to the practice of physical activity by climacteric women, reducing the deleterious effects of sedentary behaviour and improving the quality of life, health and well-being of these women. population.

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ARTIGO ORIGINAL

https://doi.org/10.6063/motricidade.27011

Evolução histórica da participação do Brasil nos jogos paralímpicos de verão

Historical evolution of Brazil's participation in the summer paralympic games

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RESUMO

O objetivo do presente estudo foi de caracterizar a trajetória evolutiva do Brasil durante a participação dos Jogos Paralímpicos de Verão entre 1972-2020 e comparar com os países mais bem ranqueados nos Jogos Paralímpicos Rio 2016, buscando relacionar com o contexto histórico-político nacional e o plano estratégico do Comitê Paralímpico Brasileiro nos diferentes ciclos Paralímpicos. Até os Jogos Paralímpicos realizados em 2020, a delegação brasileira foi representada por um total de 774 atletas, sendo 251 medalhistas (70.9% homens; 29.1% mulheres) em 17 diferentes modalidades, quatro coletivas e treze individuais. Com relação ao tipo de deficiência, 64.9% dos atletas medalhistas apresentam deficiência física, 32.3% correspondem à deficiência visual e 2.8%, deficiência intelectual. Durante o período analisado, o Brasil conquistou 373 medalhas em participações, sendo 109 de ouro (29.2%), 132 de prata (35.4%) e 132 de bronze (35.4%). A modo conclusão, é possível destacar o avanço nas políticas públicas, plano estratégico e investimentos que favoreceram que nos últimos quatro ciclos paralímpicos, o Brasil pudesse se consolidar entre as 10 maiores potências mundiais paralímpicas, conquistando o maior número de medalhas em 2016 e o terceiro lugar no crescimento acumulado (3.2%) nos Jogos Paralímpicos de Verão entre 1988-2020, sendo superado apenas por China e Ucrânia.

PALAVRAS-CHAVE: jogos paralímpico; esporte adaptado; movimento paralímpico.

ABSTRACT

This paper aimed to characterise Brazilian participation in the Summer Paralympic Games between 1972-2020 and relate it to the historical-national, political and Brazilian Paralympic Committee's strategic plan for the paralympic cycles. This paper also intended to compare Brazilian's results with the best-ranked countries in Rio 2016. Until 2020, the Brazilian delegation was represented by 774 athletes, 251 of whom were medalists (70.9% men and 29.1% women) in 17 different sports, four collective and thirteen individuals. Regarding disability type, 64.9% of the medalist athletes have a physical impairment, 32.3% visual impairment and 2.8% intellectual impairment. During the analysed period, Brazil won 373 medals: 109 gold (29.2%), 132 silver (35.4%) and 132 bronze (35.4%). In conclusion, it is possible to highlight that the improvement in public policies, strategic plans and investments has favoured Brazilian's results. In the last four Paralympic cycles, Brazil could consolidate itself, winning the largest number of medals in 2016 and reaching third place in accumulated growth (3.2%) between 1988-2020, surpassed only by China and Ukraine.

KEYWORDS: paralympic games; adapted sports; paralympic movement.

INTRODUÇÃO

Os Jogos Paralímpicos de Verão (JPV) surgiram como resultado da iniciativa proposta em 1945 por Ludwig Guttmann que implementou a prática esportiva no hospital Stoke Mandeville/Inglaterra para soldados mutilados em combates, como estratégia para reabilitação e melhora da expectativa

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Conflito de interesses: nada a declarar. Financiamento: nada a declarar.
Recebido: 18/04/2022. Aceito: 18/07/2022.

de vida (Dehghansai et al., 2020; Legg, 2018). A adesão pela prática esportiva resultou anos depois como uma prática com caráter competitivo, culminando na primeira edição dos JPV realizada em Roma no ano de 1960 (Blauwet & Willick, 2012; Brittain, 2018; Legg, 2018; Webborn & Van de Vliet, 2012; Webborn et al., 2016).

Os JPV são considerados um dos maiores eventos esportivos do mundo para pessoas com deficiência (Legg, 2018) e que está em constante evolução em diferentes indicadores como, aumento do número de Comitês Paralímpicos Nacionais (*NPC's*, sigla em inglês) participantes por edição, número de atletas, elegibilidade de diferentes deficiências (classificação esportiva paralímpica[1]), de modalidades esportivas, nas implementações tecnológicas para o desempenho dos atletas e da estrutura competitiva (de Luigi & Cooper, 2014; van der Slikke et al., 2017; Rum et al., 2021; Silva & Mello, 2021; Winckler & Mello, 2012), além disso, de investimentos financeiros para organização dos JPV (Webborn & Van de Vliet, 2012; Webborn et al., 2016).

No Brasil, considera-se que o Movimento Paralímpico (MP) foi iniciado por Robson Sampaio e Sérgio Del Grande. Ambos, após contato com o esporte para pessoas com deficiência durante reabilitação realizada nos Estados Unidos nas décadas de 50 e 60, deram origem ao Clube do Otimismo na cidade do Rio de Janeiro e o Clube dos Paraplégicos na cidade de São Paulo, respectivamente (Araújo, 2011; Miranda, 2011). Este marco, alavancou a estruturação do esporte paralímpico nacional, culminando na primeira participação internacional de atletas brasileiros nos II Jogos Parapan-americanos na Argentina em 1969 (Araújo, 2011; Miranda, 2011).

Anos depois ocorreu a primeira participação da delegação brasileira, composta por 20 atletas, nos JPV em 1972, na Alemanha (Cidade & Freitas, 2009). Em sua estreia, o Brasil se depara com um cenário internacional de pleno crescimento em número de países e atletas participantes. Nesta edição houve aumento de 74.7% de atletas participantes em 1972 comparado a 1968 (Webborn & Van de Vliet, 2012; Willick & Lexell, 2014).

Outros marcos importantes na participação brasileira em JPV foi a conquista da primeira medalha paralímpica em 1976 no Canadá (Comité Paralímpico Internacional, 2021; Miranda, 2011). A medalha de prata foi conquistada pelos atletas Robson Sampaio Almeida e Luiz Carlos Costa, no Lawn Bowls, na prova *Pairs WH*, classe para atletas com deficiência física que utilizam cadeira de rodas. Nessa mesma edição, o Brasil tem a primeira participação feminina, com as atletas Maria Alvares e Beatriz Siqueira (Comité Paralímpico Internacional, 2021; Miranda, 2011).

Com o fomento e desenvolvimento do MP no Brasil, em 1995 é fundado o Comitê Paralímpico Brasileiro (CPB), reconhecido desde então como órgão máximo de gestão esportiva paralímpica brasileira e reconhecido pelo Comitê Paralímpico Internacional (em inglês, IPC). Dentre suas atividades, destaca- se a responsabilidade de organizar, fomentar e desenvolver o esporte paralímpico no cenário nacional e convocar a delegação brasileira para participações em eventos internacionais como os JPV e inverno (Comité Paralímpico Internacional, 2021; Miranda, 2011).

Se considera que o fomento, desenvolvimento e a consolidação do MP no país foram possíveis a partir das ações de gestores e de leis aprovadas pelo governo brasileiro. No âmbito legislativo destaca-se, a Lei n° 9.615 (Brasil, 1998), conhecida como ¨Lei Pelé¨, sancionada em 1998 que determina a destinação de recursos para os Comitês Olímpico (COB) e CPB, proporcionado a profissionalização do esporte. Em 2001, a Lei Agnelo Piva determinou que 2% da arrecadação bruta de todas as loterias federais do país sejam repassados ao COB e ao CPB, garantindo investimento direto no esporte nacional. Além disso, em 2005, é instituído o programa "Bolsa- Atleta" através da Lei n° 10.891 (Brasil, 2004) , com o objetivo de patrocinar individualmente atletas e para-atletas de alto rendimento. Em 2013, esse programa foi ampliado com a inclusão do projeto "Atleta Pódio"- Lei n° 12.395/11 (Brasil, 2011a), visando apoio a atletas com destaque internacional entre os 20 primeiros do mundo (Brasil, 1998, 2011b, 2015).Como consequência da fundação do CPB e desenvolvimento das políticas públicas para o esporte paralímpico, o Brasil passa a se consolidar como uma potência paralímpica internacional, permanecendo entre os dez primeiros *NPC's* nos JPV, desde 2008.

É de nosso conhecimento apenas dois estudos que tenham apresentado informações quantitativas e qualitativas da participação brasileira em JPV. No primeiro estudo, é realizada a comparação qualitativa da participação brasileira utilizando o quadro geral de medalhas entre os JPV- Sydney 2000 e JPV-Atlanta 1996 (Costa & Santos, 2002). No segundo estudo, os autores apresentaram a evolução do CPB à nível mundial com relação ao número de atletas, países participantes nas edições do JPV e número de medalhas. Além disso, apresentam número absoluto de atletas brasileiros participantes, medalhas conquistadas e posição do Brasil na classificação geral nos JPV entre os anos de 1972 e 2012 (Mauerberg-DeCastro et al., 2016).

1 O termo Classificação Esportiva Paralímpica abrange os sistemas de classificação: funcional, visual e intelectual (Souza, 2020).

Apesar dos estudos desenvolvidos apresentarem informações relevantes da participação brasileira em JPV, não foram identificados estudos que relacionem o desempenho da participação qualitativa e quantitativa do Brasil em JPV com contexto histórico-político nacional e plano estratégico do CPB nos diferentes ciclos Paralímpicos.

Portanto, o objetivo do presente estudo foi de (i) caracterizar a trajetória evolutiva do Brasil durante a participação dos JPV entre 1972-2020 no tocante a número de atletas participantes, medalhas conquistas, modalidades medalhadas, ranking do Brasil nas edições dos JPV, (ii) identificar a evolução quantitativa do Brasil comparado aos países melhores ranqueados em JPV e, (iii) identificar e relacionar a evolução da participação brasileira nos JPV com o contexto histórico-político nacional e o plano estratégico do CPB nos diferentes ciclos Paralímpicos.

MATERIAIS E MÉTODOS

Estudo descritivo e comparativo com delineamento longitudinal. Inicialmente, os dados utilizados no presente estudo foram obtidos no website do *IPC* (https://www.paralympic.org/) e em documentos oficiais do CPB entre os anos de 1972 e 2021. De forma documental, foram analisadas as convocações oficiais das Delegações Brasileiras e planilhas de resultados gerais entre os anos de 1972 e 2021, período correspondente a JPV da era moderna (Legg, 2018). Desses documentos foram extraídos o número de atletas participantes de ambos os gêneros, modalidades e provas em que atletas brasileiros participaram. Posteriormente, os dados foram agrupados em medalhistas e não-medalhistas, o tipo de medalha conquistada, grupos de deficiência (Física-DF, Visual-DV e Intelectual-DI) e o ano de participação.

A comparação do desempenho histórico do Brasil com as demais potências paralímpicas foi realizada a partir do número total de medalhas conquistadas em cada JPV pelos dez primeiros colocados do quadro de medalhas dos JPV-Rio 2016 ($TOP_{10\text{-}RIO2016}$). Devido aos impactos provocados pela pandemia do COVID-19, gerando o adiamento dos Jogos Paralímpicos, rompendo o ciclo de competições a cada 4 anos, alteração no sistema de competições qualificatórias e comprometendo o desempenho dos atletas, foram considerados os países TOP RIO 2016.

Análise estatística

As variáveis referentes ao número de atletas brasileiros convocados e medalhados por JPV, número de atletas medalhistas de forma geral, por gênero, tipo de deficiência e modalidades, foram apresentadas em valores absolutos de acordo com o ano de participação.

Para comparar o desempenho do Brasil em relação ao $TOP_{10\text{-}RIO2016}$ foi utilizado a colocação geral no quadro de medalhas nos JPV-Rio 2016 (CGRio2016). O número de medalhas conquistadas por cada *NPC* foi relativizado pelo número total de medalhas em disputas e conquistadas em cada edição dos JPV (%MRxJPV) através da Equação 1:

$$\%MRx\ JPV = \frac{(N°\ medalhas\ conquistas\ pelo\ NPC * 100)}{N°Medalhas\ disputadas\ no\ JPV} \quad (1)$$

Foi calculado a somatória do %MRxJPV (å%MCJPV) desde 1988 até 2021, através da Equação 2:

$$\sum \%\text{MCJPV} = \%MRx\ JPV_{1988} + \%MRx\ JPV_{1992+}.....\%MRx\ JPV_{2020} \quad (2)$$

Onde:
%MRx JPV = o percentual de medalhas conquistadas relativizado em função de cada JPV,entre os anos de 1988 e 2021.

A taxa de crescimento relativo do número de medalhas conquistadas por *NPC´s* (%C) foi calculada a partir da diferença entre os valores (de %MRxJPV) obtidos na participação mais recente com a anterior através da Equação 3:

$$\%C = \%MRx\ JPV_{\text{Atual}} - \%MRx\ JPV_{\text{antecessor}} \quad (3)$$

Onde:
$\%MRx\ JPV_{Atual}$ = o percentual de medalhas conquistadas relativizado em função do JPV atual, por exemplo Tóquio 2020;
$\%MRx\ JPV_{Antecessor}$ = o percentual de medalhas conquistadas relativizado em função do JPV anterior, Rio 2016.

O crescimento acumulado (CA) foi considerado como a somatória da %C. A partir desses valores, foi gerado um rank decrescente de %C dos NPC's T(Equação 4).

$$CA = \%C_{1988} + \%C_{1992+}.....\%C_{2020} \quad (4)$$

Onde:
%C = o percentual de crescimento em relação a edição anterior de cada JPV, entre os anos de 1988 e 2021.

Todos os dados foram tabulados e analisados em *Microsoft Excel®* e através do software *Qlik-Sense-Business Intelligence®* (Pennsylvania, United States of America).

RESULTADOS

Até os JPV-Tóquio 2020[2], a delegação brasileira foi representada por 774 atletas sendo 32.42% medalhistas. Do total de medalhistas paralímpicos, 70.91% são homens e 29.08% são mulheres de 17 diferentes modalidades, sendo quatro coletivas e treze individuais. Com relação ao tipo de deficiência, 64.94% dos atletas medalhistas apresentam DF, 32.28% correspondem à DV e 2.78% para DI. A Tabela 1 apresenta a quantidade absoluta de participantes, medalhistas, modalidades e tipos de deficiência dos atletas brasileiros em todas as participações em JPV.

Foram observados que o Brasil conquistou um total de 373 medalhas em JPV, sendo 109 de ouro (29.22%), 132 de prata (35.39%) e 132 de bronze (35.39%).Classificando as medalhas conquistadas a partir dos grupos de deficiências elegíveis, a DF é responsável pelo maior número de medalhas sendo 70 de ouro, 83 de prata e 90 de bronze, totalizando 243 medalhas (65.15%), seguido da DV com 37 de ouro, 47 de prata e 39 de bronze, totalizando 123 medalhas (32.98%) e DI por 2 medalha de ouro, 2 de prata e 3 de bronze (1.87%). Destas medalhas 96.51%, se concentram nas modalidades individuais, sendo as três mais medalhadas são: Atletismo (AT) com 170 (*Ouro*= 48, *Prata*= 70, *Bronze*= 52), Natação (NA) com 125 (*Ouro*= 40, *Prata*= 39, *Bronze*= 46) e Judô (JU) com 25 (*Ouro*= 5, *Prata*= 9, *Bronze*= 11). Dentre as modalidades coletivas, as três que conquistaram o maior número de medalhas são Futebol de cegos (FC) com 5 de ouro, Futebol de Paralisados Cerebrais (FPC) com três (*Prata*= 1, *Bronze*= 2) e Goalball (GB) com três (*Ouro*= 1, *Prata*= 1, *Bronze*= 1). Na Tabela 2 são apresentados os valores correspondentes ao número e tipos de medalhas por modalidades, tipos de deficiência e gênero.

Ao analisarmos o número e o tipo de medalhas conquistadas por modalidades ao longo das participações nos JPV (Tabela 3) foi observado maior número de medalhas conquistadas e de modalidades medalhadas a partir dos JPV-Atenas 2004. Antes disso, o Brasil havia conquistado 106 medalhas, 35.21% do total atual, em cinco modalidades. Entre 2004 e 2020, foram conquistadas 267 medalhas paralímpicas em doze modalidades.

Na edição de JPV-Rio 2016, nove das dezesseis modalidades aumentaram o número de medalhas conquistadas em comparação à última edição dos JPV-Londres 2012. Em 2016, o Brasil conquistou 14 medalhas de ouro, 29 de prata e 27 de bronze, totalizando 72 em 13 modalidades. Isso garantiu a 8ª posição, a segunda melhor historicamente no quadro geral de medalhas.

Nos JPV-Tóquio 2020, o Brasil conquistou 22 medalhas de ouro, 20 de prata e 30 de bronze, totalizando 72 medalhas em 14 modalidades. Com esse resultado conquistou a 7ª posição, igualando a melhor colocação no quadro de medalhas da história conquistada nos JPV-Londres 2012, com 43 medalhas (*Ouro*= 21, *Prata*= 14, *Bronze*= 8) em sete modalidades.

A partir da Equação 4, observamos na Tabela 4 o ranking dos *NPC's* baseado no %C ao longo dos JPV desde 1988. Podemos observar que o Brasil é o terceiro NPC em termos de crescimento no número de medalhas com crescimento de 3.23%, ficando atrás apenas da China (10.94%) e Ucrânia (6.06%). Dos *NPC's* do $TOP_{10\text{-}RIO2016}$ que sediaram edições de JPV no período analisado, apenas os Estados Unidos da América (EUA) não apresentaram crescimento no número de medalhas conquistadas (*%C*= –1.67% em 1996) enquanto país-sede e apenas a Grã-Bretanha manteve crescimento na edição seguinte ((*%C*= 0.76% em 2012 e 1.32 em 2016). Os demais *NPC's* sedes apresentaram aumentos de 5.75% (China), 2.26% Austrália e 1.68% (Brasil), respectivamente.

Na edição dos JPV-Tóquio 2020, nove *NPC's* do $TOP_{10\text{-}RIO2016}$ reduziram sua representatividade em comparação à JPV Rio 2016, (China, Ucrânia, Brasil, Austrália, Holanda, Grã-Bretanha, Polônia, EUA e Alemanha) apenas a Itália aumentou a concentração de medalhas entre as duas edições. Nos JPV Rio 2016, apenas seis *NPC's* do $TOP_{10\text{-}RIO2016}$ apresentaram crescimento em comparação à Londres em 2012 (Ucrânia, Brasil, Grã-Bretanha, Holanda, Itália e EUA).

Tabela 1. Caracterização dos participantes considerando sexo, tipo de modalidade e tipo de deficiência.

Participantes	Integrantes			Modalidade			Tipo de Deficiência		
	Geral	M	F	Geral	IN	CO	DF	DV	DI
Não-Medalhistas	523	367	156	12	9	3	421	85	17
Medalhistas	251	178	73	17	13	4	163	81	7
Total	774	545	229	29	22	7	584	166	24

M: Masculino; F: Feminino; IN: Individual; CO: Coletiva; DF: Deficiência Física; DV: Deficiência Visual; DI: Deficiência Intelectual.

2 Os Jogo Paralímpicos de Tokyo 2020 foram realizados em 2021, entretanto o nome do evento permaneceu Tokyo 2020.

Na comparação entre as edições de 2008 em relação à 2004, os países que não contribuíram para essa concentração de medalhas foram Austrália, Holanda, Polônia e Alemanha. De 2012 em comparação à 2008, foram China, Ucrânia, Brasil, Grã-Bretanha e EUA.

DISCUSSÃO

O objetivo estudo foi (i) caracterizar a trajetória evolutiva do Brasil durante a participação dos JPV entre 1972-2020 no tocante a número de atletas participantes, medalhas conquistas, modalidades medalhadas, ranking do Brasil

Tabela 2. Valores absolutos de medalhas conquistadas, tipos de medalhas, modalidades, tipos de deficiência e gênero da participação brasileira nos JPV entre 1976–2020.

Modalidades Esportivas	Categoria	Deficiência	Medalhas			Total Medalhas
			Ouro	Prata	Bronze	
Para Atletismo	M	DF	16	21	22	59
		DV	11	18	7	36
		DI	1	0	0	1
	F	DF	11	14	6	31
		DV	9	17	16	42
		DI	0	0	1	1
Bocha	Mixto *	DF	6	1	4	11
Para canoagem	M	DF	1	2	1	4
Para ciclismo	M	DF	0	1	1	2
Para hipismo	Mixto *	DF	0	1	4	5
Futebol de Cegos	M	DV	5	0	0	5
Futebol de PC	M	DF	0	1	2	3
Goalball	M	DV	1	1	1	3
Judô	M	DV	4	3	4	11
	F	DV	1	6	7	14
Lawn Bawls	M	DF	0	1	0	1
Para Halterofilismo	M	DF	0	1	0	1
	F	DF	1	0	0	1
Para Remo	M	DF	0	0	1	1
	Mixto **	DF	0	0	1	1
Voleibol Sentado	F	DF	0	0	2	2
Para Natação	M	DF	31	28	31	90
	M	DV	1	1	2	4
		DI	1	2	0	3
	F	DF	2	7	8	17
	F	DV	5	0	2	7
	Mixto	DF	0	1	1	2
		DV	0	1	0	1
		DI	0	0	1	1
Para Tenis de Mesa	M	DF	0	2	1	3
	F	DF	0	1	4	5
Para Taekwondo	M	DF	1	0	0	1
	F	DF	0	1	1	2
Esgrima em cadeira de Rodas	M	DF	1	1	0	2

M: Provas masculinas; F: Provas femininas; *Modalidade disputada em classe esportiva mista, sendo que somente atletas do sexo masculino foram medalhistas; **Modalidade disputada em classe esportiva mista, sendo que um atleta do sexo masculino e uma do feminino medalharam em uma prova disputada em dupla.

nas edições dos JPV, (ii) identificar a evolução quantitativa do Brasil comparado aos países melhores ranqueados em JPV e, (iii) identificar e relacionar a evolução da participação brasileira nos JPV com o contexto histórico-político nacional e o plano estratégico do CPB nos diferentes ciclos Paralímpicos.

A nível internacional, o Brasil é considerado uma das maiores potências paralímpicas. Na última edição dos JPV-Tóquio

Tabela 3. Número de Medalhas (e tipos) por modalidades na participação dos JPV.

Modalidade Esportiva	Tipo de Medalha	1976	1984	1988	1992	1996	2000	2004	2008	2012	2016	2020	Total	TGM
Para Atletismo	Ouro	-	6	3	3	-	4	5	4	7	8	8	48	170
	Prata	-	12	8	-	5	4	6	4	8	14	9	70	
	Bronze	-	3	4	1	6	1	5	7	3	11	11	52	
Bocha	Ouro	-	-	-	-	-	-	-	2	3	1	-	6	11
	Prata	-	-	-	-	-	-	-	-	-	1	-	1	
	Bronze	-	-	-	-	-	-	-	1	1	-	2	4	
Para Canoagem	Ouro	-	-	-	-	-	-	-	-	-	-	1	1	4
	Prata	-	-	-	-	-	-	-	-	-	-	2	2	
	Bronze	-	-	-	-	-	-	-	-	-	1	-	1	
Para Ciclismo	Prata	-	-	-	-	-	-	-	-	-	1	-	1	2
	Bronze	-	-	-	-	-	-	-	-	-	1	-	1	
Para Hipismo	Prata	-	-	-	-	-	-	-	-	-	-	1	1	5
	Bronze	-	-	-	-	-	-	-	2	-	2	-	4	
Futebol de Cegos	Ouro	-	-	-	-	-	-	1	1	1	1	1	5	5
Futebol de PC	Prata	-	-	-	-	-	-	1	-	-	-	-	1	3
	Bronze	-	-	-	-	-	1	-	-	-	1	-	2	
Goalball	Ouro	-	-	-	-	-	-	-	-	-	-	1	1	3
	Prata	-	-	-	-	-	-	-	-	1	-	-	1	
	Bronze	-	-	-	-	-	-	-	-	-	1	-	1	
Judô	Ouro	-	-	-	-	1	1	1	1	-	-	1	5	25
	Prata	-	-	-	-	-	-	2	2	1	4	-	9	
	Bronze	-	-	3	-	-	-	1	2	3	-	2	11	
Lawn Bawls	Prata	1	-	-	-	-	-	-	-	-	-	-	1	1
Para Halterofilismo	Ouro	-	-	-	-	-	-	-	-	-	-	1	1	2
	Prata	-	-	-	-	-	-	-	-	-	1	-	1	
Para Remo	Bronze	-	-	-	-	-	-	-	1	-	-	1	2	2
Voleibol Sentado	Bronze	-	-	-	-	-	-	-	-	-	1	1	2	2
Para Natação	Ouro	-	1	1	-	1	1	7	8	9	4	8	40	125
	Prata	-	5	1	-	1	6	3	7	4	7	5	39	
	Bronze	-	1	7	3	7	4	1	4	1	8	10	46	
Para Tenis de Mesa	Prata	-	-	-	-	-	-	-	1	-	1	1	3	8
	Bronze	-	-	-	-	-	-	-	-	-	3	2	5	
Para Taekwondo	Ouro	-	-	-	-	-	-	-	-	-	-	1	1	3
	Prata	-	-	-	-	-	-	-	-	-	-	1	1	
	Bronze	-	-	-	-	-	-	-	-	-	-	1	1	
Esgrima em Cadeira de Rodas	Ouro	-	-	-	-	-	-	-	-	1	-	-	1	2
	Prata	-	-	-	-	-	-	-	-	-	-	1	1	

TGM: Total Geral de Medalhas.

2020, pode-se verificar que o CA (%) do Brasil apresentou valores superiores à média de desenvolvimento de adversários diretos no quadro de medalhas (Tabela 4). Para a conquista desses indicadores entende-se que as políticas públicas foram aspectos fundamentais em cada período, favorecendo o desenvolvimento do esporte paralímpico no Brasil. Esses resultados estão associados com o aumento do número de atletas medalhados, modalidades medalhadas e de atletas convocados para JPV.

A fundação do CPB é considerada ponto crucial para a evolução do MP no Brasil. Sob a administração do seu primeiro presidente, João Batista Carvalho entre 1995 e 2001, o CPB realizou ações de caráter administrativo, judicial, técnica, científica e midiática que puderam ser aplicadas já na preparação da delegação para os JPV- Atlanta 1996 (Miranda, 2011). Isso vai de encontro com as estruturas políticas que levam ao sucesso esportivo abordado por De Bosscher et al. (2006) que defendem que além do sucesso esportivo ter a capacidade de ser desenvolvido, os fatores determinantes dele ocorrem em níveis macro (meio ambiente), meso (política) e micro (talento), sendo que apenas o ambiente político é capaz de cultivar o esporte. Nesse sentido, dentre as ações políticas realizadas pelo CPB, nesse período, estão relacionadas a governança, pesquisa científica, organização e estruturação política para o esporte. Paralelamente ocorrem ações políticas de suporte financeiro ao esporte que possibilitaram condições para o aumento do número de medalhas conquistadas pelo Brasil (Figura 1).

Sem dúvidas que, após a implementação da Lei 9.615 (Lei Pelé) em 1988, e a verba de patrocinadores, a profissionalização do esporte impulsionou a preparação esportiva da delegação brasileira (de Mello, 2002). Além disso, ações de mídia aproximou o MP da sociedade brasileira que também contribuíram para a evolução de desempenho nos anos seguintes (Miranda, 2011). A curto prazo, o Brasil conseguiu subir 13 posições no quadro de medalhas já nos JPV-Sydney

Tabela 4. Ranking de *NPC* baseado no crescimento relativo, acumulado e percentual representativo de medalhas ganhas desde os JPV de 1988 do $TOP_{10\text{-}RIO2016}$.

Rank	$CG_{Rio2016}$	NPC	Variáveis	Jogos Paralímpicos de Verão									CA (%)
				1988	1992	1996	2000	2004	2008	2012	2016	2020	
1	1	China	%C	-	–0.2	0.8	1.9	4.6	5.7	0.4	–0.2	–2.2	10.9
			%MRxJPV	1.9	1.6	2.5	4.4	9.0	14.7	15.2	15.0	12.8	-
2	3	Ucrânia	%C	-	-	0.4	1.8	1.2	1.7	0.3	1.8	–1.3	6.1
			%MRxJPV	-	-	0.4	2.2	3.5	5.2	5.5	7.3	6.1	-
3	8	Brasil	%C	-	–0.7	0.9	–0.1	0.8	1.2	–0.4	1.7	–0.1	3.2
			%MRxJPV	1.2	0.5	1.3	1.3	2.1	3.3	2.8	4.5	4.4	-
4	9	Itália	%C	-	–0.3	0.5	–1.2	–0.4	0.05	0.6	0.6	1.8	1.6
			%MRxJPV	2.6	2.3	2.8	1.6	1.2	1.2	1.8	2.4	4.3	-
5	5	Australia	%C	-	0.7	1.7	2.2	–2.5	–0.9	0.06	–0.5	–0.1	0.6
			%MRxJPV	4.3	5.1	6.7	9.0	6.4	5.5	5.6	5.1	0.6	-
6	7	Holanda	%C	-	–1.2	0.2	–1.1	0.1	–0.3	1.0	1.3	–0.2	–0.1
			%MRxJPV	3.8	2.6	2.9	1.8	1.8	1.5	2.6	3.9	3.6	-
7	2	Gra-Bretanha	%C	-	0.1	–0.8	0.1	–1.9	1.1	0.8	1.3	–1.5	–0.7
			%MRxJPV	8.3	8.5	7.7	7.9	5.9	7.1	7.9	9.2	7.7	-
8	10	Polonia	%C	-	–1.5	0.1	1.0	0.2	–1.3	0.3	0.1	–0.9	–2.1
			%MRxJPV	3.7	2.1	2.2	3.2	3.4	2.1	2.4	2.4	1.5	-
9	4	EUA	%C	-	–0.6	–1.7	–3.4	–1.0	1.3	–0.5	0.8	–0.8	-5.8
			%MRxJPV	12.2	11.6	9.9	6.6	5.6	6.9	6.4	7.2	6.4	-
10	6	Alemanha	%C	-	2.6	–1.9	–3.7	–0.7	–0.8	0.2	–0.8	–0.9	-6.1
			%MRxJPV	8.8	11.4	9.4	5.7	5.0	4.1	4.3	3.6	2.7	-
%MCJPV			∑ %MRxJPV	46.80	45.78	46.12	43.81	44.13	51.78	54.53	60.61	50.09	-

$CG_{Rio2016}$: Colocação Geral nos Jogos Paralímpicos Rio 2016; NPC: Comitê Paralímpico Nacional; %C: Percentual de crescimento; %MRxJPV: Percentual de medalhas conquistadas em Jogos Paralímpicos de Verão por cada NPC em relação ao número total de medalhas disputadas em cada evento; %MCJPV: Percentual de medalhas conquistadas em JPV pelo $CG_{Rio2016}$ em relação ao número total de medalhas disputadas em cada evento; CA: Crescimento Acumulado (somatória de crescimento em percentual em função de todos JPV disputados).

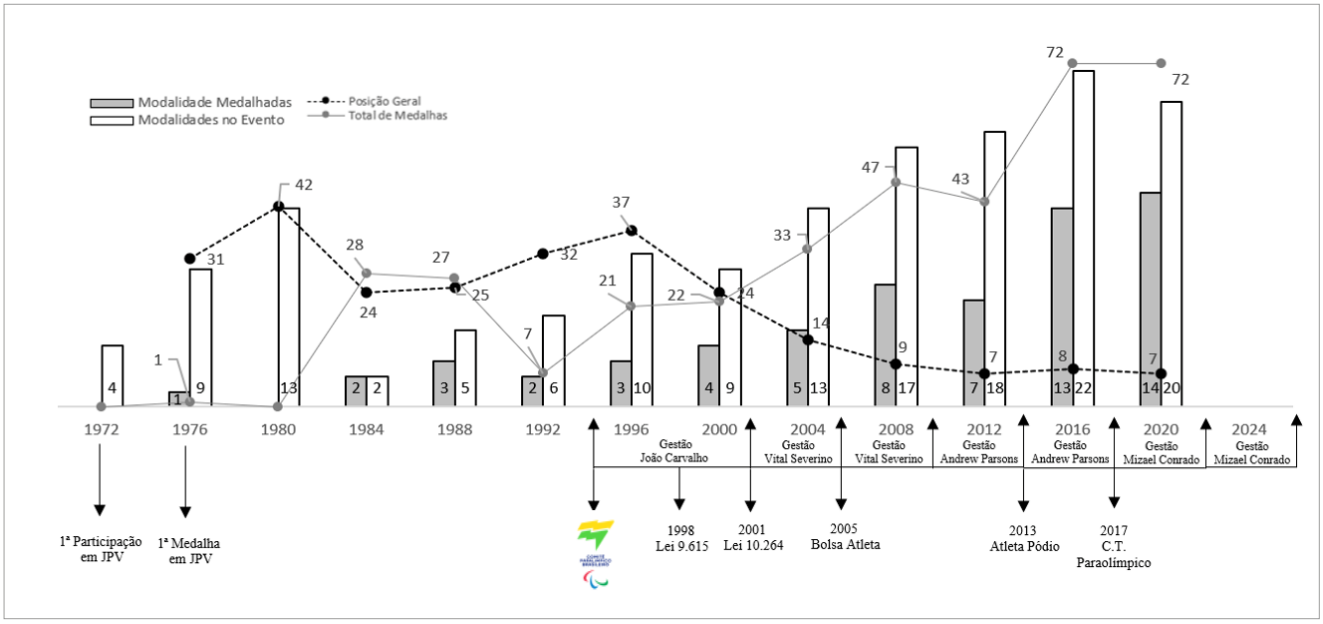

Figura 1. Colocação do Brasil no quadro geral de medalhas, quantidade de modalidades participantes, de modalidades medalhadas e número total medalhas conquistadas ao longo de todas as edições de JPV, leis implementadas durante ciclos paralímpicos e presidentes do CPB.

2000, caracterizando o início da ascensão brasileira no quadro de medalhas.

O novo salto de desempenho do Brasil pode ser relacionado com a aprovação da Lei Agnelo Piva, em 2001. Com esse incentivo financeiro, o CPB foi capaz de proporcionar um ambiente mais favorável para o desenvolvimento dos atletas focado no desempenho atlético, provendo a contratação de profissionais e aquisição de materiais esportivos qualificados. Outro aspecto relevante nesse salto qualitativo do Brasil nos JPV, ocorreu em 2004 com a instituição do programa "Bolsa- Atleta" através da Lei n° 10.891 (Brasil, 2004, 2011a), que tem como objetivo patrocinar individualmente atletas e para-atletas de alto rendimento permitindo que se dedicassem exclusivamente à preparação esportiva.

De fato, o desenvolvimento técnico científico e a ampliação da prática do esporte paralímpico, foram um marco da gestão do segundo presidente do CPB (Vital Severino Neto; 2001-2009), o qual também realizou a mudança da sede administrativa da entidade para Brasília, em 2002, facilitando a interlocução com o governo federal, aproximação com COB, aumento de modalidades praticadas à nível nacional e exposição do esporte paralímpico na mídia. Prova disso está no aumento no número de modalidades participantes e no crescimento das transmissões dos JPV-Atenas 2004, onde o Brasil foi o país que mais transmitiu o evento com 168 horas, seguido pela Espanha com 125 horas (Figueiredo & Novais, 2010; Marques et al., 2013; Miranda, 2011).

Os resultados dessas ações contribuíram para que o Brasil conquistasse a 9ª colocação em Pequim 2008, sendo pela primeira vez considerado uma das 10 maiores potências paralímpicas do mundo. Nesta edição, o Brasil medalhou em oito modalidades e registrou aumento de 42,4% no número de medalhas de ouro em comparação com JPV-Atenas 2004. Em referência ao indicador de CA (%) o Brasil (1.18%) foi superado apenas pela China (5.75%), Ucrânia (1.66%) e EUA (1.31%).

A partir dos resultados conquistados nos JPV-Pequim 2008 e com objetivo de consolidar-se entre as 10 maiores potências paralímpicas, em 2009 o CPB investiu na capacitação de profissionais e em competições à nível estudantil como, as Paralimpíadas Escolares (Comitê Paralímpico Brasileiro, 2021). Isso corrobora com o estudo apresentado por Patatas et al. (2020) de que um dos fatores importantes para o desenvolvimento do esporte paralímpico está nas políticas de retenção onde políticas e programas devem ser desenvolvidos a fim de manter os atletas no esporte e implementar estratégias ou sistemas para identificar atletas com potencial internacional, e, para isso, o processo educacional de treinadores passa a ser fundamental. Focado nessa política, o CPB cria as Paralímpiadas Escolares, considerada o maior evento para crianças e jovens em idade escolar do mundo, delimitando uma competição de entrada à nível escolar para identificar futuros atletas com potencial internacional (Comitê Paralímpico Brasileiro, 2021).

Nessa mesma esteira, com o objetivo de qualificar e disseminar o conhecimento acerca do MP, o CPB investiu na capacitação de treinadores e gestores a partir da aproximação com universidades (Universidade Federal de São Paulo, Universidade Federal de Uberlândia e Universidade Estadual de Campinas), aumentou o subsídio científico para as sessões de treinamento e fomentou pesquisas científicas específicas para a área com a criação do Congresso Paralímpico Brasileiro (Comitê Paralímpíco Brasileiro, 2010a, 2011, 2012, 2014, 2018). Esse modelo perdurou na gestão seguinte de Andrew Parsons (2009-2017) em que foi criada a Academia Paralímpica Brasileira, representada pelas principais Universidades brasileiras que apoiavam diretamente no desenvolvimento do MP nacional e a estruturação do Departamento Técnico do CPB (Comitê Paralímpíco Brasileiro, 2010b; Miranda, 2011).

Com o anúncio do Brasil como país sede dos JPV-Rio 2016, todas essas ações serviram de base de sustentação para a preparação da delegação brasileira. Em paralelo a isso, uma nova injeção de recursos financeiros ocorreu em 2011 como um aditivo do programa "Bolsa Atleta", ampliando a inclusão do projeto "Atleta Pódio"- Lei 12.395/11 (Brasil, 2011b).

No ano seguinte, durante os JPV-Londres 2012 o Brasil conquistou seu melhor resultado da história, conquistando a 7ª colocação com 43 medalhas com aumento de 31,25% no número de medalhas de ouro conquistadas em comparação aos JPV-Pequim 2008. Tais indicadores registrados garantiram pela segunda vez o Brasil entre as 10 maiores potências paralímpicas.

Em 2015, através da Lei Brasileira da Inclusão da Pessoa com Deficiência ocorreu a ampliação do repasse ao esporte de 2 para 2.7% do valor total arrecadado pelo sistema de loterias. Desse montante também foi alterado o valor de 15 para 37.04% o valor destinado ao CPB (Brasil, 2015). Com o aumento do investimento financeiro federal e as ações realizadas durante todo o ciclo paralímpico influenciaram diretamente a conquista da 8ª colocação nos JPV-Rio 2016 com total de 72 medalhas, crescimento de medalhas abaixo apenas da Ucrânia quando comparada à 2012. Analisando o impacto do projeto "Atleta Pódio" nos JPV-Rio 2016, projeto com início em 2011, percebe-se que dos 62 atletas medalhistas, em 7 modalidades individuais, 48 atletas (77.41%) foram contemplados pelo projeto e participaram da conquista de 13 medalhas de ouro (92.86%), 26 medalhas de pratas (89.66%), e 22 medalhas de bronze (75.86%), totalizando 61 medalhas (84.72%) na respectiva edição.

Esse desempenho consolidou o país entre as maiores potências mundiais no âmbito paralímpico. De acordo com os resultados apresentados, o Brasil, nos últimos quatro ciclos paralímpicos, se firmou entre as 10 maiores potências, conquistou a segunda maior evolução entre o $TOP_{10\text{-}RIO2016}$, o maior número de medalhas conquistadas na mesma edição e conquistando o terceiro lugar no crescimento acumulando (*%C*= 3.23%) nos JPV, sendo superado apenas por China e Ucrânia.

Segundo Martin-Silva et al. (2013) todos os demais países que ocupavam as primeiras posições do quadro de medalhas possuíam um centro de treinamento, exceto o Brasil. Um dos desafios após Londres-2012 seria manter o desempenho obtido até então, com expectativas de alcançar o quinto lugar no quadro geral de medalhas. Nesse sentido, dentre os desafios mais complexos para a gestão era a implementação de infraestrutura, com o Centro de Treinamento Paraolímpico para conquistar a evolução no quadro de medalhas (Martin-Silva et al., 2013).

Essa lacuna foi solucionada parcialmente em 2016, com a criação do Centro de Treinamento Paraolímpico Brasileiro-CTPB em São Paulo, que serviu como parte da base de preparação para diversas modalidades para os JPV-Rio 2016. Isso mostrou que, de fato, o investimento financeiro nos últimos ciclos foi preponderante para o crescimento e manutenção do desempenho do Brasil no cenário mundial. Esse investimento foi realizado para que o CPB se tornasse um parceiro de confiança para atrair mais investimentos de caráter privado e governamental pautado na responsabilidade do processo administrativo sob orientação e diálogo com associações esportivas (Martin-Silva et al., 2013).

Após JPV-Rio 2016, a proposta da nova diretoria sob o comando do então eleito presidente do CPB, Mizael Conrado, teve como objetivo central manter o Brasil entre as principais potências do mundo com projeções de curto, médio e a longo prazo, focados na sistematização de projetos de detecção de talentos paralímpicos à nível nacional. Pode-se dividir as ações norteadoras dessa gestão em dois grupos, as técnicas e as educacionais. As técnicas estão relacionadas a implementação do programa de iniciação esportiva em diferentes regiões brasileiras, criação do departamento de ciências do esporte com a implementação de equipamentos e tecnologias aplicados a sessões de treinamento. As educacionais envolvem o início da capacitação de professores da rede escolar, a ampliação da capacitação de treinadores nacionais, fisioterapeutas, psicólogos, classificadores e árbitros em modalidades paralímpicas. A partir dessa estrutura desenvolvida no CTPB subsidiado com parcerias entre Universidades e com o foco no alto rendimento, as ações desenvolvidas passam a ser aplicadas aos Centro de Referências visando proporcionar estrutura e treinamento qualificado para futuros atletas paralímpicos em diferentes regiões brasileiras (Comitê Paralimpico Brasileiro, 2016, 2017).

Apesar de diversas ações mencionadas, em decorrência da pandemia COVID-19 ocorreu o adiamento dos JPV-Tóquio 2020, o que representou uma ruptura do ciclo de competições a cada 4 anos, alteração no sistema de competições qualificatórias internacionais e consequentemente na conquista de medalhas nos JPV-Tóquio 2020, no qual o Brasil, manteve o número de medalhas conquistadas.

Como limitação do estudo, deve-se destacar que não foi possível verificar o impacto dos projetos desenvolvidos pelos CPB para a captação de atletas que conquistaram medalhas em JPV, a fim de identificar o nível de retenção de atletas desde o processo de iniciação até o alto rendimento e a influência do subsídio financeiro realizado em atletas medalhistas paralímpicos para delinear um perfil socioeconômico.

CONCLUSÃO

A modo conclusão se observa que a trajetória da evolução do MP no Brasil, a partir da fundação do CPB, foi focada em dois ciclos paralímpicos (1995-2005) para a estruturação da entidade à nível nacional, captação de recursos financeiros para o desenvolvimentos das ações e inclusão da pesquisa científica, seguidos de três ciclos (2006-2017) focados em proporcionar a remuneração aos atletas paralímpicos a partir de bolsas de incentivo federal, capacitação de treinadores, consolidação de competições à nível nacional e incentivo à pesquisa científica.

Tais ações foram fundamentais para a projeção do MP brasileiro à nível internacional, no qual o Brasil apresentou constante evolução, ocupando as principais posições no quadro de medalhas dos JPV a cada ciclo, aumento do no número de atletas e modalidades medalhistas, gerando crescimento acumulado positivo ciclo a ciclo.

Por fim, os resultados obtidos nos JPV Tokyo 2020, superaram os indicadores determinados no planejamento estratégico, porém é necessário dar continuidade aos estudos acerca deste tema para que se analise se o presente ciclo de três anos (2021-2024) alcançará as metas e objetivos traçadas pelo planejamento estratégico e o seu impacto no desempenho nos JPV de Paris em 2024.

AGRADECIMENTOS

A todos os presidentes e vice-presidentes que conduziram o Comitê Paralímpico Brasileiro. A todos os treinadores, atletas, gestores e colaboradores que contribuem e contribuíram para a construção da história do Movimento Paralímpico. As Confederações e Associação responsáveis por administrar as modalidades paralímpicas brasileira. Ao Departamento Técnico do Comitê Paralímpico Brasileiro e o ao setor de Classificação Esportiva Paralímpica na sistematização das informações iniciais.

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ARTIGO ORIGINAL

https://doi.org/10.6063/motricidade.27088

Análise quantitativa e qualitativa de uma intervenção com jogos motores adaptados: Projeto "Jogamos Tudo, Brincamos Todos"

Quantitative and qualitative analysis of an intervention with adapted motor games: Project "Jogamos tudo, Brincamos todos"

Raul Antunes[1]*, Catarina Mangas[1], Inês Monteiro[1], Micaela Sereno[1], Nuno Amaro[1], Rui Matos[1], Roberta Frontini[2]

RESUMO

O presente projeto piloto visa analisar o efeito de um programa de intervenção baseado em jogos lúdico-motores adaptados para crianças com deficiências sensoriais e físicas, com a duração de 5 semanas, em alunos do 1º e 4º anos de escolaridade do 1º Ciclo do Ensino Básico, ao nível da perceção das crianças sem deficiência face aos pares com deficiência, nomeadamente no que diz respeito às atitudes de inclusão e à perceção de competências. Participaram 32 alunos, dos quais 15 são do género masculino e 17 do género feminino, com idades compreendidas entre os 6 e os 10 anos. Para a avaliação da implementação deste programa de inclusão inversa, recorremos a uma metodologia mista com a avaliação quantitativa realizada através de um questionário (em processo de validação) e a avaliação qualitativa com a realização de grupos focais. Os principais resultados revelam a existência de diferenças significativas, na dimensão da perceção de competências, entre os dois momentos de avaliação (pré e pós). A análise dos grupos focais também realçou a satisfação com o programa de atividades desenvolvido e perceção da pertinência do mesmo. De uma forma geral, conclui-se que o projeto permitiu aos participantes melhorarem a perceção relativa às competências e dificuldades de uma criança com deficiência, ficando mais conhecedores de estratégias (por exemplo jogos e brincadeiras) para incluir os pares com deficiência.

PALAVRAS-CHAVE: 1º CEB; jogos; inclusão inversa; perceção de competências; atitudes de inclusão.

ABSTRACT

The present pilot project aims to analyse the effect of an intervention program based on ludic-motor games adapted for children with sensory and physical disabilities, lasting 5 weeks. The project is for students of the 1st and 4th grades of the 1st cycle of Basic Education and regards attitudes of inclusion and the perception of competencies. Thirty-two students, 15 male and 17 female, aged between 6 and 10 years old, participated in the present research. For the assessment of the implementation of this program of inverse inclusion, we used a mixed methodology with the quantitative assessment carried through a questionnaire (in the validation process) and the qualitative assessment with focus groups. The main results reveal significant differences in the perception of competence dimension between the two evaluation moments (pre and post). The analysis of the focus groups highlighted the satisfaction with the activities developed in the program as well as the perception of its relevance. In general, we concluded that the project allowed participants to be more aware of the skills and difficulties of a child with disabilities and more knowledgeable of strategies (for example, games and play) to include peers with disabilities.

KEYWORDS: 1st CEB; games; reverse inclusion; perception of competence; inclusion attitudes.

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Conflito de interesses: nada a declarar. Financiamento: Fundação para a Ciência e a Tecnologia, I.P. (UIDB/04748/2020 e UIDP/05704/2020).
Recebido: 30/04/2022. Aceito: 18/07/2022.

INTRODUÇÃO

Segundo a Organização Mundial da Saúde (OMS) e, nomeadamente, a sua Classificação Internacional de Funcionalidade, Incapacidade e Saúde (CIF), o conceito de deficiência pode ser entendido como um problema na função ou estrutura do corpo (OMS, 2004).

O direito de cada criança à educação, independentemente das suas caraterísticas físicas, está bem claro na declaração Universal dos Direitos Humanos (UNESCO, 1990), realçando que qualquer pessoa com deficiência tem o direito de expressar os seus interesses em relação à educação, devendo estes ser atendidos dentro do possível. Segundo a Convenção sobre os Direitos das Pessoas com Deficiência, as crianças com deficiência têm direito a viver de forma independente e a ser incluídas na comunidade, com direito à sua total participação na sociedade (ONU, 2006).

Na escola, a inclusão ajuda a criança com deficiência a ter a perceção da diversidade humana, das suas capacidades e potencialidades, e contribui para o aumento da responsabilidade, melhorando o seu processo de ensino-aprendizagem. Da mesma forma, a inclusão contribui para melhorias ao nível da comunicação e interação que, por sua vez, permitem ajudar a desenvolver amizades e o espírito de grupo. Este processo permite que os alunos aprendam a ser mais sensíveis, a compreender o outro, a respeitar e a crescer com as suas diferenças (Santos, 2013).

A investigação tem evidenciado os ganhos na educação quando a criança com deficiência se encontra em contextos inclusivos (Hutzler & Levi, 2008; Obrusnikova et al., 2003; Van Biesen et al., 2006).

A importância da prática de atividade física e/ou desportiva como fatores promotores de inclusão e aceitação pelos pares tem sido comprovada pela literatura (Lavega et al., 2014; Reis et al., 2020). Esta prática tem potencial para promover na pessoa com deficiência, simultaneamente, o desenvolvimento de habilidades e o aperfeiçoamento cognitivo, mas também a melhoria de aspetos sociais e relacionais (D'isanto & Tore, 2016). Torna-se, assim, imperiosa a adoção de medidas que visem o incentivo à adoção de estilos de vida ativos pela pessoa com deficiência, bem como a implementação de medidas de sensibilização sobre os benefícios da atividade física regular e prática desportiva para pessoas com deficiência (Saraiva et al., 2013).

A Constituição da República Portuguesa faz referência, no seu Artigo 79.º, ao direito à cultura física e ao desporto para todos, reforçando a mesma ideia no Artigo 2.º da Lei nº. 5/2007, de 16 de janeiro — Lei de Bases da Atividade Física e do Desporto, que assume o desporto como um fator fundamental para a formação do indivíduo e para o desenvolvimento da sociedade (IPDJ, 2016). Da mesma forma, também a Lei n.º 38/2004, de 18 de agosto — Lei de Bases da Prevenção e da Reabilitação e Integração das Pessoas com Deficiência, reforça a importância da prática desportiva para os cidadãos com deficiência, essencialmente naquilo que se refere ao desporto como medida de reabilitação (IPDJ, 2016).

Porém, não são apenas as pessoas, adultos ou crianças com deficiência, que beneficiam deste processo de inclusão. Importa assim entender o conceito de inclusão inversa, que pode ser entendida como o processo onde o indivíduo sem deficiência participa em atividades específicas para a pessoa com deficiência (Yamaguti, 2013). Os benefícios da inclusão inversa têm sido estudados em diversos países tais como a Bélgica (Van Biesen et al., 2006), a Grécia (Panagiotou et al., 2008), Israel (Hutzler & Levi, 2008) e os Estados Unidos da América (Obrusnikova et al., 2003), sendo reportados essencialmente benefícios ao nível de atitudes das crianças sem deficiência face à inclusão de crianças com deficiência. Neste sentido, as crianças sem deficiência relataram que, durante este tipo de atividades, aprenderam que, só porque uma criança parece ou age de maneira diferente, não significa que não possa ser uma amiga ou não se possam divertir e brincar juntos (Schoger, 2006). Parece assim claro o efeito muito positivo na interação entre crianças sem deficiência com os pares com deficiência (Lavega et al., 2014; Reis et al., 2020).

Tendo por base os princípios expostos, este trabalho tem como objetivo a análise do efeito de um programa de intervenção de 5 semanas com crianças do 1º e 4º anos de escolaridade do 1º Ciclo do Ensino Básico da zona centro de Portugal. A partir deste, procurou-se conhecer as atitudes inclusivas das crianças sem deficiência face aos seus pares com deficiência e a perceção que têm acerca do nível de competência deste último grupo. Assim, foi hipotetizado neste trabalho que os alunos participantes neste projeto apresentariam uma melhoria nas duas dimensões estudadas (i.e., atitudes de inclusão e perceção de competências da criança com deficiência), apresentando valores superiores no momento pós-intervenção.

MÉTODO

A investigação realizada recolhe e analisa dados quantitativos e qualitativos. Procura, neste sentido, através de um tratamento estatístico, identificar tendências nas respostas dos participantes e, ainda, de forma complementar, conhecer em maior profundidade o fenómeno em estudo (Creswell, 2010). Tendo este paradigma como base, seguiu-se um estudo de natureza quasi-experimental, por se procurar identificar relações de causa-efeito, controlando e manipulando deliberadamente as condições que determinam os acontecimentos sem, no entanto, ter um absoluto controlo sobre os mesmos (Euzébio et al., 2021).

Amostra

Participaram neste estudo 32 alunos com idades compreendidas entre os 6 e 10 anos, de duas turmas de uma escola privada do distrito de Leiria (uma turma do 1º e uma do 4º ano de escolaridade do 1º Ciclo do Ensino Básico), cada uma composta por 16 alunos. Dos 32 alunos participantes, 17 eram do sexo feminino e 15 do sexo masculino.

Procedimentos

Foi contactada a direção da escola, explicando o objetivo do projeto e a forma como o mesmo seria implementado. A direção da escola prontamente aceitou que o projeto piloto fosse implementado na instituição e disponibilizou-se a realizar uma reunião com todos os pais das crianças que iriam participar no projeto, a fim de serem devidamente informados e esclarecidos.

Pelo facto de se tratar de uma escola privada não foi necessário solicitar autorização a qualquer agrupamento de escolas ou mesmo ao Ministério da Educação.

Foi entregue o consentimento informado que foi lido, explicado e assinado pelos encarregados de educação/representantes legais dos alunos. Às crianças foi, ainda, pedido o seu assentimento para participação no projeto.

Foi garantida a confidencialidade dos dados recolhidos e respeitados todos os pressupostos éticos da declaração de Helsínquia.

Foi definido o cronograma de intervenção, delineado em concordância com um estudo elaborado por Obrusnikova et al. (2003). O programa teve a duração de 5 semanas de intervenção prática, com uma frequência semanal e uma duração de 45 minutos em cada sessão.

Todas as sessões englobaram diversas atividades que exploraram o desenvolvimento de diferentes competências motoras (e.g.: estruturas sensório-motoras, motricidade fina e global, coordenação, equilíbrio corporal, precisão de lançamento, manipulação de objetos, orientação espaço temporal, entre outros domínios) e também sociais (exemplo: espírito de equipa/entreajuda, comunicação, cooperação, respeito pelos colegas, entre outras).

As atividades foram adaptadas de acordo com a tipologia de deficiência a ser trabalhada, nomeadamente com o recurso à utilização de vendas, limitação do movimento dos membros superiores e inferiores, ou até à proibição de falar, numa lógica de experimentação das sensações da deficiência motora e sensorial, adaptando-se ou desenvolvendo-se jogos para simular experiências vividas por pessoas com cegueira, surdez, que se deslocam em cadeiras de rodas e que têm membros amputados.

No que diz respeito à sua operacionalização, as sessões foram realizadas no campo exterior ou no ginásio da Escola, recorrendo-se: i) a materiais reutilizáveis, reaproveitando garrafas de água, caixas de cartão, etc.; ii) reinventando os recursos já existentes, adaptando-os às necessidades das tarefas (por exemplo, criar uma bola de futebol para pessoas cegas, a partir de uma bola de futebol normal, embrulhada em sacos de plástico e com guizos, de forma a produzir um ruído ao rolar no chão); iii) utilizando o material disponibilizado pela Escola, como bolas e coletes.

O reaproveitamento e reutilização de materiais, procuraram, por um lado, seguir uma perspetiva ecológica e de sustentabilidade e, por outro, viabilizar a continuidade do projeto, de uma forma acessível e sem custos associados.

Relativamente às atividades, importa destacar alguns exemplos de forma a obter um melhor entendimento da dinâmica das sessões. Assim, e relativamente à deficiência visual, realizou-se, entre outros, o jogo do "Mata adaptado", que se assemelha ao jogo do mata tradicional, sendo jogado, no entanto, com os jogadores vendados, tendo como principal objetivo evitar ser atingido por uma bola de *Goalball*, que emite um som particular semelhante a guizos a chocalhar, e que permite que os jogadores identifiquem a trajetória da bola apenas através do som da mesma. Para a deficiência sensorial, destacamos o jogo do lencinho adaptado a pessoas com surdez, em que, em vez dos participantes serem chamados através de números, como acontece no jogo tradicional, o estímulo foi a demonstração de diferentes cores. Para pessoas amputadas dos membros superiores, podemos referir o exemplo do jogo "Balãobol", que consiste em manter um balão (ou uma bola) no ar o maior tempo possível, com os participantes condicionados, colocando um dos membros superiores dentro da camisola. Por último, e relativamente aos membros inferiores, um exemplo de atividade foi o *bowling* sentado, onde se colocavam as crianças a jogar sentadas e sob diversos constrangimentos (colocar os dois pés no chão, apenas um apoio no chão, pernas cruzadas ou sentados no chão).

Instrumentos

Para a realização do estudo recorreu-se à utilização de uma metodologia quantitativa e qualitativa. No que se refere à metodologia quantitativa, recorreu-se a um questionário (que se encontra em processo de validação), que foi elaborado por dois especialistas, um da área das ciências do desporto e outro da área da educação, aos quais foi solicitada a devida permissão para a sua utilização, no presente contexto. É constituído por 26 perguntas de resposta fechada, com um escala com três níveis de resposta, dos quais: (-) não concordo; (0) talvez; (+) concordo; de modo a assinalar com

alguma exatidão o grau de concordância em relação a questões sobre atitudes, perceções e juízos de valor. É composto por duas partes: a primeira parte referente à identificação dos participantes, e a segunda parte que avalia duas variáveis (atitudes de inclusão e perceção das competências), sendo que cada dimensão é composta por 13 itens que se apresentam com o formato dos seguintes exemplos:

a. atitudes de inclusão, que representa as atitudes das crianças face à inclusão de um colega com algum tipo de deficiência - "Não me importava de ter crianças com deficiência na escola?";
b. perceção das competências, que representa a noção que as crianças sem deficiência têm sobre as competências de uma criança com deficiência – "As crianças com deficiência podem participar em todas as atividades na escola?".

Com o objetivo de aprofundar/complementar a informação obtida por via do questionário anteriormente apresentado, recorreu-se a uma metodologia qualitativa, mais propriamente à realização de dois grupos focais (um com cada turma), no final da última sessão. Os grupos tiveram a participação de 5 alunos do 4º ano e de 6 alunos do 1º ano, selecionados aleatoriamente entre os participantes. Em cada um dos grupos focais procurou-se abordar a temática referente à satisfação com as atividades e, ainda, recolher informações acerca da perceção de competências dos pares com deficiência e também sobre as atitudes de inclusão face aos mesmos.

As entrevistas foram conduzidas por uma psicóloga, que nunca tinha estado presencialmente nas sessões desenvolvidas, para que fosse um elemento externo a dirigir as conversações dos grupos focais, sem a presença de ninguém conhecido, para não interferir ou condicionar as respostas ou opiniões dos alunos. As entrevistas foram gravadas em áudio, registadas e transcritas, analisadas, classificadas em subtemas e interpretadas à luz da metodologia qualitativa.

Análise de dados

Os dados quantitativos recolhidos através do inquérito por questionário foram analisados com vista à comparação entre os momentos de avaliação pré e pós implementação do programa de intervenção (momento 0 e momento 1). tendo em conta que não se verificaram os pressupostos para utilização da estatística paramétrica, uma vez que o teste Shapiro-Wilk demonstrou que não se verificava a normalidade da distribuição das variáveis em estudo, recorremos à estatística não paramétrica, nomeadamente ao teste de Wilcoxon.

A estatística descritiva foi calculada (mediana ± desvio padrão) para a amostra total e para cada variável (atitudes de inclusão e perceção de competências) com um intervalo de confiança de 95%. Para a análise estatística das informações recolhidas foi estabelecido como nível de significância $p \leq 0.05$. Todo o procedimento de tratamento e análise estatística de dados foi executado usando o software Statistical Package for the Social Sciences, V.26 (SPSS).

Relativamente aos grupos focais e às respetivas transcrições, recorreu-se à análise de conteúdo, no sentido de proceder a uma organização dos dados que permitisse obter um significado (Cohen et al., 2017; Quivy & Campenhoudt, 2019). Para o efeito, partiu-se, da questão de investigação, dos objetivos definidos e das temáticas em apreço, para a definição do sistema de categorização.

Através de uma organização rigorosa e sistemática dos dados, de acordo com as categorias e subcategorias definidas, selecionaram-se as unidades de contexto, enquanto excertos que permitiram enquadrar as unidades de registo, ou seja, os menores recortes de ordem semântica, e os indicadores, que se traduziram em inferências ou deduções do investigador a partir das palavras dos participantes (Bardin, 2016). Tiveram-se, ainda, em consideração, as unidades de enumeração, no sentido de se conhecer o número de ocorrências ao longo da realização dos grupos focais.

Seguiram-se, neste sentido, as três fases definidas por Bardin (2016): descrição (em que se organiza, explora e sintetiza a informação), inferência (em que os dados se tornam significativos e válidos) e interpretação (em que se relacionam e validam os resultados face à questão de investigação/objetivos, a conhecimentos obtidos a partir da análise do estado da arte, sendo, ainda, complementados com a perspetiva dos investigadores).

RESULTADOS

No que respeita à caracterização dos 32 participantes no projeto, 22 (68.7%) referiram praticar alguma modalidade desportiva fora da escola, como por exemplo, natação ou futebol, enquanto os restantes 10 (31.3%) alunos não realizam qualquer prática desportiva fora do contexto escolar.

Observa-se ainda, com recurso à Tabela 1, que em ambos os momentos os elementos da amostra apresentaram valores superiores na dimensão atitudes de inclusão em relação à dimensão perceção de competências.

Podemos ainda constatar que, através da observação da Tabela 2, e no que respeita à comparação entre o Momento 0 (pré-teste) e o Momento 1 (pós-teste), a existência de diferenças significativas na dimensão da perceção de competênciascom os elementos da amostra a apresentarem valores superiores no Momento 1. Já nos valores apresentados na

variável de atitudes de inclusão, não se verificaram diferenças significativas entre os dois momentos.

Relativamente à análise qualitativa, nomeadamente no que diz respeito aos grupos focais, categorizaram-se as principais expressões ilustrativas em quatro temas fundamentais: satisfação com o projeto, perceção acerca da deficiência, estratégias da inclusão e aprendizagens em relação ao projeto. Estes subdividiram-se em subtemas por forma a categorizar pormenorizadamente as diferentes expressões.

No grupo focal da turma do 1º ano, conforme se pode verificar através da análise da Tabela 3, todos os alunos (6) demonstraram satisfação com a intervenção prática. Inclusivamente todos eles destacaram as atividades destinadas a pessoas com deficiência visual e auditiva realizadas ao longo do projeto. No que concerne ao tema da perceção acerca da deficiência, 2 alunos mencionaram competências da criança com deficiência e 3 referiram dificuldades da criança com deficiência, inclusive 1 aluno referiu que seria importante que outros alunos de outras turmas ou escolas tivessem a mesma experiência com este projeto, para que entendam as dificuldades que as crianças com deficiência enfrentam ao brincar. Em relação às estratégias de inclusão, uma criança referiu no seu discurso que uma criança cega ou que não mexesse partes do corpo, conseguia fazer estas atividades se fechasse os olhos e não utilizasse os membros inferiores, sendo categorizado como estratégia para a inclusão de colegas com deficiência e 3 alunos demonstraram-se predispostos e capazes de incluir. Quanto às aprendizagens globais no projeto, 1 aluno referiu que uma criança cega ou que não mexesse uma parte do corpo, conseguia fazer as atividades porque esta "podia ter esses problemas", ou seja, se a criança tivesse uma deficiência auditiva, ela conseguiria fazer a atividade para pessoas com surdez. Referiram também ter uma menina com deficiência na Escola, e que a ajudavam e brincavam com ela.

Em relação ao grupo focal da turma do 4º ano, ao se tratar de alunos mais velhos, conseguimos obter mais informações, o que nos permitiu recolher mais conteúdo. No geral, e com base na análise da Tabela 4, estes alunos também demonstraram satisfação global com este projeto, destacando as atividades "para pessoas sem ver, sem ouvir,

Tabela 1. Estatística descritiva da totalidade da amostra estudada (*n*= 32).

	n (%)	Dispersão		
		mediana	média± dp	(IC95%)
Género				
Feminino	17 (51.1)			
Masculino	15 (46.9)			
Ano de escolaridade				
1º ano	16 (50)			
4º ano	16 (50)			
Prática desportiva fora da escola				
Sim	22 (68.7)			
Não	10 (31.3)			
Momento 0 (pré intervenção)				
Atitudes de inclusão		2.82	2.72± 0.23	(2.63–2.80)
Perceção de competências		2.20	2.20± 0.28	(2.10–2.30)
Momento 1 (pós intervenção)				
Atitudes de inclusão		2.73	2.71± 0.21	(2.63–2.68)
Perceção de competências		2.28	2.30± 0.24	(2.22–2.39)

dp: desvio padrão; IC95%: intervalo de confiança 95%.

Tabela 2. Comparação entre os dois momentos (momento 0 vs momento 1).

	Momento 0		Momento 1		*P*
	média± dp	mediana	média± dp	mediana	
Atitudes de inclusão	2.72± 0.23	2.82	2.71± 0.21	2.73	0.72
Perceção de competências	2.20± 0.28	2.15	2.30± 0.24	2.28	0.02*

dp: desvio padrão; Momento 0: pré intervenção; Momento 1: pós intervenção; *$p< 0.05$.

sem um braço". Relativamente à perceção acerca da deficiência, um aluno mencionou identificar algumas competências da criança com deficiência (bem como algumas das suas dificuldades). Quatro elementos deste grupo focal mostraram ainda ter a capacidade de entender que algumas atividades eram difíceis de realizar para determinada

Tabela 3. Análise do Grupo Focal do 1º ano.

Tema Principal	Subtemas	Exemplo expressão ilustrativa	Nº
Satisfação com projeto	Satisfação global	"Eu adoro tanto as atividades que nem quero que as atividades acabem." (P1)	6
	Atividades destacadas	"Estivemos a jogar um jogo de cegos, e de mudos e não conseguíamos ouvir nada." (P1)	6
Perceção acerca da deficiência	Competências da criança com deficiência	"[uma criança cega ou que não mexesse umas partes do corpo, conseguia fazer estas atividades] elas conseguiriam porque elas podiam ter esses problemas" (P4)	2
	Dificuldades da criança com deficiência	"[é importante as crianças de outras turmas ou de outras escolas façam estas atividades] para perceberem os problemas que os outros têm" (P1)	3
Estratégias de inclusão	Estratégias/atividades para a inclusão de colegas com deficiência	"[uma criança cega ou que não mexesse umas partes do corpo, conseguia fazer estas atividades] só conseguia fechar os olhos e as pernas" (P5)	1
	Predisposição, capacidade de incluir, etc…	"Temos uma menina na nossa escola que se chama Sofia e a gente brinca com ela e ajuda- a." (P4)	3
Aprendizagens	Aprendizagens globais no projeto	"[uma criança cega ou que não mexesse umas partes do corpo, conseguia fazer estas atividades que vocês estiveram a fazer] elas conseguiriam porque elas podiam ter esses problemas" (P4)	1

nº: Número de referências feitas ao subtema.

Tabela 4. Análise do Grupo Focal do 4º ano.

Tema Principal	Subtemas	Exemplo de expressão ilustrativa	Nº
Satisfação com projeto	Satisfação global	"Eu gostei de tudo." (A1)	5
	Atividades destacadas	"Nas primeiras aulas nós púnhamos a venda, tínhamos um colega ao lado e o colega ia-nos guiando (…) fizemos sempre jogos para pessoas sem ver, sem ouvir, sem um braço (…) desenhávamos nas costas do amigo um desenho (…) achei que era um jogo muito divertido" (A4)	3
Perceção acerca da deficiência	Competências da criança com deficiência	"Se os jogos fossem adaptados dava para toda a gente (…) porque nós tentámos, não era totalmente, mas sentimos o que elas sentiam, e isso ajudava." (A5)	1
	Dificuldades da criança com deficiência	"O Futebol para Cegos (…) uma pessoa sem uma perna não conseguia fazer" (A5)	4
	Estratégias que podem ser utilizadas	"Comecei em casa a mandar a bola para a parede e a tentar agarrá-la." [para treinar o lançamento só com um braço] (A4)	1
	Outros aspetos relevantes	"(Futebol para Cegos) porque eu senti a dificuldade que era jogar, mas sem ver." (A1)	1
Estratégias de inclusão	Estratégias / atividades para a inclusão de colegas com deficiência	"Se os jogos fossem adaptados dava para toda a gente." (A5)	3
	Predisposição, capacidade de incluir, etc…	"[era bom ter uma criança com deficiência no grupo] porque nós conseguiríamos entender melhor como é que é ter alguém com problemas (…) nós conseguiríamos ajudá-la para ela ir melhorando" (A4)	3
Aprendizagens	Aprendizagens globais no projeto	"Acho que nós aprendemos mais sobre isso porque podemos sentir o que elas sentem e também pudemos perceber (…) os jogos que podemos fazer para elas se sentirem melhor e as coisas que podemos ajudar para elas ficarem melhores." (A4)	2

nº: Número de referências feitas ao subtema.

deficiência, como demonstrado no seguinte excerto "tivemos atividades que eles conseguiam fazer e outras que não". Outro aluno referiu uma estratégia que podia utilizar para melhorar a sua prestação durante as atividades ("Comecei em casa a mandar a bola para a parede e a tentar agarrá-la") e, por fim, um aluno mencionou que sentiu a dificuldade que era jogar sem ver. Já no tema das estratégias de inclusão, 3 crianças mostraram estar aptas a realizar atividades para a inclusão de colegas com deficiência e outras 3 crianças falaram, implicitamente, acerca das suas capacidades de inclusão. No que toca às aprendizagens adquiridas com o projeto, este grupo referiu na maioria que seria benéfico ter um colega com deficiência na turma, com o intuito de perceber melhor as suas dificuldades e, dessa forma, poder ajudá-lo. Um aluno acrescentou, inclusive, que, dessa forma, podia sentir o que elas sentem, ou seja, experienciar as sensações de pessoas com deficiência (sensorial ou física) através de momentos de diversão que permitiam uma inclusão natural e a sensibilização para a diferença, a que foi feita referência no enquadramento teórico inicial, ao explorar-se o conceito de inclusão inversa.

DISCUSSÃO

O objetivo do presente trabalho consistiu na análise do efeito de um programa de intervenção de 5 semanas (projeto-piloto) com crianças dos 1.º e 4.º anos de escolaridade do 1.º Ciclo do Ensino Básico, ao nível da perceção das crianças sem deficiência face aos pares com deficiência, nomeadamente no que diz respeito às atitudes de inclusão e à perceção de competências.

Apenas na variável *perceção de competências* se verificaram diferenças estatisticamente significativas entre os dois momentos (pré e pós intervenção). Este dado parece indicar-nos que o programa de intervenção, baseado na experimentação de atividades práticas (neste caso os jogos motores adaptados) apresentou um impacto maior sobre esta variável. Este indicador surge também pela análise dos grupos focais de ambas as turmas onde é referida, por diversas vezes, a dificuldade que os participantes sentiram perante os constrangimentos colocados nas diferentes tarefas/atividades. Parece igualmente que estas crianças entenderam com maior clareza a dimensão *perceção de competências*, nomeadamente, o que as crianças com deficiência conseguem ou não fazer. Este resultado deve ser encarado com especial atenção, especialmente tendo em conta os indicadores fornecidos pela literatura sobre o efeito muito significativo deste tipo de práticas, nomeadamente no que diz respeito à interação entre crianças sem deficiência com os pares com deficiência (Lavega et al., 2014; Reis et al., 2020).

Relativamente à variável *atitudes de inclusão*, a ausência de diferenças estatisticamente significativas pode ser entendida pelo facto de, no momento 0 (pré-intervenção), os elementos da amostra já apresentarem um valor muito elevado nesta dimensão (2.72; numa escala de 0 a 3). Para o entendimento deste resultado torna-se essencial ter em consideração o facto de a instituição escolar em causa valorizar bastante este tema, reconhecendo a importância do acolhimento de alunos com deficiência na sua comunidade educativa, não só através de diferentes atividades, mas também ao incluir várias crianças com deficiência. Porém, apesar desta intervenção ser uma realidade, através da implementação de algumas atividades de educação para a diferença, a intervenção ao nível da atividade física adaptada não existia até a implementação do presente projeto. Este tipo de projetos ou iniciativas podem, como é referido na literatura, ter um papel importante para que os alunos, desde cedo, aprendam noções de respeito pelo outro e de respeito pela diferença (Santos, 2013).

Estes indicadores parecem ir ao encontro de estudos anteriores que revelaram que a atividade física e o desporto têm um grande potencial de promoção e perceção da inclusão, tendo a educação física um papel fundamental ao nível da inclusão das crianças com deficiência (Block & Vogler, 1994; Obrusnikova et al., 2003; Schoger, 2006).

Além do mais, importa destacar a elevada satisfação com o projeto, demonstrada pelos diferentes participantes nos grupos focais, salientando não só a satisfação geral com o projeto, como também a satisfação e entusiasmo com as diferentes atividades propostas. Importa compreender este indicador, especialmente tendo em conta a tipologia de atividades que fizeram parte do programa, com uma ênfase muito grande dada ao jogo (nomeadamente o jogo tradicional adaptado) que, como refere a literatura, é não só um importante instrumento de desenvolvimento de capacidades físicas, motoras, sociais, afetivas, cognitivas e linguísticas das crianças (Vaz da Silva & Milagaia, 2018) como também um promotor de satisfação e prazer (Moreira, 2017).

A implementação de projetos do mesmo âmbito do "Jogamos Tudo, Brincamos Todos", parece, assim, ter potencial para provocar um efeito muito positivo na comunidade escolar, especialmente no que se refere à promoção de uma melhor perceção sobre as competências (e sensações, experiências ou dificuldades) de uma criança com deficiência. Este indicador é especialmente importante se tivermos em consideração que a maioria da investigação nesta área se

centra, essencialmente, na avaliação das atitudes ou perceções das crianças face aos seus pares com deficiência através da aplicação de questionários (Joaquim, 2016; Mota, 2013; Pereira, 2011).

Importa, no entanto, realçar que a limitação causada pela pandemia Covid-19 condicionou a implementação do projeto nas condições que tinham sido consideradas inicialmente (com maior duração e maior frequência semanal). Da mesma forma, será fundamental a validação de um instrumento de medida quantitativo que permita, de forma mais objetiva, avaliar estas dimensões (atitudes de inclusão, perceção de competências).

Por outro lado, será importante, em estudos futuros, procurar compreender o efeito que este projeto poderá ter em outros níveis de ensino (tanto a Educação Pré-escolar como o 2.º Ciclo do Ensino Básico) bem como em outros contextos de ensino. Será ainda importante testar outras possibilidades deste programa, nomeadamente no sentido de compreender o efeito de programas deste género quando implementados durante um período de tempo mais longo.

CONCLUSÃO

A implementação deste projeto piloto, "Jogamos tudo, brincamos todos", baseado em jogos motores adaptados, com a duração de 5 semanas, revelou ter um efeito positivo ao nível das atitudes de inclusão dos participantes (em crianças dos 1.º e 4.º anos do 1º Ciclo do Ensino Básico). Também importa destacar o alto nível de satisfação dos participantes com o projeto e com as diferentes atividades, bem como uma elevada consciência das dimensões que estavam a ser trabalhadas e do *transfer* para a vida diária.

As crianças, como motores de inclusão para as sociedades, devem assim ser alvo da intervenção através de atividades e programas (como é exemplo este programa) que lhes permitam desenvolver as noções de respeito pela diversidade e individualidade, bem como de estratégias que permitam uma inclusão mais eficaz.

AGRADECIMENTOS

Os autores agradecem à escola e a todas as crianças e seus encarregados de educação pela participação nas diferentes sessões do projeto.

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REVIEW ARTICLE

https://doi.org/10.6063/motricidade.26513

The effects of Transcranial Direct Current Stimulation on psychomotor performance of athletes: a systematic review and meta-analysis

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ABSTRACT

Psychomotor performance is a complex function generated by brain and motor systems integration, measured by accuracy, latency, and movement speed. In sports, looking for ways to improve movements is usual. Also, utilising Transcranial Direct Current Stimulation (tDCS) as a non-invasive stimulation technique may produce alterations in psychomotor sports skills. We conducted a systematic review, including experimental studies with sham or control groups in adults reporting tDCS effects on athletes' psychomotor performance. Cochrane Manual for Systematic Reviews and the statement on systematic reviews and meta-analysis of PRISMA-P (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols) were followed. PsycINFO, PubMed (central), Scopus, Web of Science, Embase, SPORTDiscus, and Cochrane Library databases were searched. Empirical studies published in English, Spanish, and Portuguese from 2009 onwards and whose primary results presented an effective measure of transcranial direct current stimulation in the psychomotor performance of adult athletes were included. The results list 10 articles, 6 of them entered in the meta-analyses. The articles presented a low risk of bias and low publication bias but great dispersion of stimulation areas.
KEYWORDS: psychomotor performance; sports; tDCS; neuromodulation.

INTRODUCTION

Humans are born with a natural capacity to learn by integration with environmental stimuli in responses generated by integration with sensory inputs and motor outputs (Hindmarch, 2014). Reflex is the simplest response, and integration can be quite complex, involving Central Nervous System and generating a motor reaction: a psychomotor response. Psychomotor function comprehends physical movement (motor) and cognitive processes. Measurement occurs by accuracy or speed (latency or reaction time) to measure psychomotor performance (Hatfield et al., 2004; Kovaleva et al., 2012).

One of the most evident ways to present psychomotor performance is through sports activity. Movement is necessarily efficient (Hatfield et al., 2004), i.e., it has a low response cost, maxim accuracy, and minimum latency (O'Dwyer & Neilson, 2000; Hatfield & Hillman, 2001). As a result, improving psychomotor performance in athletes is the objective (Hatfield & Hillman, 2001). And to achieve that, learning techniques, psychological techniques, training, nutritional alterations, environmental manipulations, and drugs are used. Sports performance results from both genetic factors and the individual's degree of experience (Davids & Baker, 2007). The athlete's performance level depends on his/her morphofunctional characteristics, specific sports demands, and individual experiences in training and competition (Shyamali Kaushalya et al., 2022). Some specific psychomotor skills may be stimulated in athletes at the same time as his/her physical preparation to expand general physical fitness. Transcranial direct current stimulation (tDCS) emerges as

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Conflict of interests: nothing to declare. Funding: Universidade Federal do Pará, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (code 001) and Conselho Nacional de Desenvolvimento Científico e Tecnológico.
Received: 02/17/2022. Accepted: 09/21/2022.

a neuromodulation tool to modulate human performance in exercise and sports. Stimulation with this method is done in two ways: the anodal tDCS, considered to stimulate neural areas; and the cathodal tDCS, normally considered as a way to inhibit brain area activity (Brückner & Kammer, 2017).

The tDCS contributed to reinforcing the brain's important role in regulating exercise performance, integrating physiological and psychological cues (Campos et al., 2016).

Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique through two electrodes that induce alterations in the polarisation of cortical neurons in resting membranes (Nitsche & Paulus, 2000; Machado et al., 2019). Therapeutic use extends to pain control, adjunctive therapy to psychological and neurological pathologies, for example, anxiety, depression, Parkinson Disease, and panic (Lefaucheur et al., 2017). Use in sports has been popular since 2013 (Lefaucheur et al., 2017), improving psychomotor performance by self-stimulation. The literature on this topic is unclear, with positive results in some sports but not in others (Lefaucheur et al., 2017).

The use of tDCS induces changes in skills related to psychomotor performance, such as reaction time, accuracy (motor skill acquisition), and fatigue reduction (Machado et al., 2019). Some authors think that tDCS is a possible way of non-pharmacological doping and breaks the spirit of sports (Davis, 2013). However, some disagree and say tDCS is not doping because do not contradict WADA recommendations; instead, it might generate ethical questions (Holgado et al., 2019a; Zhu et al., 2019). Literature description related to experimental studies regarding tDCS effect may contribute to answering questions about the use of tDCS in athletic competitions.

Although there are other reviews, their objectives were different: Machado et al. (2019) and Alix-Fages et al. (2019) focused on endurance and strength; Holgado et al. (2019b) pointed out exercises and their indexes in a broad way, not in sports; Lattari et al. (2018) concentrated on women; and Shyamali Kaushalya et al. (2022) centred on runners and cyclists. Our review focuses on psychomotor performance, as defined above.

This paper aims to present a systematic review to evaluate the effect of transcranial direct current stimulation on athletes' psychomotor performance.

METHODS

This systematic review and meta-analysis followed the model "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA-P) (Moher et al., 2015) according to Cochrane Manual for Systematic Reviews. We managed citations and references in Mendeley; data were extracted and handled in Excel. This review was enrolled in the international prospective register of systematic review: PROSPERO RD42020210550. Figure 1 summarises this process.

Eligibility criteria

Types of studies

We included experimental studies (randomised controlled trials, cohort, and case-control), cross-sectional and longitudinal studies, and sham-controlled studies reporting Transcranial Direct Current Stimulation effects (tDCS) or High-Definition tDCS (HDCS) on athletes' psychomotor performance in healthy samples. Dissertations, books, book chapters, reports, conference material, review articles, meta-analyses, instruments' validation, and scales were excluded from the review.

Types of participants

We considered adults (aged 18+ years), male or female, and athletes who participated in a tDCS study, including psychomotor performance.

Patient and public involvement

No patient was involved.

Types of outcome measurement

The principal result was related to the functional effect of the stimulation on modulation skills needed for psychomotor performance in motor flexibility, force, and efficacy in sports.

Search strategies

These electronic databases were searched: PsycINFO, PubMed (central), Scopus, Web of Science, Embase, SPORTDiscus, and the Cochrane Library. Empirical studies published in English, Spanish, and Portuguese from January 2009 onwards and whose primary results presented a measurable effect of transcranial direct current stimulation on the psychomotor performance of adult athletes were included.

Search criteria

We selected studies purposing to measure tDCS effect only, using these keywords: (1)'Transcranial direct current stimulation'; (2) 'tDCS'; (3) 'HDCS'; (4) 'Electric Stimulation Therapy'; (5) 'Neuromodulation'; AND; c) concerning sports: (6) 'Sports'; (7) 'Athletic Performance'; (8) 'Psychomotor Performance'. In addition, we made a search

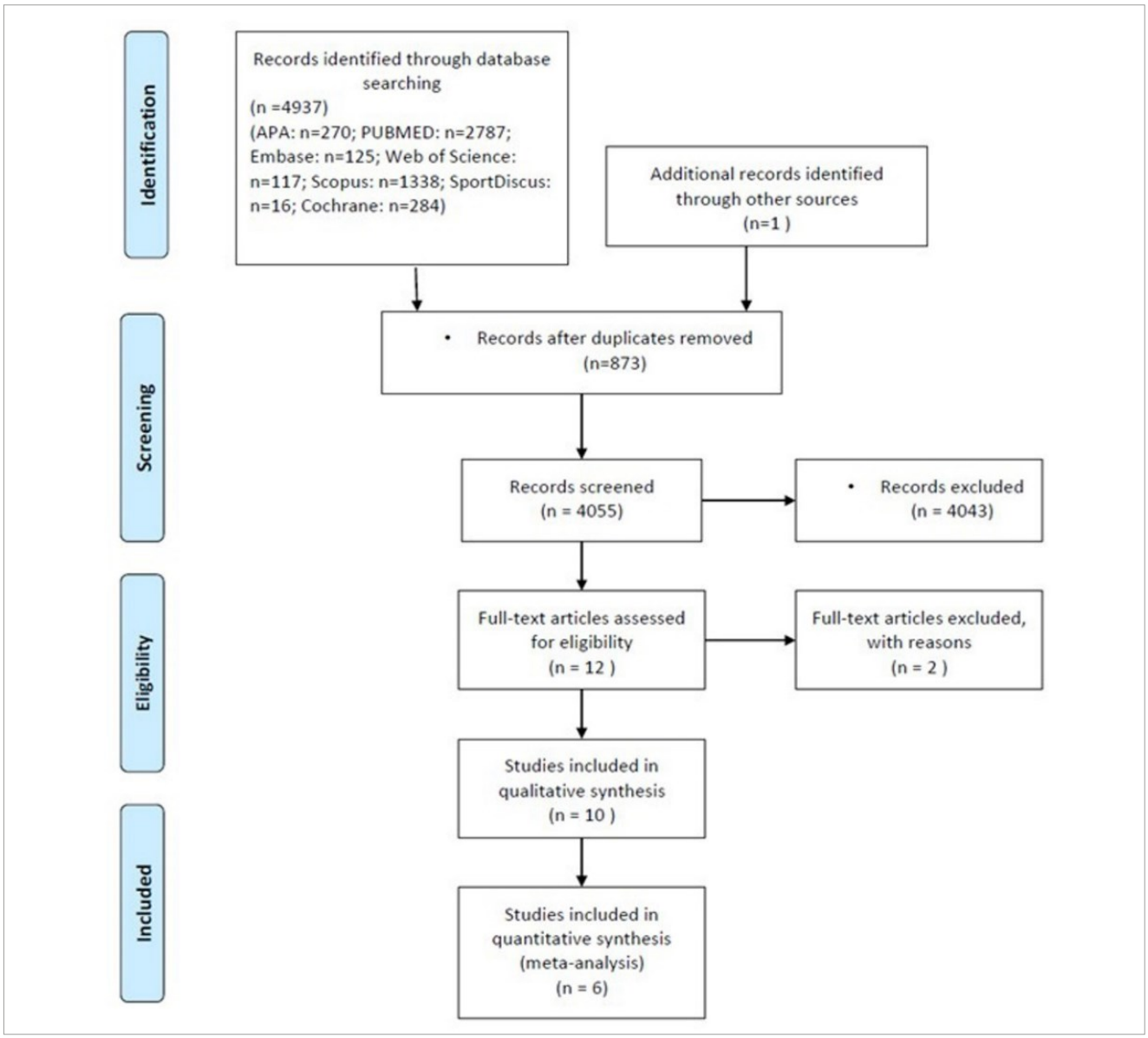

Figure 1. PRISMA summary of the study selection process.

with boolean terms: [('Transcranial direct current stimulation') OR (tDCS) OR (HDCS) OR ('Electric Stimulation Therapy') OR ('Neuromodulation')] AND [('Sports') OR ('Athletic Performance') OR ('Psychomotor Performance')].

Selection process

All search results were imported into Mendeley software to manage data and eliminate duplicates. Two independent reviewers made a preliminary title and summaries texts selection for inclusion and exclusion. Subsequently, the full-text selection was made, and two reviewers applied inclusion and exclusion criteria to identify relevant studies to be included in the systematic review analysis. Discrepancies were solved by consensus with the intervention of a third reviewer.

Data extraction process

Data were organised by a reviewer using a standardised extraction form previously prepared in Excel to collect these variables: (1) metadata (authorship, publication date, etc.); (2) demographic data (sample size in each group, age, sex); (3) types of sports (psychomotor performance measures); (4) characteristics of the tDCS technique: electrode position; current intensity; electrode size; current density (current divided by electrode area); the number of data and (5) methods (randomisation protocol; blind evaluation; number

evasion). After extracting data, if needed, reviewers addressed any disagreement by consensus with the third reviewer.

Quality assessment

Indicated which study characteristics were assessed and/or any formal risk of bias/quality assessment tools was used. The 'risk of bias' was assessed by two independent reviewers using the Cochrane Risk of Bias (RoB 2.0) tool for Randomised Controlled Trials and the Cochrane Risk of Bias in Non-Randomised Studies - of Interventions (ROBINS-I) tool for non-randomised studies (Sterne et al., 2019).

Data synthesis

This study was a meta-analysis, and statistical analysis was carried out using the R software (version 4.0.0) and the R meta-package (https://cran.r-project.org/web/packages/meta/meta.pdf). Each study calculated effect size (i.e., Cohen's d) to indicate the difference between distinct stimulation conditions considering training and post-training activities (in case of a project between subjects) or using a Cohen-adjusted formula for testing t paired (in case of a project within-subject). We believe several studies would give small sample sizes. We adjusted the sample size to the bias of small decreases - Hedges' g (Hedges & Olkin, 2014), interpreted as Cohen's d. As we were expecting decreased heterogeneity between studies, we calculated averages based on a random-effects model for a population, varying according to study heterogeneity. Heterogeneity significance was mandatory using two tests with Q statistics Cochran's test ($P< 0.05$). The bias assessment report was presented using the funnel graph asymmetry test (for example, Begg, Egger test).

Analyses were considered from variable testing. In the case of categorical variables (participant characteristics such as sex, age, and outcome measures), they were based on mixed-effects of meta-analytical categorical tests. In this model, studies within subgroups were combined with a random-effects model, and tests for significant differences between subgroups were conducted with the fixed-effects model. Analysis of continuous variables happened with maximum unrestricted likelihood meta-regression to verify significant relationships between continuous variables, considering the Z value and a corresponding p-value.

RESULTS

Overview

A total of 4,055 unique records were screened, and 10 full texts were assessed for eligibility. All studies about pathologies or clinical uses were eliminated from the analysis, remaining six eligible texts for the meta-analysis. This low quantity of articles represents the way of data presentation. The systematic review covered the period between 2009 and November 2020. Figure 1 summarises the study flow. Table 1 summarises studies data.

Study characteristics

Design

All but one study (Okano et al., 2015) were randomised, and all had some level of blinding: one triple-blinded design and two double-blinded designs. Most studies were crossover, with a sham control in some subjects; however, three of them (Kamali et al., 2019a; Kamali et al., 2019b; Mesquita et al., 2019) had a paired group design.

Sample

50% sample was composed of high-level athletes (Holgado et al., 2019c; Lattari et al., 2020; Mesquita et al., 2019; Seidel & Ragert, 2019; Seidel-Marzi & Ragert, 2020) and 50% by novices or non-professional athletes (Huang et al., 2019; Kamali et al., 2019a; Kamali et al., 2019b; Mesquita et al., 2019; Okano et al., 2015). Type of athletic activity varies, including football and handball (Seidel & Ragert, 2019; Seidel-Marzi & Ragert, 2020), cycling (Holgado et al., 2019c; Huang et al., 2019; Okano et al., 2015), golf (Harris et al., 2019), taekwondo (Mesquita et al., 2019), pistol shot (Kamali et al., 2019a) and bodybuilder (Kamali et al., 2019b; Lattari et al., 2020).

Stimulation

Most studies (60%) used 2 mA by 20 min (Holgado et al., 2019c; Huang et al., 2019; Kamali et al., 2019a; Kamali et al., 2019b; Lattari et al., 2020; Okano et al., 2015; Seidel & Ragert, 2019; Seidel-Marzi & Ragert, 2020). Two studies (20%) used 1,5 mA by 15 min (Harris et al., 2019; Mesquita et al., 2019): one of them (10 %) used 2, 2 mA by 20 min, and the other one (10%) used 2 mA for 13 min (Huang et al., 2019). The stimulation area was diversified, with the presence of M1 bilateral (Seidel & Ragert, 2019; Seidel-Marzi & Ragert, 2020) or unilateral (Huang et al., 2019), CB2 right (Kamali et al., 2019a; Kamali et al., 2019b), C3 and C4 (Mesquita et al., 2019), F4, OZ DLPFC (Harris et al., 2019; Holgado et al., 2019c), FP2 (Lattari et al., 2020), TC and T3 (Okano et al., 2015)

Psychomotor measurement

The measure, quite diverse, was accomplished in time reaction (latency to response) (Kamali et al., 2019a; Lattari

Table 1. Summarised data of the papers in systematic revision.

Study	Design Sample and Groups	Experimental Methods And Stimulation	Psychomotor Measurement
Harris et al. (2019)	Sham-controlled, randomised-group, paired samples, one blind 73 participants (Golf athletes in 4 groups of 19 participants (frontal, 21.7± 2.8, 6F; M1,21.6± 2.9, 5F; V1:20.5±1.0, 7F; or Sham: 22.0± 3.7, 11F)	1 session 1,5 mA right DLPFC, M1 right; VI or Sham (M1), 5 min after test, 3 conditions Baseline, low pression, and High pression	performance (errors), quiet eye period; Anxiety IAMS;
Holgado et al. (2019c)	randomised, sham-controlled, single-blind, within-subject design experiment (cross-over) 39 males cyclists, 27(6.8) years, 70.1 (9.5) KG, 3 conditions anodal, cathodal, and Sham	3 sessions of self-paced, 2 mA, 20 min, DLPFC	ergometric bike: power output, heart rate, flake test (inhibitory test) SRPE and EEG
Huang et al. (2019)	In this triple-blind, randomised, sham-controlled study 9 males (20± 1.2 years), 73.1± 6.5 Kg, practice 3 times/week activity in the lasts 6 months	2 sessions, 5 days interval 2,2 mA, 20 m min, M1	; ergometer bike, 50 rpm, resistance 10% weights/6 sec, with intervals 24 s. peak power output and mean power
Kamali et al. (2019a)	sham-controlled, paired samples 17 right-handed participants (9 males, 8 females; age 26 to 33 years, with 2 to 3 years of experience in pistol	2 sessions, 48 h interval, an experimental group with a session sham and other, tDCS 2 mA, 20 min, CB2 right, session 1: 20 min tDSC.	shots latency, accuracy); Mirror tracing, dynamic tremor tracing
Kamali et al. (2019b)	sham-controlled, paired samples, double-blinded 12 experienced male bodybuilders (aging 18 to 44 years, weight 60-120 kg, with regular activity in the lasts 2 years	2 sessions, 72 h interval, an experimental group with a session sham and other, tDCS 2 mA, 13 min, M1 and TC	Visual analog scale; Hater hate, rated perception extension, one-repetition maximum. Short-term endurance index, The Cambridge brain sciences cognitive platform. Surface electromyography and prefrontal hemodynamic response
Lattari et al. (2020)	sham-controlled, double-blinded, crossover study randomised 10 subjects, 22.7± 3.9 years, classified advanced in strength training (47.8 6 22.7 months of training) (1), practitioners of squatting exercises (43.3 6 25.7 months),	2mA, 20 min, fp2 area, 3 sessions, anodal, cathodal, or sham with 48-72 h interval	Countermovement Jump Kinematic Test-Retest Reliability, Countermovement Jump Assessment in Experimental Conditions
Mesquita et al. (2019)	sham-controlled, paired samples 19 TKD athletes,12 men, 7 women; mean ± SD, age: 19± 3 years; body mass: 60.7± 6.9 kg; height: 171.7± 6.9 cm; body fat: 13± 8%; practice time: 8.9± 5.0 years; level: international/national	athletes were randomly assigned in a single-blind and counterbalanced order to either the anodal (a-tDCS) or the sham condition. In each session, the subjects executed performance assessments composed by CMJs and the FSKT immediately and 1 h after stimulation. Additionally, subjects should report their session rating of perceived exertion (session-RPE) 30 min after the performance assessment. Experimental sessions were performed at the same time of the day and were interspaced by at least 48 h 1.5 mA, 15 min, C3 and C4	Countermovement Jump. Two minutes after the warm-up the subjects performed 3 CMJs with 1-minute rest between them; Frequency Speed of Kick Test (FSKT)- Time of reaction
Okano et al. (2015)	single-blinded 10 subjects, 33± 9 years; national-level cyclist, 10-11 years training.	2 sessions, 24 h interval, 2mA, 20 min, TC area, anodal T3,	Maximal incremental exercise test, RPE responses
Seidel & Ragert (2019)	sham-controlled, crossover, double-blinded 46 participants, male and female divided into 3 groups (football, handball, and non-athletes. 2 years of regular practice and participation in competitions.	2 sessions, 24 h interval, 2 mA, 20 min, area M1 bilateral, session 1: 20 min tDSC, testing before, in 10 min on stimulation period, after stimulation (0 min and 30 min); session 2: idem	reaction time tasks (RTT) and tapping tasks (TT)

Continue...

Table 1. Continuation.

Study	Design Sample and Groups	Experimental Methods And Stimulation	Psychomotor Measurement
Seidel-Marzi & Ragert (2020)	sham-controlled, double-blinded, crossover study. 46 participants, divided into 3 groups (football, handball, and non-athletes. 2 years of regular practice and participation in competitions. 13 FB (three females, mean age= 24.00± 3.89 years), 12 HB (five females, mean age= 22.50± 4.32 years) and 21 NA (11 females, mean age= 26.95± 3.43 years). On average, FB trained for 16.31± 5.02 years and currently 5.65± 2.15 h/week, whereas HB trained for 13.17± 4.49 years and currently 8.54± 3.84 h/week in their respective sports disciplines. On the other hand, NA performed an average of less than 2 h	2 sessions, 24 h interval, 2 mA, 20 min, M1 bilateral, session 1: 20 min tDSC, testing before, in 10 min on stimulation period, after stimulation (0 min and 30 min); session 2: idem	reaction time tasks (RTT) and tapping tasks (TT)

et al., 2020; Mesquita et al., 2019; Seidel & Ragert, 2019; Seidel-Marzi & Ragert, 2020), repetition (Kamali et al., 2019a; Mesquita et al., 2019; Okano et al., 2015; Seidel & Ragert 2019; Seidel-Marzi & Ragert, 2020), power (Harris et al., 2019; Holgado et al., 2019c; Huang et al., 2019; Kamali et al., 2019b; Okano et al., 2015), or accuracy (Kamali et al., 2019a). Other non-psychomotor measurements were present in many articles, especially psychological measurements of anxiety and impulsivity, or physiological measurements, i.e., heart rate or EEG (Holgado et al., 2019c).

Results

Positive effects of tDCS were demonstrated in half of the studies (Huang et al., 2019; Kamali et al., 2019a; Kamali et al., 2019b; Okano et al., 2015; Seidel-Marzi & Ragert, 2020). One study analysed negative effects (Mesquita et al., 2019), and four papers presented no effects (Harris et al., 2019; Holgado et al., 2019c; Lattari et al., 2020; Seidel & Ragert, 2019). Power dimension is the most common effect (Huang et al., 2019; Kamali et al., 2019b; Okano et al., 2015; Seidel-Marzi & Ragert, 2020), and one study, with shooters, related effect and accuracy (Kamali et al., 2019a).

The power effect was investigated in objective measures (for example, motor movement's repetition or power in a cycle) and subjective ones (fatigue test).

Risk of bias

In most of the studies, our study sample had a low risk of bias, except one with a high risk of blinding assessment. Figure 2 presents this analysis.

Meta-analysis

Meta-analysis is identified in Figures 3 and 4, and includes six studies (Holgado et al., 2019c; Huang et al., 2019; Mesquita et al., 2019; Okano et al., 2015; Seidel & Ragert, 2019; Seidel-Marzi & Ragert, 2020). General study meta-analysis identified significant heterogeneity of I2= 72%, t2= 0.4750, p< 0.01, indicating the use of the random effects model is adequate. The results confirmed a significant effect Hedges' g= 1.44, 95%CI 0.92–1.92. Assessing study publication bias, the funnel graph confirmed a degree of asymmetry. Egger's test revealed an intercept value of 2.627 [95%CI –0.509– –5.763; t= 1.661] with a p-value of 0.1277, indicating no substantial asymmetry in the funnel graph, so there is no evidence of publication bias.

DISCUSSION

Our analysis identified that tDCS had some effects on the athlete's psychomotor performance, however, it is a controversial fact. There is no homogeneity in performance dimensions, namely, strength, accuracy, and latency. Analysed articles confirm the effect on force dimension in those who report some effect by direct measure (W or Kg), indirect measure (perceived effort), or repetition speed measure, which can be considered as a force dimension. Even accuracy data, obtained from snipers, seems to indicate power data and can be explained by better control of the weapon's retro-shot.

Relying on experimental plans and their specific objectives, either stimulated areas or test types and sports are diverse, not allowing a minimal general protocol for the tDCS use in the area. To know if there is a real effect of

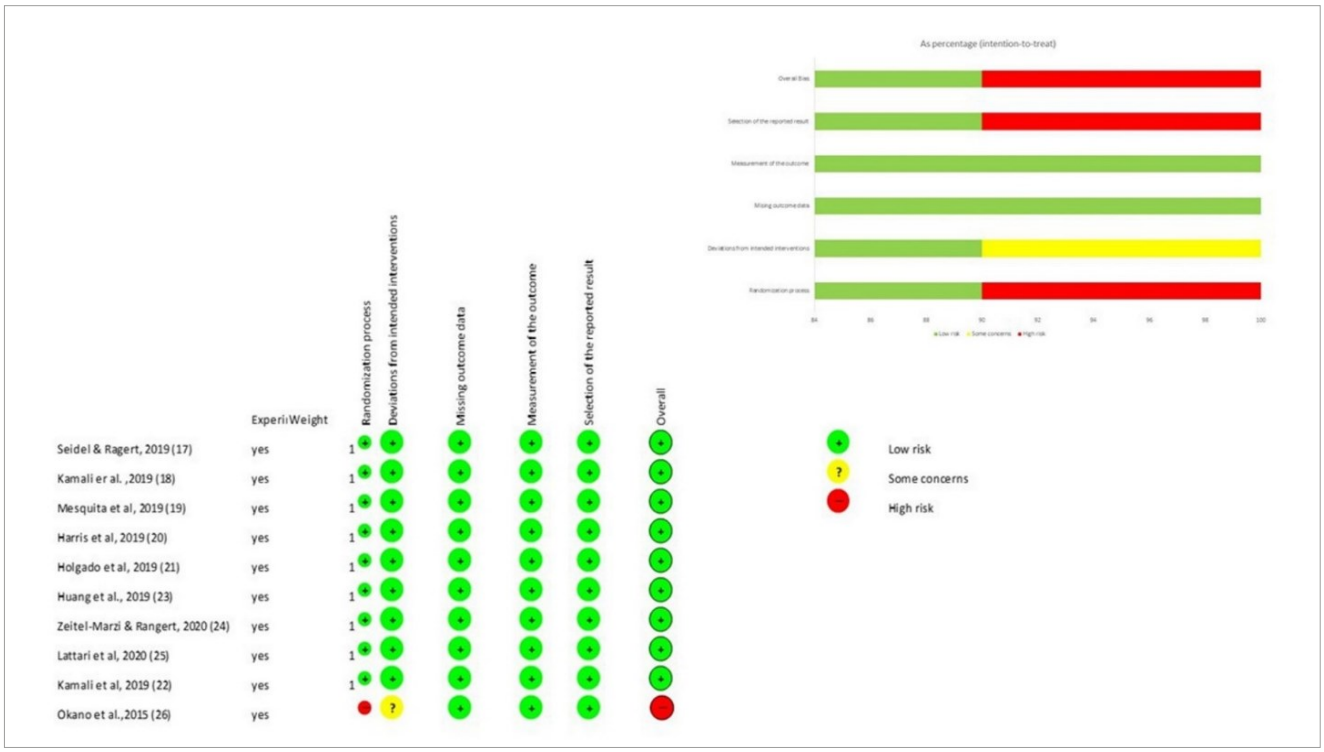

Figure 2. Risk of bias assessment based on the evaluation domains listed in the Cochrane Collaboration Risk of Bias Tool: (A) risk of bias graph, (B) risk of bias summary.

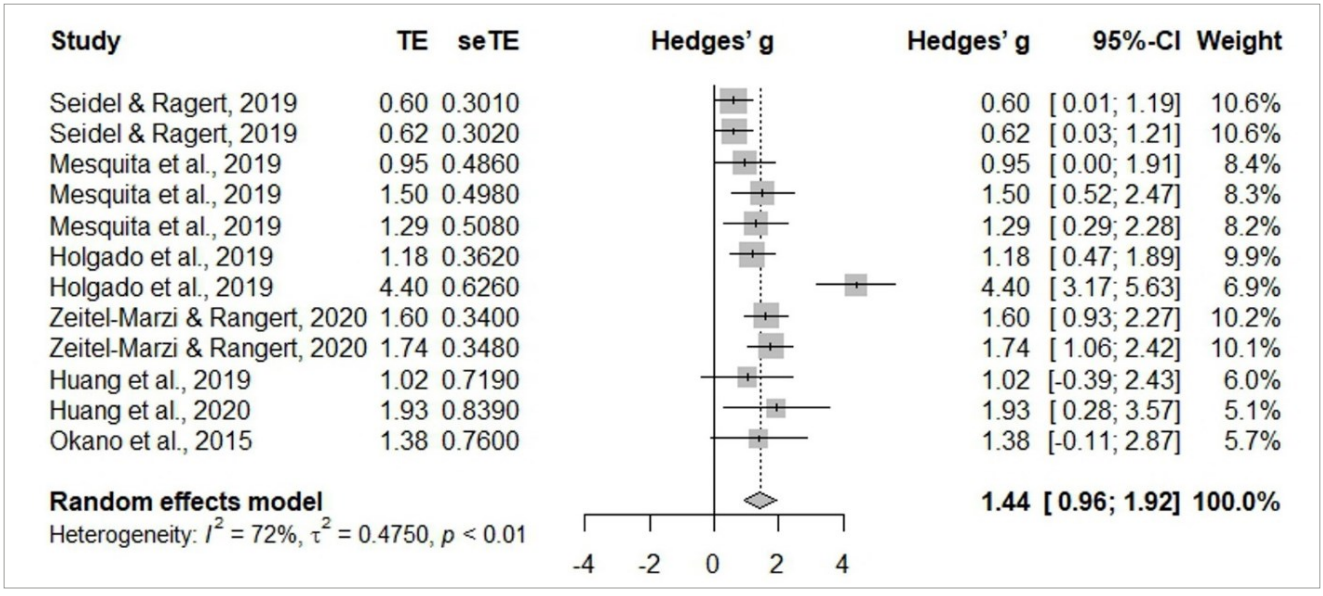

Figure 3. Forest plot of tDCS effect size on performance and subjective outcome.

tDCS in each psychomotor dimension, it would be necessary to describe accurately the existence of each sport and test these activities separately. Thus, it would be required to stimulate different areas and to test the effect of strength, accuracy, and latency (response time) in a laboratory situation. In a laboratory study concerning trained cyclists submitted to anodic tDCS before exercise, Okano et al. (2015) demonstrated improved dynamic motor performance (incremental exercise test) and tolerance to athletes' physical effort. As for sport applicability, specifically concerning motor fatigue because of exhaustive physical work maintained for a long period, Seidel-Marzi and Ragert (2019)

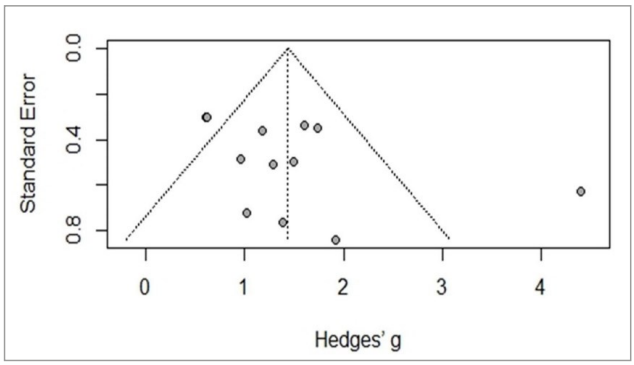

Figure 4. Funnel plot of Hedges' g effect size versus study standard error.

evidenced that regardless of sport's requirement or athlete's training level, tDCS can reduce motor fatigue during rapid repetitive movements.

On the other hand, in sports requiring a closed motor skill, such as golf, for example, which performance is particularly important to control visual attention (golf courses at baseline), no beneficial effects were observed after receiving tDCS (Harris et al., 2019), reinforcing evidence of no learning transfer to actual sport performance. In this sense, it would be necessary to consider the specific requirements of each sport to these dimensions and their combinations. Only in this way could we answer if tDCS influences sport so that it can be considered doping or not and if the effect on psychomotricity is of such a magnitude that it can be considered a non-sports intervention.

However, we cannot make a conclusion on the current state of the art reflected in this review. Although the articles have a good experimental design, they do not present data density to support a definitive conclusion or construction of a stimulation protocol for athletes in training or competition.

Our work has several limitations coming from the articles used: on the one hand, there are diverse ways to perform the tDCS; on the other hand, the methods to measure the psychomotor effect vary a lot. Moreover, this has an impact on our review results.

CONCLUSIONS

The tDCS has an effect on strength, but this is not clear and may depend on the sport's requirements or procedure variations. Nonetheless, currently, it is not possible to define a safe and effective tDCS use protocol for athletes to increase psychomotor performance. Due to this, more parameterised studies are necessary to develop protocols to use in this population, to improve psychomotor activity.

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REVIEW ARTICLE

https://doi.org/10.6063/motricidade.26751

Correlation between creatine kinase (CK) and thermography: a systematic review with meta-analysis

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ABSTRACT

This research aimed to investigate the association between the skin temperature variation of the skin identified by thermography and serum CK values in healthy subjects based on a systematic review with meta-analysis. A systematic literature search was performed in June 2021 in the SCOPUS, MEDLINE, and Web of Science databases (2000 to 2021). MeSH and DeCS platforms were used to find the descriptors in English referring to the terms "thermography" and "creatine kinase" with their synonyms (nine and 13, respectively) to find studies, following the PIRT strategy: Participants (healthy subjects); Index Test (thermography); Reference Test (CK collection); Target Condition (having analyzed the results of the Index and Reference Test). A meta-analysis was performed to calculate the association between variables. A total of 483 files were retrieved from the databases, and 13 were selected for analysis (five met the criteria for meta-analysis). Considering the 13 studies reviewed, there is a general balance in obtaining results of CK increase along with skin temperature versus studies that didn't observe any association between the measures. However, the meta-analysis showed no significant association between the variables analyzed (r= –0.05; p= 0.06; 95%CI –0.11 – 0.00). This result suggests that the result of one test cannot estimate the result of the other. It was concluded that there is no good association between CK levels and thermography results; it's recommended the use of thermal images in addition to other evaluation methods in order to assist in the determination of special differential diagnoses of musculoskeletal injuries.

KEYWORDS: thermal imaging; muscle damage; skin temperature.

INTRODUCTION

In sports, injury prevention is a primary concern for teams and clubs' technical committees and health departments, not only because of the damage caused by the athlete's distance itself but also because of the high costs arising from the underlying treatments (Neves et al., 2016; Viegas et al., 2020). Considering this point of view, especially in high-performance sports activities, there is great interest in technical committees in facilitating and cheapening the process to identify possible future injuries of an athlete through the technology available today (Santos Bunn, 2020).

Thereunto, there are several direct or indirect indicators of the possibility of injury that can be used to monitor the health status and physical strain of athletes, such as measuring enzymes present in the bloodstream — lactate dehydrogenase (LDH), troponin I, myoglobin, and creatine kinase (CK-MM) — verification of maximum voluntary action, ultrasonography, tomography, surface electromyography, magnetic resonance, muscle biopsy, thermography, observation of subjective pain perception scale, also represented by delayed onset muscle soreness (DOMS), among others (Andrade Fernandes et al., 2017a).

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Conflict of interests: nothing to declare. Funding: nothing to declare.
Received: 03/16/2022. Accepted: 06/27/2022.

The CK, in its muscular form, is an objective measure. However, it can only be accessed through the blood, not allowing for a precise locate the injured structure. In this sense, the combination of indicators that will enable objective and subjective measurements have been recommended, and several studies have pointed out the use of thermography for this purpose (Andrade Fernandes et al., 2017b; Júnior et al., 2021; Neves et al., 2015; Neves et al., 2016; Priego-Quesada et al., 2020).

In case of suspicion of musculoskeletal injury, imaging tests (ultrasound, tomography, surface electromyography, magnetic resonance imaging, among others) have been the main choice for confirming the diagnosis. However, they are costly methods to be maintained periodically, in addition to not being portable and emitting excessive ionising radiation, which is harmful to health. Therefore, a solution to promote the optimisation of this process is the use of thermography. It is a tool that obtains infrared images through cameras capable of measuring the surface temperature of the body's skin, indicating an accelerated metabolic activity in some areas of the body, which may show the location of sites with a high chance of developing lesions (Andrade Fernandes et al., 2017a). The advantages are vast compared to other imaging techniques: safety, non-contact, non-invasive, painless, no ionising radiation, no side effects, no contraindications, and efficacy (Viegas et al., 2020). Researchers have, therefore, been successful in the combined use of physiological indicators to prevent injuries. If, on the one hand, high serum CK levels indicate the possibility of injury in any body area, thermography allows locating this area so that, consequently, a prevention protocol can be adopted (Andrade Fernandes et al., 2017b; Júnior et al., 2021; Kennedy et al., 2017; Neves et al., 2015; Neves et al., 2016; Priego-Quesada et al., 2020).

However, the literature doesn't clarify whether the variation shown in skin temperature is associated with indirect blood markers of muscle damage, as some studies find an association (Andrade Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Júnior et al., 2021) and others do not (Bandeira et al., 2012; Kennedy et al., 2017). Knowing the magnitude of the associations between CK and thermography would support a more scientific, practical, and efficient application to prevent injuries in physically active subjects. In this sense, it can be questioned whether an eventual direct replacement of the CK assessment (invasive method) by the thermal image assessment (non-invasive method) would be possible? Or whether both should be used in a complementary way?

Thus, this study aimed to investigate the association between thermal variation identified by thermography and muscle CK values in healthy subjects from a systematic review with meta-analysis. A null hypothesis (h0) assumed that there was no association between thermal variation identified by thermography and muscle CK values.

METHODS

Protocol and registration

The protocol for this study was registered in the International Prospective Register for Systematic Reviews (PROSPERO) under number CRD42021262109.

Eligibility criteria

The PRISMA 2020 (Page et al., 2021) recommendations were followed in this systematic review with meta-analysis, and the PIRT (WHO, 2014) strategy was used to construct the research question and search for evidence. Therefore, diagnostic accuracy studies with the following characteristics were included: Participants/Patients (healthy subjects); Index Test (thermography); Reference Test (CK collection); Target Condition (having analyzed the results of the Index and Reference Test).

Regarding the researched reports, searches were carried out for scientific articles published in renowned journals and periodicals from 2000 to 2021 in English, Spanish and Portuguese, considering, therefore, that the use of thermography technology is of recent application in the sports world and there was a significant evolution in the quality of the cameras used. Furthermore, studies found in duplicate were removed, and articles involving animal tests were not listed.

Information sources

In June 2021, searches were performed in the SCOPUS, MEDLINE, and Web of Science databases in the Instituto Militar de Engenharia (IME) library. As for the articles not available for free in the download tools, the author was contacted via e-mail to request the sharing of the content, and additional studies were manually included based on the searched reference lists.

Search strategy

The search was performed in the SCOPUS, MEDLINE, and Web of Science databases using the English terms "thermography" and "creatine kinase (CK)", with their respective variations shown in Table 1 below. The descriptors in question were obtained using the MeSH, and DeCS platform, as well as other synonymous terminologies found in the literature were added. In addition, Boolean operators (delimiters) were

used to search the databases: "OR" for synonymous descriptors and "AND" for the association of different descriptors, as shown in Table 1 below.

Selection process

The identification of the works was carried out by reading titles and abstracts that showed relationships of variation between skin temperature and the biochemical marker creatine kinase (CK). The number of files identified in each database was recorded, and files that weren't related to the topic sought or marked as ineligible by automation tools, or presented in the form of duplicates, were removed.

The files selected in the initial identification were read in their entirety to carry out screening, eventually excluding articles with no specific relationship with the topic or that didn't have versions in the chosen languages or weren't available. The reports approved in this screening comprise the study scope of the systematic review. In turn, the studies that exclusively presented some type of statistical association with their respective correlation coefficient "r" specifically on the descriptors of the topic in question compose the studies retrieved for the meta-analysis. Scientific articles identified through other reliable sources were included in the scope of the work. The numerical values from the selection process were explained in a flowchart following the PRISMA 2020 recommendations (Page et al., 2021).

Data items and collection process

Three independent collaborators conducted the data collection process: two of them were responsible for the search and selection process of the separate primary studies (T.M.S and E.B.N). The other was responsible for the statistical elaboration of the meta-analysis (P.S.B). After completing the study selection process and eliminating duplicates, the first two reviewers compared the obtained results and proceeded according to the articles' eligibility criteria and quality assessment. After that, all indicators (characteristics of the samples, the intervention methods used, the regions of interest (ROI) analyzed by thermal imaging, the results obtained, and the conclusions) were used to analyse the studies that make up the scope of work were spreadsheet. The third collaborator, in turn, compiled statistical data for the work based on articles that exclusively presented the modalities of statistical association with their respective Pearson and Spearman correlation coefficients and used the Statsdirect tool (version 3.0) to produce the meta-analysis result graphs.

Quality assessment of studies

At this stage, the assessment of the methodological quality of the included studies was performed using the QUADAS-2 (Whiting et al., 2006) method to assess the risk of bias and applicability concerns of each study based on four domains: patient selection, index test, reference test, and timing, enabling

Table 1. Literature search strategy[#].

[Thermography		[Creatine Kinase, MM Form
OR Temperature Mapping OR Mapping, Temperature OR Mappings, Temperature OR Temperature Mappings OR Thermal imaging * OR Thermal image * OR Infrared imaging * OR Infrared images * OR Skin temperature *]	AND	OR Creatine Kinase, M OR Creatine Kinase, MM OR Creatine Kinase, Muscle OR Kinase, M Creatine OR Kinase, MM Creatine OR Kinase, Muscle Creatine OR M Creatine Kinase OR MM Creatine Kinase OR Muscle Creatine Kinase OR ADP Phosphocreatine Phosphotransferase OR ATP Creatine Phosphotransferase OR Creatine Phosphokinase OR Macro-Creatine Kinase]

[#]The terms were removed from the DeCS/MeSH descriptor search tool, except those marked with an asterisk.

the verification of the impact of the results of each study and how they will influence the discussion and conclusion of the systematic review and meta-analysis. For the applicability concerns the domains "sample selection", "test-index", "reference standard" are the parameters evaluated.

Effect measures and synthesis methods

According to the meta-analysis, the indices and statistical correlation coefficients used to synthesize or present results were evaluated using the Hedge-Olkins Fixed Effects method. Thereunto, regions of interest and temporal flow of measurement were analyzed for each correlation coefficient. Data were analyzed according to combinations of study results and trends obtained in the meta-analysis, observing their respective consistency measures (I^2, for example) (McNeish & Kelley, 2019).

RESULTS

The PRISMA flow diagram of the included studies is depicted in Figure 1 below. In Figure 1, it can be seen that 482 files were identified in the databases, and another one was obtained by manual search. After reading the titles and abstracts, 386 duplicates were excluded. Another 65 records marked as ineligible by automation tools (search filters) were removed from areas of knowledge and articles older than the year 2000. In addition, of the remaining 31 articles, another 15 were removed for not specifically addressing the topic sought and another four for not having a full version in English, leaving 13 reports evaluated as eligible to be included in the scope of study of the systematic review. Of the 13, only five had a correlation coefficient "r" referring to the topic and, therefore, were included in the meta-analysis.

The characteristics of the 13 studies included in the systematic review are presented in Table 2, which details the characteristics of the samples, the intervention methods used, the regions of interest (ROI) analyzed by thermal imaging, the results obtained, and the conclusions.

From the related samples, all studies selected healthy, non-injury professional athletes, with general ages ranging from 15 to 47 years, and from sports such as soccer, rugby, cross-country skiers, and endurance swimmers, except four studies that selected amateur runners (Pérez-Guarner et al., 2019), untrained men (Da Silva et al., 2018), and just healthy individuals (Petrofsky et al., 2011; Petrofsky et al., 2012). The selected ROI, in turn, were in short anterior and posterior chains of the lower limbs, except for three studies that included anterior and posterior views of the whole body (Drzazga et al., 2018; Pérez-Guarner et al., 2019; WHO, 2014) and two more that selected only the biceps (Petrofsky et al., 2011; Petrofsky et al., 2012) as the region of interest.

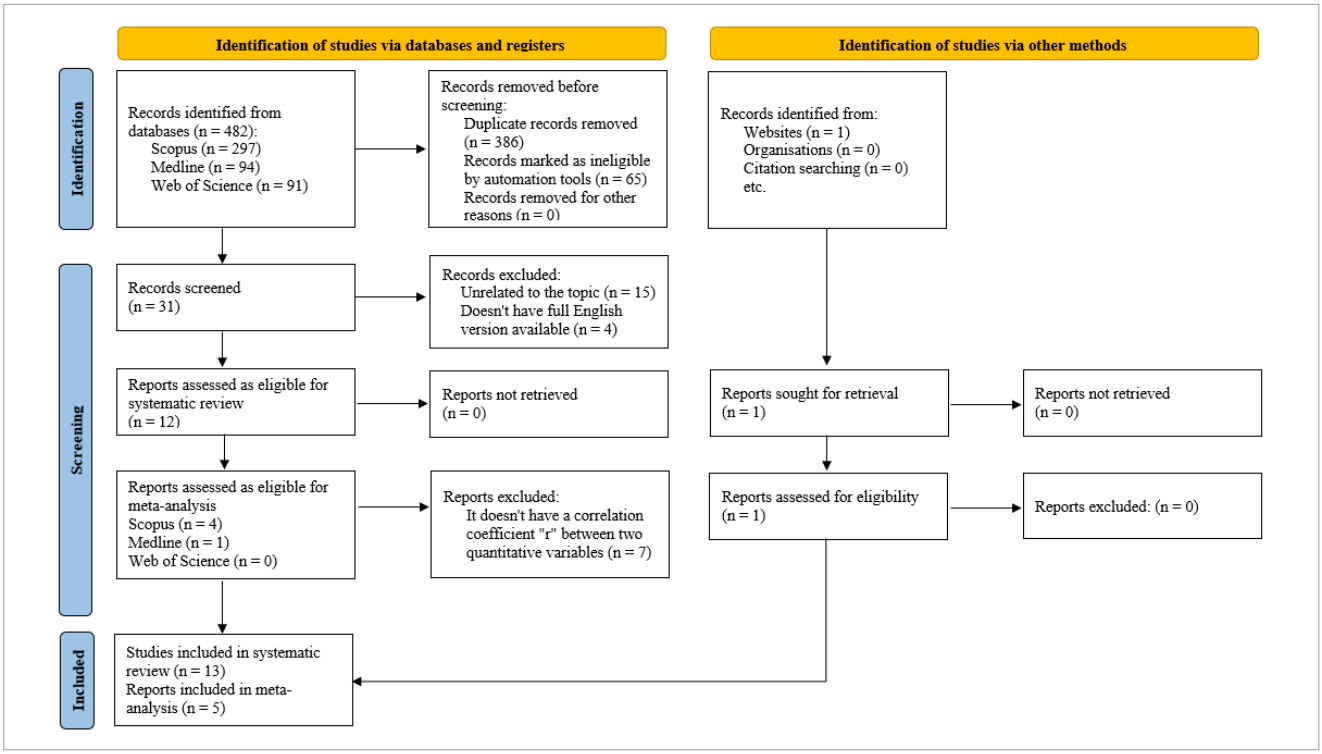

Figure 1. Flow diagram of the studies included in this systematic review with meta-analysis regarding the association between CK and thermography.

Table 2. Association between thermography and CK: Systematic Review.

Bibliographic Reference	Sample	Intervention Method	Region of Interest (ROI) analyzed by thermal imaging	Results	Conclusion
Júnior et al. (2021)	Elite Male Football Players *n*= 20 age: 25.6± 4.0	An evaluation session was carried out before and another session after the competitive football season (16 weeks). In both sessions, blood collection was performed, evaluation of skin temperature asymmetry (Tsk) using infrared thermography (IRT) and evaluation of force asymmetry through the countermovement test (CMJ).	Anterior and posterior views of the lower limbs.	There were significant increases in Tsk ($p < 0.03$) and CK ($p = 0.0001$) even after a 3-day rest interval (no training).	CMJ testing can be combined with infrared thermography to monitor force asymmetry and help prevent muscle damage.
Carvalho et al.* (2021)	Healthy male athletes from a professional football club *n*= 22 age: 27.7± 3.93	Athletes were followed in 19 national championship matches, with an interval of 7 days between matches. In each match, athletes used a GPS device to collect performance data. 48 hours after each match, each athlete's perception of recovery, fatigue, and pain was documented, blood was collected for CK analysis, and infrared thermography was applied.	Anterior and posterior incidences of the lower limbs, which were divided into seven regions of interest (ROI), totalling 14 anterior ROIs and 14 posterior ROIs.	No correlation was observed between mean skin temperature and blood CK levels, pain level, perception of recovery, and perception of fatigue ($r< 0.2$, $p> 0.05$).	Infrared thermography didn't correlate with CK level, pain, perceived fatigue or recovery, nor with performance variables within the field.
Barros et al. (2020)	Healthy male athletes not using inappropriate ergogenic supplements and not in rapid weight loss programs *n*= 10 age: 22.50± 2.84	All athletes underwent three resistance training (RT) methods: traditional, tension and occlusion training. Torque peak, fatigue index, blood sample, thermal images and pain perception were measured immediately before and after the training session and 24 h and 48 h after.	Anterior and posterior views of the thighs.	Thermographic analysis revealed a reduction in skin temperature on both thighs after the tension (−9.37%) and vascular occlusion (−6.01%) methods. Only the vascular occlusion method showed an increase in CK ($p< 0.001$; $\eta 2p= 1.08$) and lactate dehydrogenase "LDH" ($p< 0.001$; $\eta^2_p = 1.56$).	An RT session with blood flow restriction (vascular occlusion method) increases plasma levels of CK and LDH, increases the subjective perception of muscle pain, and decreases peak muscle torque and skin temperature.
Pérez-Guarner et al.* (2019)	Male and female amateur runners *n*= 11(M) *n*= 6 (F) age: 41± 6	Runners were measured 24 h and 48 h before and 24 h and 48 h after running a half marathon. The tests included obtaining blood markers, perception of pain and fatigue, skin temperature and jumping performance.	Anterior and posterior incidences divided into 10 zones (chest, anterior upper limbs, dorsal back and posterior upper limbs, abdominal, back and lumbar buttocks, anterior thigh, posterior thigh, etc.).	CK ($p< 0.001$ and effect size *"ES"*= 2.1) increased 24h after the half marathon. No increase in skin temperature was observed in tests after competition, and no regression model was able to predict physiological stress based on skin temperature. Only a bivariate correlation was observed between the 24-hour variation (pre – 24 h) of CK and the skin temperature of the posterior upper limb ($p= 0.04$; $r= 0.5$).	Monitoring basal skin temperatures doesn't appear to be an adequate method to detect physiological stress after a half marathon. In line with the observed results, we recommend caution when interpreting peaks in basal skin temperature in field sports assessments.

Continue...

Table 2. Continuation.

Bibliographic Reference	Sample	Intervention Method	Region of Interest (ROI) analyzed by thermal imaging	Results	Conclusion
Matta et al. (2019)	Healthy male players from a Brazilian 1st division football club *n*= 10 Age: 25.3± 4.6	24 and 48 hours after a soccer match, GPS sensors were used to quantify the demand for game conditions among all participants, along with post-game measurements of serum CK, skin conductance and thermographic images of the lower limbs.	Anterior and posterior views of the lower limbs. Description of the ROI used: 5 cm above the upper edge of the patella to the line from the groin to the thigh; and for the leg, 5 cm below the lower edge of the patella to 10 cm above the lateral malleolus.	There was no significant difference (p> 0.05) in contralateral thermal symmetry in the lower limbs. However, both values (maximum and mean) of skin temperature showed a significant difference (p< 0.05) at rest when compared to 24h and 48h after the game. Furthermore, the serum CK level remained elevated for up to 48 h post-match compared to rest.	The results showed that 48 hours after the game is not enough for soccer players to fully recover.
Da Silva et al.* (2018)	healthy untrained men *n*= 20 age: 24	Before, immediately after, and 48 h after a calf exercise protocol (multiple sets of plantar and ankle flexion for body elevation), blood samples were collected to determine CK and acetylcholinesterase activity. In addition, thermal images were recorded of the exercised muscles to determine skin temperature variation, and DMIT was quantified.	Anterior and posterior views of the legs.	There was an increase in CK activity 48 hours after exercise (p< 0.01). Skin temperature parameters didn't correlate with creatine kinase responses (p> 0.05).	Changes in skin temperature are not correlated with the level of exercise-induced muscle damage estimated by CK activity in untrained individuals.
Drzazga et al. (2018)	Two groups of elite male athletes. A group of cross-country skiers* and a group of elite endurance swimmers** *n**= 6 *n***= 4 age*: 23± 2.68 age**: 21.5± 2.08	At first, thermal images of the athletes' bodies were recorded from the front and back, before, and about 1 to 2 minutes after performing a treadmill run until exhaustion. After two weeks, measurements were repeated after one hour of treadmill running. Functional (heart rate, oxygen consumption, workload) and biochemical (CK and LDH activities, lactate, and haemoglobin concentration) markers were also evaluated.	Anterior and posterior incidences of the body divided into 22 muscle zones (trapezius, pectoralis major, deltoid, serratus anterior, biceps brachii, latissimus dorsi, etc.).	Although there was great variability in the CK response among all subjects, the change in the activities of this augmenting enzyme was similar in each group, with no specific association with skin temperature.	Additional information about muscle work in different sports modalities can be useful in evaluating the efficiency of athletes. However, further investigation is needed to validate the results.
Andrade Fernandes et al.* (2017b)	Under-20 athletes from the 1st Brazilian soccer division *n*= 10 age: 19± 1	Skin thermal responses obtained by IRT and CK concentration were evaluated in response to two soccer matches, with 3 days of recovery between each match. Measurements were taken 24 h before and after 24 h and 48 h after the first match. Then the data were measured again 24 h before and after 24 h and 48 h of the second match.	Anterior and posterior views of the lower limbs (thigh and leg).	Tsk and CK were moderately correlated in all analyzed *ROI* s, with greater correlation in the right leg anterior (r= 0.425) and left leg anterior (r= 0.428).	After obtaining lower limb Tsk as well as CK, there was a significant change in response to two consecutive matches separated by an interval of 3 days. In addition, an overall increase in these indices was obtained in the thighs and legs in the front and back.

Continue...

Table 2. Continuation.

Bibliographic Reference	Sample	Intervention Method	Region of Interest (ROI) analyzed by thermal imaging	Results	Conclusion
Andrade Fernandes et al. (2017a)	Right-handed defender, non-smoker athlete with no recent history of injury, member of a club from the 1st Brazilian football division *n*= 1 age: 27	24 hours before, 24 and 48 hours after an official soccer match, Tsk measurements with a thermal camera and blood CK concentrations were obtained using lancing devices.	Anterior and posterior views of the lower limbs (thigh and leg).	The results showed that CK values were 193 U / L 24 hours before, rising to 1.083 U / L 24 hours after the game and 414 U / L 48 hours after the game. Qualitative analysis of thermograms showed that entire lower limbs are much warmer 24 hours after the match, and certain areas such as right anterior thigh, left anterior leg, both anterior ankles and both posterior thighs have not fully recovered their initial Tsk 48 hours after the game.	Participation in a professional football match can lead to significant increases in Tsk values measured by 24-hour IRT. Thermography could help in the training control process as part of an injury prevention program in professional football clubs.
Bandeira et al.* (2014)	Male Rugby Athletes of a National-Level Professional Club *n*= 21 age: between 19 and 31	Blood samples were taken to assess the serum CK concentration and the acquisition of infrared images of the athletes to assess the skin temperature, both 48 h after a rugby training session and 48 h after a rugby match.	Anterior and posterior views of the body, individually analysing all the main muscles and their portions.	There was no correlation between the CK variation and the mean temperature variation of the selected muscle areas. However, in the group of athletes who presented CK elevation above 50% between the first and the second time of evaluation, the muscles of the left pectoralis and the left semitendinosus presented significant differences with values of p= 0.037 and p= 0.045, respectively.	It is concluded that thermography can be used as a support method for diagnosing muscle injury in athletes.
Bandeira et al. (2012)	Male athletes of the Paraná Clube soccer team *n*= 18 age: between 15 and 17	First, a thermographic image of each athlete was captured before the start of the training session. After the training session, a blood sample was collected to verify the serum lactate level of each athlete. Subsequently, 24 hours after training, another blood collection was performed to check the serum CK level of each athlete. Another individual thermographic image was also acquired at this stage	Quadriceps femoris and specific analysis of the rectus femoris, adductor longus, vastus medialis muscles.	There was no statistically significant correlation between CK values 24 h post-training and temperature variation (24 h post-training – pre-training) in the muscles evaluated for the control group. There was a statistically significant difference in temperature (24 h post-training – pre-training) for the three muscles studied only in the experimental group.	The use of thermographic images, together with CK, is a possibility to determine the intensity and location of muscle injuries after training since the aforementioned biochemical marker cannot determine the anatomical location of the muscle injury.

Continue...

Table 2. Continuation.

Bibliographic Reference	Sample	Intervention Method	Region of Interest (ROI) analyzed by thermal imaging	Results	Conclusion
Petrofsky et al. (2012)	healthy individuals *n*= 20 age: between 20 and 40	Heat was applied for 8h immediately after an exhausting biceps exercise (4 sets of 25 repetitions with 35% of 1RM) or applied after 24 h or both. Self-reported pain perception and blood biomarkers were measured through blood collection before, immediately after and 3 h, 24 h, 48 and 72 h after the exercise session.	Incidences in 4 regions of the biceps brachii.	In all groups evaluated, there was an increase in skin temperature 24h after exercise. In the immediate heat group, CK increased within 48h. The biggest increase was in the 24h heat group, with the immediate plus 24h heat group falling in between. For the 24h heat group, CK increased to 3.280ng for 72 h. Didn't indicate association.	When heat is applied immediately to the area of exercised muscle, there is a reduction in muscle pain and an apparent acceleration in the recovery process compared to not applying heat.
Petrofsky et al. (2011)	healthy individuals *n*= 20 age: between 20 and 40	Heat was applied for 8h immediately after exhaustive biceps exercise. (25 repetitions until exhaustion with 35% of 1RM) or applied after 24 h or both. Self-reported pain perception and blood biomarkers were measured through blood collection before, immediately after and 3 h, 24 h, 48 and 72 h after the exercise session.	Incidences in 4 regions of the biceps brachii.	Muscle temperature increased at 3 and 24 hours after exercise and decreased at 48 h. Mean CK was 120.2± 28.2 ng/ml pre-exercise, with no difference between groups (p> 0.05). Didn't indicate association.	The data suggest that heat applied immediately and/or 24 hours after exercise reduces muscle pain and accelerates the healing process.

*Articles selected to compose the meta-analysis according to the eligibility criteria.

Regarding the intervention methods, all studies performed infrared thermal imaging and blood collection, obtaining, respectively, the surface temperature of the skin in the ROI and the serum levels of CK and other biomarkers. Some studies also measured other variables such as countermovement jumping (Júnior et al., 2021; Pérez-Guarner et al., 2019), perception of recovery (Carvalho et al., 2021), perception of fatigue (Barros et al., 2020; Carvalho et al., 2021; Pérez-Guarner et al., 2019), perception of pain (Barros et al., 2020; Carvalho et al., 2021; Da Silva et al., 2018; Pérez-Guarner et al., 2019; Petrofsky et al., 2011; Petrofsky et al., 2012), functional markers (heart rate, the volume of maximum oxygen, etc.) (Drzazga et al., 2018) and peak torque (Barros et al., 2020). In addition, each author performed the assessments in different time frames. Regarding stimuli (sports matches, aerobic exercises, counter-resistance exercises, etc.), the authors performed the assessments as follows: 48 h before (Pérez-Guarner et al., 2019), 24 h before (Andrade Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Pérez-Guarner et al., 2019), immediately before (Bandeira et al., 2012; Barros et al., 2020; Da Silva et al., 2018; Drzazga et al., 2018; Júnior et al., 2021; Petrofsky et al., 2011; Petrofsky et al., 2012), immediately after (Bandeira et al., 2012; Da Silva et al., 2018; Júnior et al., 2021; Neves et al., 2016), 1 h after (Drzazga et al., 2018), 3 h after (Petrofsky et al., 2011; Petrofsky et al., 2012), 24 h after (Andrade Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Carvalho et al., 2021; Matta et al., 2019; Pérez-Guarner et al., 2019; Petrofsky et al., 2011; Petrofsky et al., 2012), 48 h after (Andrade Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Barros et al., 2020; Da Silva et al., 2018; Petrofsky et al., 2011; Petrofsky et al., 2012) and 72 h after (Petrofsky et al., 2011; Petrofsky et al., 2012).

Table 3 below shows the quality assessment of studies carried out with the QUADAS-2 tool (Whiting et al., 2006) by analysing the risk of bias and concerns about the applicability and external validity of the studies, classifying them as low risk (↓), non-risk evident (?) and high risk (↑).

Considering the 13 studies reviewed, there is a general balance in obtaining results of CK increase along with skin temperature versus studies that didn't observe any association between the measures. In other words, five studies (Andrade

Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Júnior et al., 2021; Matta et al., 2019; Pérez-Guarner et al., 2019) found some association between the variables and eight studies (Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Carvalho et al., 2021; Da Silva et al., 2018; Matta et al., 2019; Petrofsky et al., 2011; Petrofsky et al., 2012) didn't find any type of association.

The result of the meta-analysis is shown in Figure 2 below. Each line of the graph, generated in the Stats Direct 3.0 tool, indicates the Pearson or Spearman correlation coefficient in each region of interest analyzed by thermal imaging in certain temporal sections evaluated by each author, with their respective *p* values inserted. In addition, the I^2 statistic = 0% (95%CI 0% – 25.8%) was observed, indicating that there isn't evidence of heterogeneity between studies. Thus, according to Figure 2, the correlation coefficient of the combined studies presented *r*= –0.05 (95%CI –0.11 – 0), with *p-value*= 0.0568, which indicates a result not significant for the association between CK and thermography.

DISCUSSION

The present study evaluated the statistical association between serum CK levels and skin temperature through a systematic review with meta-analysis. A total of 483 studies were retrieved from the databases, and 13 were selected for qualitative analysis, five of which were selected for quantitative analysis (Figure 1).

Most of the authors (Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Da Silva et al., 2018; Matta et al., 2019) who claimed not to find associations didn't present the corresponding statistical data. Furthermore, there was one author (Pérez-Guarner et al., 2019) who found an association is only one of the chosen ROIs and presented this only result, failing to present the non-association results obtained from the other ROIs. Some authors (Andrade Fernandes et al., 2017b; Barros et al., 2020; Drzazga et al., 2018; Júnior et al., 2021; Matta et al., 2019; Pérez-Guarner et al., 2019; Petrofsky et al., 2011; Petrofsky et al., 2012) presented general results, without providing the association in each chosen ROI.

Comparing the reviewed studies, the fact of obtaining a general balance between positive and negative results for the association between variables observed by the systematic review reinforces that there isn't consensus in the literature and that, consequently, there isn't a way to categorically state that there is any relationship between the variables. Da Silva et al. (2018), for example, observed that there was no association between the two variables after a muscle injury induction protocol; it can be said that in a real situation, with the analysis of training diaries and comparing with laboratory situations, it wasn't possible to see an association between muscle damage biomarkers with increased skin temperature. However, it is worth noting that a good part of the studies, such as the one by Andrade Fernandes et al. (2017b) for example, found significant associations with the justification that strenuous exercise does generate micro muscle injuries

Table 3. Results of the assessment of risks of bias and QUADAS-2 applicability of the studies included in the systematic review that associated CK with thermography.

Bibliographic Reference	Risk of Bias				Applicability Concern		
	Patient Selection	Index Test	Reference Test	Timing	Patient Selection	Index Test	Reference Test
Júnior et al. (2021)	↓	↓	↓	↓	↓	↓	↓
Carvalho et al.* (2021)	↓	↓	↓	↓	↓	↓	↓
Barros et al. (2020)	?	↓	↓	↓	↓	↓	↓
Pérez-Guarner et al.*(2019)	↓	↓	↓	↓	↓	↓	↓
Matta et al. (2019)	?	↓	↓	↓	↓	↓	↓
Da Silva et al.* (2018)	↓	↓	↓	↓	↓	↓	↓
Drzazga et al. (2018)	?	↓	↓	↓	↓	↓	↓
Andrade Fernandes et al.* (2017b)	?	↓	↓	↓	↓	↓	↓
Andrade Fernandes et al. (2017a)	↑	↓	↓	↓	↓	↓	↓
Bandeira et al. *(2014)	↓	↓	↓	↓	↓	↓	↓
Bandeira et al. (2012)	?	↓	↓	↓	↓	↓	↓
Petrofsky et al. (2012)	↓	↓	↓	↓	↓	↓	↓
Petrofsky et al. (2012)	↓	↓	↓	↓	↓	↓	↓

↓: Low risk; ↑: High risk; ?: Risk not evident; *Articles selected to compose the meta-analysis according to the eligibility criteria.

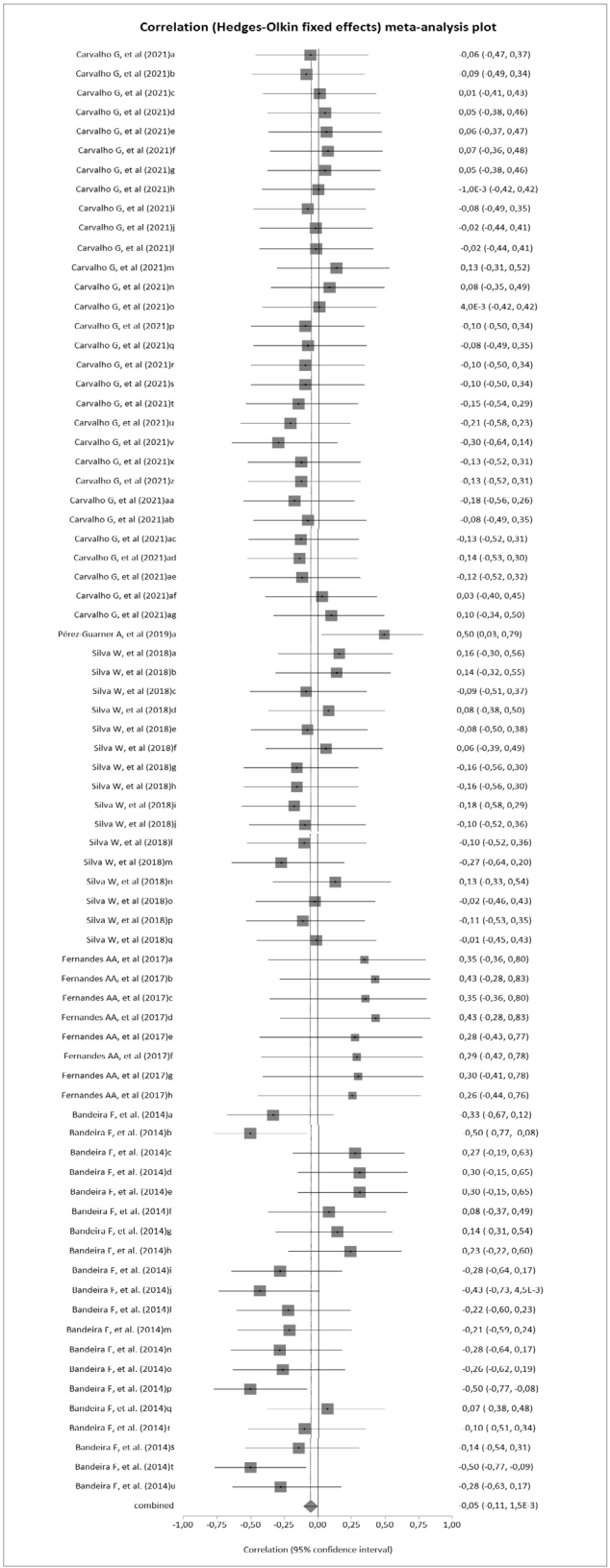

Figure 2. Hedge-Olkins Fixed Effects method meta-analysis plot: combined association between CK and thermography. Lowercase letters indicate different regions of interest (ROIs) evaluated in the same study.

that cause muscle CK to leak into the bloodstream, as well as lead to inflammatory processes that increase local temperature. However, studies recommend caution when interpreting the results, as well as reinforcing the idea of using thermography as a joint diagnostic support method, as Bandeira et al. (2014) recommends for example.

Some studies performed collections 48 h before (Pérez-Guarner et al., 2019) and 24 h before (Andrade Fernandes et al., 2017b; Neves et al., 2015; Pérez-Guarner et al., 2019), as well as immediately before (Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Barros et al., 2020; Da Silva et al., 2018; Drzazga et al., 2018; Júnior et al., 2021; Matta et al., 2019; Petrofsky et al., 2011; Petrofsky et al., 2012) and after (Bandeira et al., 2012; Barros et al., 2020; Da Silva et al., 2018; Júnior et al., 2021) and also 1 h after (Drzazga et al., 2018), 3 h after (Petrofsky et al., 2011; Petrofsky et al., 2012), 24 h after (Andrade Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Carvalho et al., 2021; Matta et al., 2019; Pérez-Guarner et al., 2019; Petrofsky et al., 2011; Petrofsky et al., 2012), 48 h after (Andrade Fernandes et al., 2017a; Andrade Fernandes et al., 2017b; Bandeira et al., 2012; Barros et al., 2020; Da Silva et al., 2018; Petrofsky et al., 2011; Petrofsky et al., 2012) and up to 72 h after (Petrofsky et al., 2011; Petrofsky et al., 2012), with each author choosing a period they deemed convenient for their intervention, causing divergences in the general comparison of studies. In addition, some authors (Bandeira et al., 2012; Barros et al., 2020; Drzazga et al., 2018; Júnior et al., 2021; Petrofsky et al., 2011; Petrofsky et al., 2012), despite having performed collections in different periods, presented statistical results of general association, while others presented results by period specifically (Andrade Fernandes et al., 2017b).

This difference in the time cut used by each author (1 h, 3 h, 24 h, 48 h, etc. after intervention) may impact the interpretation of the results since CK has its peak incidence in the bloodstream within 24 h after the stimulus, with cases in which it can increase or decrease within 72 hours (Bandeira et al., 2012). Thus, it is considered that this non-linearity of the biomarker and the fact that some blood collections were performed outside this time range after the stimulus may have affected the association between the observed CK level and skin temperature. However, heterogeneity wasn't observed among the included studies.

The results showed that thermographic evaluation isn't a recommended substitute for tests to detect the indirect biomarker CK in blood since no significant association was observed in the evaluation by meta-analysis (r= –0.05; p= 0.0568; 95%CI –0.11 – 0). In addition to the divergence in the design of the studies analyzed, this result can also be

explained based on the physiology of each of these indicators. CK is a systemic biochemical indicator present in the bloodstream, and its values can be altered by damage to inner or outer muscles. On the other hand, although body temperature is also systemic, surface skin temperature (measured by thermography) is a local indicator (Fernández-Cuevas et al., 2015), reinforcing the lack of association.

In addition, skin temperature can be influenced at times due to inflammation or infection, fractures, oedema, etc. (Fernández-Cuevas et al., 2015). CK values, on the other hand, aren't necessarily modified by these types of alterations, except when they result from a muscle injury (Bandeira et al., 2012). Another factor to be considered is that each individual may present different levels of this biomarker, and some individuals may reach this CK peak in the bloodstream within 72 hours (Bandeira et al., 2012).

Bandeira et al. (2012) already stated that thermography associated with the use of CK could be used as a complementary method for locating muscle injuries in athletes, suggesting, however, opting for visual inspection of thermal images. The results found in this meta-analysis reinforce the practical applicability of thermography, like the fact that no significant association was found between serum CK levels, as well as the association between thermographic assessment and the risk of injury (Santos Bunn et al., 2020), which reinforces the idea of using thermal imaging in sports as a complementary method to more invasive exams for the assessment of athletes and, mainly, in the diagnosis and prevention of injuries, because when there is an association between two methods, it isn't necessary to use both, as from one of them it would be possible to estimate the other.

Thus, the main limitations of the evidence included in the review are related to the limited provision of statistical data, as well as the lack of magnitude and quantity of results. When comparing serum CK levels and thermography, there is a lack of presentation of correlation coefficients.

Limitations of this study can be mentioned: the scarcity of studies specifically looking for the association between serum CK levels and thermography, the diversity of different study designs, and, as mentioned in the previous paragraph, the lack of objective records of the relationship between serum CK levels and skin temperature.

To provide a perspective for future studies, we suggest the scientific community carry out further research seeking the association between serum CK levels and thermography in sports that have a low possibility of trauma due to contact between athletes since this can represent an intervening variable in the study impacting the interpretation of infrared images. Another suggestion is to search for this association in sports activities, whose primary motor muscles are superficial, such as cycling and hard running, making it easier and more accurate to identify, through thermal images, possible muscle damage that will also lead to an increase in CK.

CONCLUSION

Considering the parameters related to the use of thermography in this systematic review with meta-analysis, it can be concluded that there is no association between serum CK levels and thermography results. In clinical practice, it is recommended to use infrared thermal images in complement to the assessment of serum CK levels to assist in the determination of differential diagnoses of musculoskeletal injuries.

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ARTIGO DE REVISÃO

https://doi.org/10.6063/motricidade.26884

Alongamentos no tratamento de fascite plantar

Use of stretching in the treatment of plantar fasciitis

João Miguel Figueiral Ferreira[1]*, Silvana Ferreira[1], Marta Martins[1], Ana Paula Pinheiro[1]

RESUMO

O objetivo deste trabalho foi determinar se exercícios de alongamento em pacientes com fascite plantar são benéficos na melhoria da dor. Para isso foram pesquisados estudos controlados aleatorizados, publicados nos últimos 10 anos na PubMed (*n*= 29), Cochrane (*n*= 30) e PEDro (*n*= 28). Foi investigado o efeito de exercícios de alongamento em doentes com fascite plantar na dor comparado com outros tipos de intervenção ou sem intervenção. Os artigos foram avaliados quanto ao risco de viés pela RoB2, o nível de evidência e força de recomendação pela SORT. Após aplicação dos critérios de elegibilidade, dos 87 artigos pesquisados, resultaram 3 artigos. Os exercícios de alongamento da fáscia plantar mostram-se mais eficazes que anti-inflamatório não esteroide oral e alongamentos do gastrocnémio e tão eficazes como palmilhas de silicone associadas a calor. No entanto, quando comparados os alongamentos da fáscia plantar e tendão de Aquiles com proloterapia com lidocaína, a primeira intervenção evidencia resultados inferiores. Já o uso de *foam roller* apresentou melhores resultados em 2 dos *outcomes* estudados, não havendo diferença estatisticamente significativa nos restantes. Os alongamentos parecem ter lugar no tratamento da fascite plantar, existindo métodos que podem ser mais eficazes, nomeadamente a proloterapia e exercícios com *foam roller*.

PALAVRAS-CHAVE: fascite plantar; fasciíte plantar; exercício de alongamento; alongamentos; exercícios de alongamento muscular.

ABSTRACT

The objective of this research was to determine whether stretching exercises in patients with plantar fasciitis are beneficial in improving pain. Randomized controlled clinical studies published in the last 10 years were searched in PubMed (*n*= 29), Cochrane (*n*= 30) and PEDro (*n*= 28). The effect of stretching exercises in patients with plantar fasciitis on pain compared with other types of intervention or no intervention was investigated. Articles were evaluated for risk of bias using RoB2 and the level of evidence and strength of recommendation applying SORT. This research resulted in 87 articles, which, after applying the eligibility criteria, resulted in 3 articles. Plantar fascia stretching exercises are shown to be more effective than oral non-steroidal anti-inflammatory drugs and may be more effective than calf stretches and as effective as heat associated silicone heel pads. However, the first intervention shows inferior results when comparing plantar fascia and Achilles tendon stretching with lidocaine prolotherapy. Additionally, foam roller use presented better results in 2 of the outcomes studied, with no statistically significant difference in the remaining. Stretching seems to have a place in the treatment of plantar fasciitis, but there are methods that may be more effective, namely prolotherapy and foam roller exercises.

KEYWORDS: plantar fasciitis; stretching exercises; stretching; muscle stretching exercises.

INTRODUÇÃO

A fascite plantar é um dos problemas mais comuns ao nível do pé, sendo caracterizada pela presença de alterações degenerativas da fáscia plantar resultantes do seu sobreuso (Boonchum et al., 2020; Luffy et al., 2018; Siriphorn & Eksakulkla, 2020; Trojian & Tucker, 2019). Na grande maioria das situações, os achados clínicos resultantes da anamnese e exame objetivo são suficientes para efetuar o diagnóstico (Luffy et al., 2018; Siriphorn & Eksakulkla, 2020; Trojian & Tucker, 2019). Ainda assim, o recurso a exames de imagem

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Conflito de interesses: nada a declarar. Financiamento: nada a declarar.
Recebido: 31/03/2022. Aceito: 05/06/2022.

pode auxiliar na sua confirmação e na exclusão de diagnósticos diferenciais (Luffy et al., 2018; Trojian & Tucker, 2019).

A combinação de abordagens de tratamento conservador é a opção mais comummente utilizada, tendo um prognóstico habitualmente favorável, com 70 a 80% dos pacientes a apresentarem diminuição das queixas álgicas apenas com este tipo de tratamento (Luffy et al., 2018; Siriphorn & Eksakulkla, 2020). Uma vez que um dos possíveis fatores de risco associados a esta condição é a limitação da amplitude de movimento de dorsiflexão, com presença de retração ao nível da fáscia plantar, do tendão de Aquiles e do músculo gastrocnémio, a utilização de alongamentos enquanto estratégia de intervenção ganha importância (Boonchum et al., 2020; Luffy et al., 2018; Siriphorn & Eksakulkla, 2020; Trojian & Tucker, 2019). Apesar de não existir um tratamento estandardizado para todos os casos de fascite plantar, os alongamentos são um recurso frequentemente implementado,dado serem uma intervenção com baixos custos associados e existir a possibilidade de ser executada em contexto domiciliário de forma autónoma (Boonchum et al., 2020; Luffy et al., 2018; Schneider et al., 2017). Ainda assim, destaca-se a existência de pelo menos uma revisão sistemática previamente publicada por Siriphorn e Eksakulkla (2020) em que os alongamentos são comparados a outras estratégias terapêuticas. No entanto, este estudo admitiu como intervenção que os exercícios de alongamento fossem aplicados com outras intervenções terapêuticas adicionais o que dificulta a compreensão da estratégia de tratamento que foi eficaz. Além disso, este trabalho sugere que nova pesquisa fosse conduzida sobre esta temática, uma vez que não conseguiram apresentar conclusões claras e robustas. Por isso, uma vez que, desde a data da sua redação, surgiram novos trabalhos de relevo acerca desta temática torna-se pertinente perceber se é possível tecer conclusões mais orientativas.

Deste modo, o objetivo do presente trabalho é analisar o efeito na dor da utilização de exercícios de alongamento no tratamento da fascite plantar comparando-os com o efeito de outras abordagens terapêuticas utilizadas nesta patologia, placebo ou ausência de tratamento.

MÉTODO

Estratégia de pesquisa

A presente revisão sistemática foi conduzida de acordo com as orientações de *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) e a estratégia população-intervenção-comparação-*outcomes*-desenho de estudo (PICOS) (Page et al., 2021). Foram pesquisadas nas bases de dados PubMed (MEDLINE), Cochrane (CENTRAL) e PEDro (Physiotherapy Evidence Database).

Os critérios de elegibilidade foram assegurados pela estratégia PICOS. Assim, a população considerada foram indivíduos adultos com diagnóstico de fascite plantar. Os exercícios de alongamento das estruturas adjacentes à fáscia plantar foi a intervenção avaliada. Por sua vez, os exercícios de alongamentos foram comparados com outras intervenções terapêuticas, placebo ou, se caso disso, ausência de intervenção. O *outcome* de interesse foi o impacto dos tratamentos na dor. Por fim foram pesquisados estudos controlados aleatorizados (ECA).

Foi utilizada uma combinação de palavras-chave presentes no título e/ou resumo e de descritores MeSH (Medical Subject Headings) através dos operadores booleanos. Foram pesquisados os termos: ("Fasciitis, Plantar"[MeSH] OR "plantar fasciitis") AND ("Muscle Stretching Exercises"[MeSH] OR "stretch*"). Foram também aplicados filtros de pesquisa no que diz respeito ao desenho de estudo (estudos controlados aleatorizados), à data de publicação (nos últimos 10 anos) e língua (inglês e português).

Critérios de elegibilidade

Os seguintes critérios de inclusão foram considerados: população de ambos os sexos com idade igual ou superior a 18 anos; presença de fascite plantar sintomática; participantes com capacidade de compreender e executar as atividades solicitadas; estudos que abordassem o uso de qualquer protocolo de exercícios de alongamento de estruturas adjacentes à fáscia plantar (fáscia plantar e gastrocnémio); estudos que comparassem esses exercícios de forma direta com outras intervenções ou não intervenção; estudos que avaliassem o impacto destas medidas na melhoria da dor, através de qualquer instrumento de avaliação com esse propósito; estudos controlados aleatorizados (ECA).

Foram excluídos: estudos em que os participantes apresentassem comorbilidades do sistema musculoesquelético que condicionassem sintomas semelhantes aos de fascite plantar e/ou a capacidade de desempenhar as atividades pedidas; estudos que aplicassem alongamentos como co-intervenção; estudos que não avaliassem como intervenção exercícios de alongamento das estruturas envolvidas na fascite plantar; intervenções em que existisse dúvida se esse propósito seria alcançado; estudos que não avaliassem de alguma forma o *outcome* dor; artigos que apresentassem outro tipo de desenho de estudo.

A pesquisa foi limitada a artigos originais publicados online, em inglês ou português, até 18 de janeiro de 2022, sendo considerados apenas os artigos publicados até 10 anos antes dessa data.

Processo de seleção

Os artigos duplicados foram removidos antes da aplicação dos critérios de elegibilidade. Os artigos foram avaliados por dois revisores quanto ao cumprimento dos critérios de inclusão e exclusão. Foram avaliados de forma sequencial quanto ao título, resumo e artigo, pelos autores de forma independente. As divergências foram resolvidas pela discussão da interpretação dos critérios de elegibilidade até ser obtido consenso. Caso tal não fosse conseguido, um terceiro revisor seria consultado.

Avaliação do risco de viés, níveis de evidência e força de recomendação

A avaliação do risco de viés realizada por dois revisores com recurso à *Cochrane Risk of Bias Tool version* 2.0 (RoB2) para os seus cinco domínios: processo de randomização, desvios da intervenção pretendida, dados de *outcomes* em falta, medidas de *outcome* e seleção dos resultados reportados. Para avaliação do nível de evidência e força de recomendação foi utilizada a *Strength of Recommendation Taxonomy* (SORT).

RESULTADOS

A pesquisa de literatura resultou num total de 87 estudos controlados aleatorizados. Após a aplicação dos critérios de elegibilidade e da remoção de artigos duplicados, 3 estudos foram incluídos nesta revisão conforme apresentado no fluxograma seguinte (Figura 1).

A Tabela 1 sumariza a caracterização das amostras dos estudos incluídos nesta revisão. Não se observou a repetição de comparadores entre os estudos analisados. Assim, os exercícios de alongamento foram comparados com

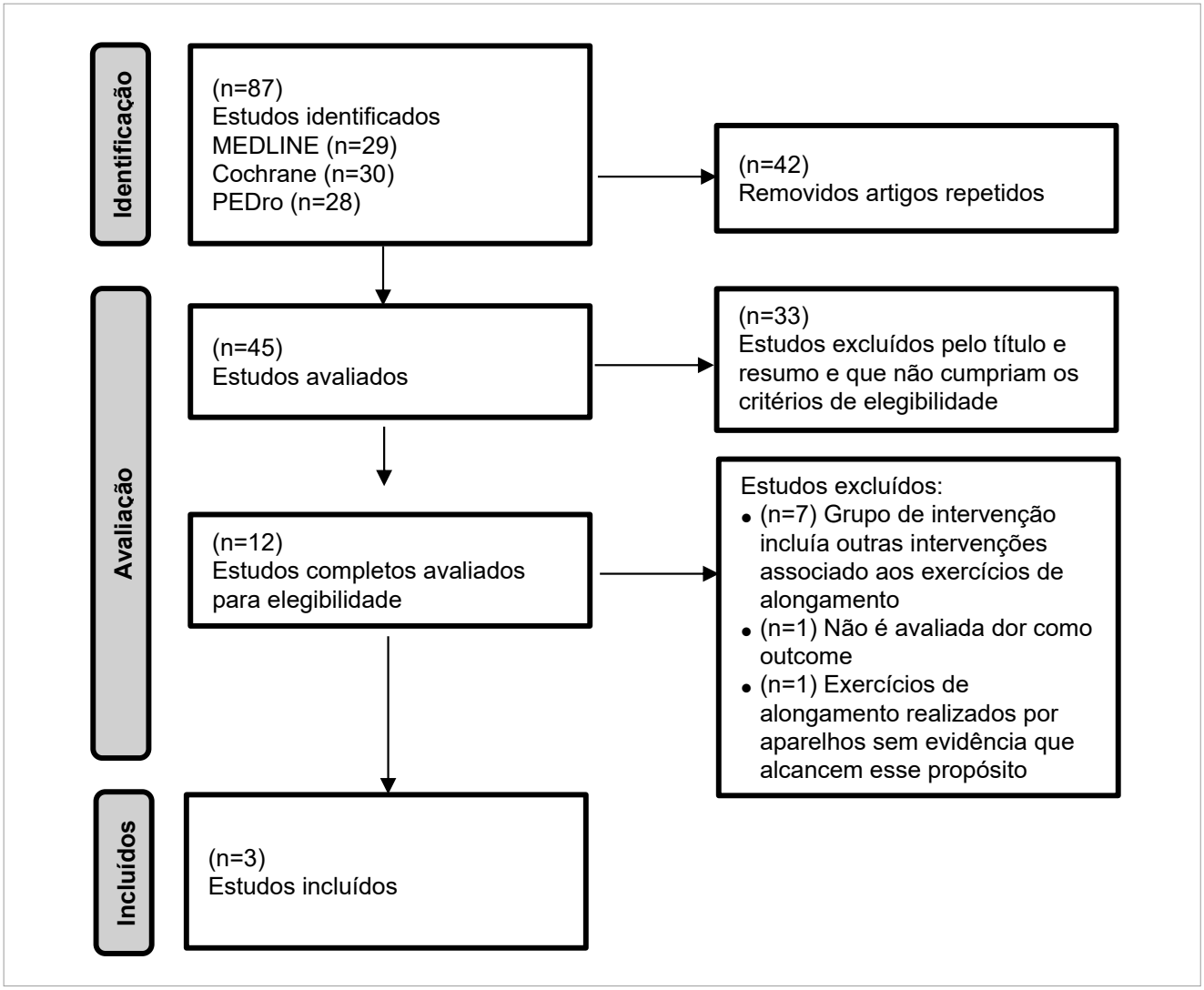


Figura 1. Fluxograma da exclusão e seleção dos estudos.

proloterapia, analgesia farmacológica, palmilhas de silicone associadas à aplicação de calor e exercícios com *foam roller,* conforme apresentado na Tabela 2 que apresenta a descrição das metodologias utilizadas, *outcomes* avaliados, resultados e nível de evidência.

A avaliação do risco de viés, apresentada na Figura 2, foi dificultada pela ausência de dados, não sendo revelado em nenhum dos artigos se existiu ocultação da alocação. Além disso, na maioria das intervenções analisadas não foi possível realizar ocultação aos investigadores ou participantes, contudo Gupta et al. (2020) tentaram realizar ocultação dos diferentes tipos de alongamentos realizando falsos exercícios com esse propósito.

DISCUSSÃO

No trabalho de Ersen et al. (2018) observam-se diferenças estatisticamente significativas a favor da proloterapia em comparação com os alongamentos da fáscia plantar e tendão de Aquiles nos *outcomes* VAS (*Visual Analog Scale*) e FAOS (*Foot and Ankle Outcome Score*) (aos 42, 90 e 360 dias) e FFI (*Foot Function Index*) (aos 42 e 90 dias). Os aparentes benefícios da proloterapia parecem estar de acordo com as revisões de Lai et al. (2021) e Sanderson e Bryant (2015). Já Gupta et al. (2020) destacaram os resultados sem diferença estatisticamente significativa entre a aplicação de calor com palmilhas de silicone, alongamento ativo da fáscia plantar e alongamento ativo do gastrocnémio no que diz respeito ao *outcome* FFI e nos *outcomes* das duas primeiras intervenções quanto ao *outcome* FADI (*Foot and Ankle Disability Index*). O grupo tratado com anti-inflamatórios não esteroides (AINEs) mostrou, no entanto, resultados inferiores aos outros grupos. Li et al. (2019) já teriam apresentado o uso de AINEs como uma alternativa que, apesar de mais eficaz que placebo, apresenta menor eficácia que outras opções avaliadas nessa meta-análise. Gupta et al. (2020) destacam, ainda, o efeito superior dos alongamentos específicos da fáscia plantar quando comparado com os alongamentos específicos do gastrocnémio, estando em concordância com a revisão sistemática e meta-análise de Siriphorn and Eksakulkla (2020). Por outro lado, Ranbhor et al. (2021) identificaram diferenças estatisticamente significativas a favor da utilização de *foam roller* nos exercícios dirigidos à fáscia plantar e ao gastrocnémio nos *outcomes* PPT (*Pain Pressure Threshold*) do gastrocnémio e solear, mas sem diferença estatisticamente significativa na VAS ou PPT da fáscia plantar, instrumentos que, discutivelmente, são mais direcionados aos resultados avaliados nesta revisão. O uso de *foam roller* já tinha sido previamente identificada como eficaz na abordagem da fascite plantar no trabalho de Hameed e Srivastava (2020).

Implicações clínicas

Apesar da menor eficácia dos AINEs, continuam a ser uma opção terapêutica que, sendo prescrita ou não, é utilizada como uma alternativa acessível para controlo da dor (Nahin, 2018). Desta forma, os exercícios de alongamento devem ser considerados parte integrante do tratamento conservador da fascite plantar, uma vez que apresentam custo reduzido, facilidade de reprodução em contexto domiciliário e efeitos secundários negligenciáveis, tornando-os uma opção a ter em conta (Siriphorn & Eksakulkla, 2020). Assim, a acessibilidade e segurança dos alongamentos torna-os uma alternativa importante na prática clínica. Contudo, não pode ser descurada a evidência de que existem tratamentos mais eficazes.

Tabela 1. Caracterização dos participantes recrutados para os estudos incluídos nesta revisão.

Autores (Ano)	Título	Desenho de Estudo	Caracterização da Amostra	
			Tamanho da Amostra (M, F)	Média de Idades± DP
Ersen et al. (2018)	*A randomized-controlled trial of prolotherapy injections in the treatment of plantar fasciitis.*	Estudo Controlado Aleatorizado	GI: 26 (5, 21) GC: 25 (6, 19)	GI: 45.1± 6.7 GC: 46.3± 7.6
Gupta et al. (2020)	*Comparing the Role of Different Treatment Modalities for Plantar Fasciitis: A Double Blind Randomized Controlled Trial.*	Estudo Controlado Aleatorizado	Total: 156 (51, 105) G1: n.d. G2: n.d. G3: n.d. G4: n.d.	Total: 43.4± 10.6 G1: n.d. G2: n.d. G3: n.d. G4: n.d.
Ranbhor et al. (2021)	*Immediate effect of foam roller on pain and ankle range of motion in patients with plantar fasciitis: A randomized controlled trial.*	Estudo Controlado Aleatorizado	GI: 25 (18, 7) GC: 25 (18, 7)	GI: 33.08± 10.83 GC: 38.28± 13.67

DP: desvio padrão; GI: Grupo de intervenção; GC: Grupo de controlo; M: género masculino; F: género feminino; n.d.: não descrito.

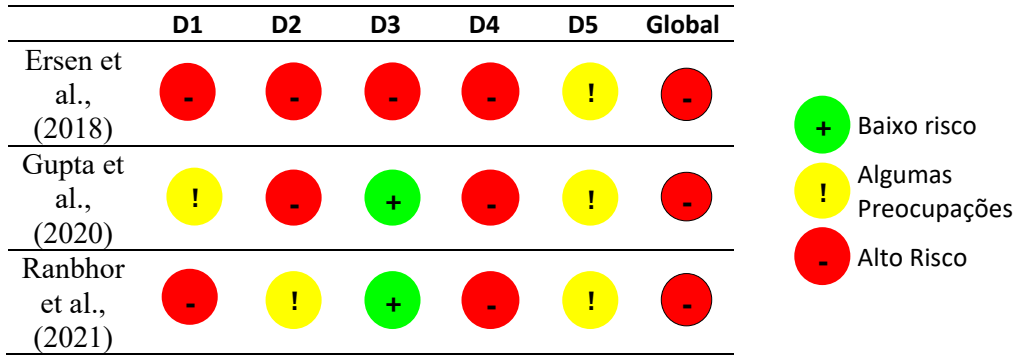
Limitações

A dor é um elemento avaliado pelos vários instrumentos de medida implementados, tanto de forma direta (VAS, PPT) como sob a forma de componente/domínio de questionários específicos (FFI, FAOS, FADI). Assim sendo, em todos os estudos incluídos é apresentada informação que engloba pontos como a dor e a funcionalidade, ainda que não exista uniformização do instrumento usado entre os estudos, o que dificulta a interpretação dos resultados.

Tabela 2. *Sumário das intervenções, outcomes, resultados e avaliação do nível de evidência.*

Autores (Ano)	Intervenção		Outcomes		Resultados	NE
	Caracterização	Aplicação	Instrumentos de Medição	Momentos de Avaliação		
Ersen et al. (2018)	GI: proloterapia guiada por ecógrafo (3.6 mL dextrose a 15% e 0.4 mL de lidocaína) administrada em 5 pontos da fáscia plantar. GC: exercícios de alongamento da fáscia plantar e tendão de aquiles.	GI: 3 injeções administradas a cada 3 semanas. GC: exercícios implementados conforme o descrito por DiGiovanni et al. (2006) com uma frequência de 3 vezes por semana ao longo de 3 meses.	*10-point Visual Analog Scale* (VAS) *Food and Ankle Outcome Score* (FAOS) *Foot Function Index* (FFI)	*Baseline* e aos 21, 42, 90 e 360 dias.	Diferenças estatisticamente significativas a favor do GI em VAS, FAOS (42, 90, 360 dias) e FFI (42, 90 dias).	2
Gupta et al. (2020)	G1: tratamento AINEs. G2: aplicação de calor combinada com o uso de palmilhas de silicone. G3: alongamento ativo da fáscia plantar e placebo do gastrocnémio. G4: alongamento ativo do gastrocnémio e placebo da fáscia plantar.	G1: 75mg Indomethacin uma vez por dia ao longo de um período máximo de 3 semanas. G2: aplicação de calor por 20 minutos por noite e uso de palmilhas durante as atividades da vida diária. G3: alongamento realizado 2 vezes por dias, sendo mantido por 10 segundos ao longo de 15 repetições. G4: alongamento realizado 2 vezes por dias, sendo mantido por 10 segundos ao longo de 15 repetições.	*Foot Function Index* (FFI) *The Foot and Ankle Disability Index* (FADI)	Semanalmente ao longo dos primeiros 4 meses, aos 6, 8 10 e 12 meses.	Diferenças estatisticamente significativas entre G1e G2, G1 e G3, G1 e G4 em FFI com piores resultados em G1; diferenças estatisticamente significativas entre G1 e G2, G1 e G3, G1 e G4, G3 e G4 em FADI, não favorecendo G1 e G4.	2
Ranbhor et al. (2021)	GI: exercícios com *foam roller* (gastrocnémio e fáscia plantar) GC: auto-alongamento (gastrocnémio e fáscia plantar)	GI: alongamentos mantidos por 45 segundos seguidos de 15 segundos de repouso, sendo realizadas 5 repetições dos mesmos. GC: alongamentos mantidos por 45 segundos seguidos de 15 segundos de repouso, sendo realizadas 5 repetições dos mesmos.	*Visual Analog Scale* (VAS) *Pain Pressure Threshold* (PPT)	Antes e imediatamente após a implementação da intervenção.	Sem diferença estatisticamente significativa na VAS e PPT da fáscia plantar. Diferenças estatisticamente significativa a favor do GI em PPT do gastrocnémio e solear.	2

NE: Nível de Evidência; GI: Grupo de intervenção; GC: Grupo de controlo; AINEs: Anti-inflamatórios Não Esteroides.



D1: Processo de randomização; D2: Desvios da intervenção pretendida; D3: Dados de *outcomes* em falta; D4: Medidas de *outcome*; D5: Seleção dos resultados reportados.

Figura 2. Avaliação do risco de viés através da Risk of Bias. Tool version 2.0.

Os exercícios de alongamento da fáscia plantar e do gastrocnémio/tendão de Aquiles implementados nos estudos aqui incluídos foram os mesmos, diferindo na frequência, séries, repetições. Tal facto, constitui uma limitação na compreensão do real efeito desta abordagem na fascite plantar. Para além disso, a intervenção baseada em alongamentos empregue por Ranbhor et al. (2021) teve lugar em apenas um episódio de tratamento ao contrário dos restantes estudos em análise nesta revisão, que se estenderam durante um período mais alargado. Essa característica deve-se ao objetivo definido pelos autores de compreender os efeitos imediatos da utilização de *foam roller* enquanto abordagem de libertação miofascial (Ranbhor et al., 2021). Por outro lado, os períodos de *follow-up* especificados por Ersen et al. (2018) e por Gupta et al. (2020) foram de 360 dias e 12 meses, respetivamente. No entanto, é referido por outros estudos que cerca de 80% dos pacientes com fascite plantar apresentam melhoria dos sintomas em 12 meses com tratamento conservador (Luffy et al., 2018; Trojian & Tucker, 2019). Este fator pode, também, constituir uma limitação uma vez que poderá influenciar as conclusões expostas pelos autores, nomeadamente no estudo de Gupta et al. (2020) que, apesar de avaliações intermédias, apenas analisam os resultados da avaliação realizada ao final de 1 ano.

As características da literatura que cumpriu os critérios de elegibilidade aqui definidos também constituem uma limitação. Por um lado, o risco de viés associado a cada um dos estudos incluídos foi elevado, destacando-se negativamente os domínios processo de randomização (D1), desvios da intervenção pretendida (D2) e medidas de *outcome* (D4). Por outro lado, verificou-se uma grande diversidade de comparadores e a inexistência de comparação com placebo ou com não-intervenção. Deste modo, é aconselhada ponderação na interpretação dos resultados obtidos.

Seria pertinente que investigação futura conseguisse uniformizar os instrumentos para avaliar a dor e diferenciar as estruturas em foco (fáscia plantar, gastrocnémio/tendão de Aquiles ou a combinação das duas) bem como as características dos exercícios de alongamento (como frequência, repetições, duração, por exemplo). Para além disso, nos estudos com *follow-up* de maior duração, os resultados intermédios serão também relevantes para perceber os efeitos das intervenções em estudo.

CONCLUSÕES

Os exercícios de alongamento mostraram-se menos eficazes que a proloterapia e exercícios com recurso a *foam roller* e tão eficazes como o uso de palmilhas associado à aplicação de calor. Ainda assim, verificaram-se resultados favoráveis da realização de alongamentos da fáscia plantar quando comparado com o uso de AINEs. Deste modo, os alongamentos devem ser uma estratégia conservadora na abordagem de tratamento da fascite plantar (Força de Recomendação: B).

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ARTIGO DE REVISÃO

https://doi.org/10.6063/motricidade.26923

O papel do técnico de exercício físico como promotor da qualidade de vida na Dificuldade Intelectual e Desenvolvimental

The role of the physical exercise technicians as a promoter of quality of life in Intellectual Disability

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RESUMO

Esta revisão narrativa tem como objetivo examinar as evidências atuais que suportam a importância do exercício físico e o papel do técnico de exercício físico como promotor de educação para a cidadania, da aptidão física e o seu impacto no desempenho das atividades de vida diária e, por conseguinte, da qualidade de vida de indivíduos com Dificuldade Intelectual e Desenvolvimental. Várias questões são elencadas, de modo a perceber as razões para as elevadas taxas de sedentarismo nesta população, o porquê da escassez de estudos experimentais, quem são os intervenientes na avaliação, prescrição e condução dessas atividades, qual a formação dos intervenientes e que cuidados devem ter com a referida população, no qual, através da uma reflexão suportada pela evidência científica, tentar-se-á dar resposta. Em termos de resultados é clara necessidade do mercado de técnicos de exercício físico com formação de base na área das ciências do desporto e específica em atividades físicas adaptadas, no desenrolar de funções, tarefas e atividades com indivíduos com Dificuldade Intelectual e Desenvolvimental, seja em contexto de ensino regular, de *fitness* ou modalidade desportiva e, consequentemente, promotores de qualidade de vida em indivíduos com Dificuldade Intelectual e Desenvolvimental.

PALAVRAS-CHAVE: dificuldade intelectual e desenvolvimental; prescrição; técnico de exercício físico; qualidade de vida.

ABSTRACT

This narrative review aims to examine the current evidence that supports the importance of physical exercise and the role of the technicians as a promoter of citizenship education, physical fitness and its impact on the performance of activities of daily living and, therefore, on the quality of life of individuals with Intellectual and Developmental Disabilities. Several questions are listed in order to understand the reasons for the high rates of a sedentary lifestyle in this population, the reason for the scarcity of experimental studies, who are the actors in the evaluation, prescription and conduct of these activities, what the training of the actors is and what care should be taken. have with that population, in which, through a reflection supported by scientific evidence, an attempt will be made to respond. Results show a clear need in the market for physical exercise technicians with basic training in the area of sports sciences and specifically in adapted physical activities, in the development of functions, tasks and activities with individuals with Intellectual and Developmental Disabilities, whether in the context of regular education, fitness or sport and, consequently, promoters of quality of life in individuals with Intellectual and Developmental Disabilities.

KEYWORDS: intellectual disability; physical exercise technician; prescription; quality of life.

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Conflito de interesses: nada a declarar. Financiamento: Fundação para a Ciência e Tecnologia, I.P., no âmbito do projeto UIDB/04748/2020.
Recebido: 05/04/2024. Aceito: 19/09/2022.

INTRODUÇÃO

O exercício físico (EF), a atividade física (AF) e o desporto são conceitos que, por vezes, são confundidos, misturados ou usados de forma incorreta. O conceito de AF pode ser descrito como: "qualquer movimento voluntário produzido pelo músculo-esquelético e que resulta num aumento do metabolismo basal" (Caspersen et al., 1985) e, segundo a Organização Mundial da Saúde (2020), a sua prática regular pode prevenir e ajudar a controlar doenças metabólicas e cardiovasculares, tendo um papel fundamental na saúde mental e qualidade de vida (QV). Por sua vez, o EF contempla um planeamento sistemático de AF, com uma estrutura e repetição definidas, tendo em vista manter ou melhorar uma ou mais componentes da aptidão física, nomeadamente, a força, a capacidade cardiorrespiratória, o equilíbrio e a flexibilidade (Caspersen et al., 1985). Outro conceito importante a ter em consideração é o desporto. Segundo a Carta Europeia do Desporto (Ministério da Educação, 1992), nomeadamente no Artigo 2º: "Entende-se por Desporto todas as formas de atividade física que, através de uma participação organizada ou não, têm por objetivo a expressão ou o melhoramento da condição física e psíquica, o desenvolvimento das relações melhoramento da condição física e psíquica, o desenvolvimento das relações sociais ou a obtenção de resultados na competição a todos os níveis."

O desporto é um direito transversal a todos os indivíduos, conforme o Artigo 2.º da Lei n.º 5/2007 - Diário da República n.º 11/2007, Série I de 2007-01-16 – Lei de Bases da Atividade Física e do Desporto e a Constituição da República Portuguesa, na 7.ª revisão constitucional (2005), através do Artigo 79.º e constitui um fator indispensável na formação do indivíduo e no desenvolvimento da sociedade.

O desporto e a educação estão interligados, na medida em que assentam os seus valores na educação, convívio, amizade, confiança, solidariedade e autonomia, objetivando o desenvolvimento da personalidade e da cidadania, sendo, por isso, o desporto útil à sociedade (Marques, 2001). Para Sarmento (2020), o desporto, mais do que um espetáculo, é uma prática social e educativa, promovendo o desenvolvimento orgânico da aptidão física e da saúde (composição corporal, higiene, entre outros), permitindo um entendimento do valor do corpo (superação e limites) e, por outro lado transmitindo os valores da cooperação, trabalho em grupo e respeito pelo outro. Através do desporto, podemos também trabalhar e desenvolver as competências de vida, nomeadamente intelectuais, cognitivas, motoras e físicas (Gomes & Resende, 2020).

A população com Dificuldade Intelectual e Desenvolvimental (DID) é caracterizada por um défice de funcionamento intelectual e adaptativo nos domínios conceptual, social e prático. De igual modo, é identificada com os níveis: leve, moderado, grave e profundo, de acordo com o seu quociente de inteligência e desenvolve-se antes dos 18 anos na perspetiva da *American Psychiatric Association* (2013) ou dos 22 no modelo teórico de Schalock et al. (2021). De referir que a nomenclatura DID, veio substituir os termos anteriormente utilizados "deficiência mental" e "atraso mental", na convicção que é um termo menos ofensivo para os indivíduos e foi proposto pela *American Association on Intellectual and Developmental Disabilities* (AAIDD) (Schalock et al., 2021). Apesar de existirem várias subpopulações com DID, com as suas características heterogéneas, a maioria da literatura apenas se foca nos indivíduos com e sem Síndrome de *Down*.

Em Portugal, segundo os Censos 2001 (INE, 2002), o número de pessoas com deficiência era de 636.059 pessoas, numa população com um total de 10.3 milhões de habitantes, ou seja, 6.13% da população tinha algum tipo de deficiência. A partir dos Censos 2011 (INE, 2012), existiu uma alteração metodológica ao nível da recolha de dados sobre a deficiência, passando a privilegiar-se a funcionalidade/incapacidade/dificuldade como resultado da interação do indivíduo no contexto. As questões de avaliação com base no diagnósticos, foram alteradas e passaram a retratar as limitações ou o grau de dificuldade dos indivíduos, face a situações reais do dia a dia (ver, ouvir, andar, memória, concentração, tomar banho/vestir-se sozinho e compreender/fazer-se entender) (INE, 2011). Apesar de se integrarem os indivíduos com DID nos dados da população em geral, em Portugal, este facto impossibilita a sua quantificação, ao certo. Contudo, segundo os dados dos Censos 2011 (INE, 2012), 17.79% da população com 5 ou mais anos e 49.51% da população com 65 ou mais anos declaram ter dificuldade em realizar pelo menos uma das 6 atividades diárias referidas anteriormente.

Segundo o instituto Instituto Português do Desporto Juventude (2016) as seguintes características podem estar presentes num indivíduo com DID: baixa inteligência, défice de comportamentos adaptativos, nomeadamente no que diz respeito aos cuidados pessoais (hábitos à mesa, locomoção, higiene e vestuário), capacidades de comunicação, como a linguagem falada, escrita, atividade numérica e desenvolvimento de conceitos temporais e sociais, bem como de ocupação (atividades domésticas, recreativas, comportamento em sala de aula, sexualidade, agilidade, destreza, concentração, responsabilidade, capacidade de cumprir ordens e inserção num grupo).

Desde a década de 90 do século passado, a palavra inclusão tem estado na vanguarda e tem sido associada à pessoa com deficiência. Em Portugal, vários passos têm sido dados para uma verdadeira inclusão das pessoas com deficiência na

sociedade, nomeadamente com a apresentação da Estratégias Nacional para a Inclusão das Pessoas com Deficiência 2021-2025 (ENIPD 2021-2025), sendo um objetivo estratégico, na medida em que se pretende valorizar todos os cidadãos e cidadãs, potenciando-as e capacitando-as. Contudo, aparentando ser uma palavra efetuosa, a palavra inclusão acarreta um preconceito carregado de exclusão. Para incluir, significa que algo foi planeado sem pensar uma determinada dimensão ou incluir quem está excluído. Daí, surgiu o conceito integrar, no qual o indivíduo com deficiência deve ser integrado nas aulas de educação física, no ginásio, na sociedade em geral. De igual modo o estigma e o preconceito ainda são frequentes para com esta população (Reis et al., 2019), o que pode estar relacionado com a exclusão da sua participação em atividades na sociedade e despreocupação com as suas vontades, objetivos e QV, que foi evidente durante longos anos.

Através de uma reflexão da informação extraída pela revisão narrativa de literatura, sintetizada e estruturada em torno dos temas/termos: 1) EF; 2) DID; 3) técnico de EF, o presente estudo tem como objetivo examinar as evidências científicas que suportam a importância do EF e ao papel do técnico de EF como promotor da aptidão física e o seu impacto no desempenho das atividades de vida diária e, por conseguinte, da QV de indivíduos com DID.

METODOLOGIA

As revisões narrativas são abordagens válidas para conhecimento geral, englobando informação ampla sobre um tema específico, de forma coesa e organizada, apesar de não serem utilizadas descrições metodológicas detalhadas e restritivas das revisões sistemáticas (Bettany-Saltikov, 2010).

Em termos metodológicos, foi utilizada uma pesquisa bibliográfica nas bases de dados: *Pubmed* (título e resumo), *Web of Science* (título, resumo e palavras-chave), *Scopus* (título, resumo e palavras-chave) e *SPORTDiscus* (título, resumo e palavras-chave). A pesquisa foi atualizada até ao dia 18 de março de 2022 e foram utilizadss os seguinte termos de pesquisa nas diferentes bases de dados: *("intellectual disability" OR "intellectual disabilities" OR "mental retardation" OR "down syndrome") AND ("fitness professional" OR "exercise professional" OR "fitness instructor" OR "exercise instructor" OR "personal trainer" OR "physical education teacher" OR "professional development").*

Desenvolvimento

A presente revisão narrativa examina as evidências científicas que relacionam o EF e o papel do técnico de EF à promoção aptidão física, desempenho das atividades de vida diária e, por conseguinte, da QV de indivíduos com DID. Tendo em consideração a abrangência de informação recolhida, a secção de desenvolvimento foi dividida em quatro partes: i) EF e DID; ii) técnico de EF e DID; iii) aspetos físicos, fisiológicos, psicológicos, sociais e emocionais inerentes à DID; iv) *Técnico de EF como promotor da QV de indivíduos com DID.*

Exercício físico e dificuldade intelectual e desenvolvimental

Na Lei de Bases da Prevenção e da Reabilitação e Integração das Pessoas com Deficiência (Lei n.º 38/2004, de 18 de Agosto) a prática desportiva apresenta contributos para o desenvolvimento da capacidade de integração social de pessoas com deficiência, e determina que a política do desporto crie condições para a participação dessas mesmas pessoas (artigo 38.º), nomeadamente a criação/construção de estruturas adequadas, que, segundo a Constituição da República Portuguesa, na 7.ª revisão constitucional (2005) e a Lei de Bases da Atividade Física e do Desporto (Artigo da 2º Lei n.º 5/2007 - Diário da República n.º 11/2007, Série I de 2007-01-16), é um direito de todos e um fator indispensável na formação da pessoa e no desenvolvimento da sociedade.

A prática de AF, EF e/ou desporto tem sido amplamente aceite como um método eficaz e não dispendioso para promover a aptidão física. Como benefício adjacente, a redução do risco do aparecimento de doenças metabólicas e cardiovasculares e, conseguinte, a promoção da saúde mental e QV, torna a sua prática regular imprescindível (ACSM, 2017; World Health Organization, 2020).

Apesar de serem escassos os estudos de intervenção ao nível do EF, na DID, existem indicadores de que a prática de AF, EF e/ou desporto tenham impacto nas variáveis referidas anteriormente (Bartlo & Klein, 2011; Jacinto et al., 2021a; Jacinto, et al., 2021b).

Com o aumento da esperança de vida destes indivíduos, causas de morbilidade e mortalidade, devido a doenças cardiovasculares e outras complicações como a obesidade e sedentarismo, também aumentaram comparativamente à população sem esta patologia (Janicki et al., 1999). Apesar dos benefícios do EF, os estilos de vida sedentários são uma realidade nesta população (Dairo et al., 2016), fazendo com que não atendam às recomendações para a prática de AF (World Health Organization, 2020). Esta baixa adesão aos estilos de vida ativos está diretamente relacionada com uma baixa aptidão física e consequentes baixos níveis de todas as capacidades físicas (Chow et al., 2018), o que os coloca mais suscetíveis de desenvolver doenças crónicas (de Winter et al., 2012). Como mencionado anteriormente, estes fatores levam a um

grande dispêndio em gastos com a saúde (afetando o poder socioeconómico do seio familiar e do país) (Robertson et al., 2000), aumentando também a taxa de mortalidade (Glover et al., 2017) nos indivíduos com DID.

Algumas características associadas à DID afetam a adoção de estilos de vida ativos e comprometem o sucesso na realização das tarefas diárias, como problemas fisiológicos, de saúde, ou outro tipo de deficiência associado (multideficiência) (van Schijndel-Speet et al., 2014). Existem ainda outros tipos de barreiras que comprometem/dificultam/impedem a prática regular de EF/AF, nomeadamente fatores familiares, sociais, arquitetónicos e financeiros (van Schijndel-Speet et al., 2014). No estudo de Jacinto et al. (2021c) é também mencionada especificamente a barreira da falta de técnicos especialistas em AF adaptadas.

É uma necessidade clara de mercado os técnicos de EF com competências técnicas para desempenhar funções no âmbito da intervenção profissional no contexto da AF adaptada (modalidades coletivas; *fitness*; Instituições Particulares de Solidariedade Social).

Técnico de exercício físico e dificuldade intelectual e desenvolvimental

Em Portugal, tendo em consideração o Decreto-Lei n.º 39/2012 de 28 de agosto, o técnico de EF é a figura responsável para orientação e condução do exercício de AF e desportivas (antigo PROCEAFD), devendo este profissional ser titular de uma licenciatura na área do desporto e da educação física, bem como a presença assídua em ações de formação contínuas e creditadas.

O técnico de EF desempenha um papel ativo na promoção da saúde pública (Melton et al., 2008) e é visto como um elemento chave na "luta" contra a obesidade (Florin et al., 2012). Por sua vez, a prática regular de EF é visto como uma forma de promover a saúde e longevidade (Sallis, 2009) e têm como missão o combate à obesidade e à inatividade física, a educação para a cidadania, para os valores da sociedade, solidariedade, transparência, respeito e igualdade (Rodrigues, 2020).

Vários são os estudos que se têm debruçado sobre a formação de técnicos de EF, treinadores e professores (Rodrigues, 2020), contudo, para intervir na área da deficiência, nomeadamente na DID atendendo ao seu perfil de funcionamento, é necessário formação específica (Rimmer et al., 2017), para além da formação base na área das ciências do desporto, que lhe fornece um conjunto de competências básicas que lhe confere o estatuto profissional. Sem essa formação específica, os resultados podem não ser os desejados, aumentando a taxa de abandono, lesões e diminuindo a eficácia e o sucesso de programa de intervenção (Obrusnikova et al., 2021). Pretende-se, com base nessa formação especializada, transmitir conhecimentos e competências essenciais e determinar os níveis mínimos de competência para exercer funções nesta área particular (Sarmento et al., 2000).

Conscientes de um contexto de atividade profissional muito vasto e diversificado, tendo em conta as suas especificidades e atuações ao nível profissional (clubes, ginásios, associações desportivas, federações, coletividades, sistema educativo, entre outros), este fato poderá conduzir a dificuldades no desenvolvimento curricular (Rodrigues, 2020). Neste contexto, as Unidades Curriculares ou os planos de estudos com foco na temática da AF adaptada deverão constar nos ciclos de estudos, dos diversos cursos do ensino superior, nas áreas das ciências do desporto e devem incidir nas competências, pedagogia e experiência relacionadas com a pessoa com deficiência (Obrusnikova et al., 2021), sustentadas no conhecimento técnico e científico, resultado da investigação validada e testada (Rodrigues, 2020).

Esta necessidade de abordar as questões da AF adaptada são evidentes e têm demonstrado ser eficazes para o sucesso do técnico de EF na execução das suas funções, bem como do desempenho do aluno (Koh, 2021). Contudo, os cursos de ensino superior ainda carecem de formação a este nível e os técnicos de EF/professores, por vezes, demonstram atitudes menos positivas fase à deficiência (Hersman & Hodge, 2010). Tendo em consideração que Portugal possui 36 licenciaturas nas áreas das ciências do desporto, existe alguma incerteza acerca do ensino dos futuros profissionais que intervenham com a população com deficiência, reconhecendo que alguns aspetos necessitam de ser objeto de reflexão: i) volume de abordagem às questões da atividade física adaptada; ii) quais os modelos de formação utilizados e se a abordagem é direcionada ao formando e formador e às suas competências e à necessidade do mercado; iii) quais os processos pedagógicos utilizados; iv) quais as competências que devem ser adquiridas; v) qual o volume prático e de contato com a população; vi) e se a formação inicial (licenciatura) será suficiente para um sucesso no desenrolar das funções.

Não é só uma necessidade dos técnicos de EF, é também transversal aos professores de educação física. Com a escolaridade obrigatória até aos 18 anos, houve um crescente aumento de alunos com DID nas escolas (Rodrigues & Nogueira, 2010), aumentando a probabilidade do contato com um indivíduos com necessidades educativas especiais e deficiência nas aulas. Caso os professores não possuam uma formação específica na área, a inclusão de alunos com deficiência nas suas aulas de educação física também não será realizada de forma plena.

Ao contrário de outras profissões relacionadas com a saúde, os técnicos de EF não são obrigados, por lei, a terem esta licença para exercerem a sua profissão (Melton et al., 2008). Assim, qualquer local/instituição/organização onde se desenvolva e dinamize AF adaptadas, não são obrigados a contratarem um técnico com competências específicas para a intervenção (Melton et al., 2008).

A realização de cursos de formação para os profissionais, não apenas ao nível da formação inicial, mas também da formação contínua e específica, com a integração de conteúdos programáticos nos seus planos de estudo englobando as dimensões do EF para os indivíduos com DID, bem como a caracterização dos aspetos físicos, fisiológicos, psicológicos, sociais e emocionais inerentes à DID, é fundamental para o sucesso no desenrolar das funções, no âmbito da intervenção profissional, no contexto da atividade física adaptada. Este acréscimo de conhecimento e competências, permite a atualização das competências técnicas alusivas ao EF, o desenvolvimento e progressão profissional do técnico de EF, bem como uma visão mais holística e detalhada do indivíduo, contribuindo para uma ajustada programação, estruturação, execução e acompanhamento das diversas sessões de programas de EF, promovendo o bem-estar e QV de indivíduos com DID (Jacinto, 2020).

O técnico de EF deverá focar-se no desempenho do praticante com DID, orientada para os seus objetivos. Segundo o Quadro Europeu para as qualificações (Parlamento Europeu e do Conselho, 2008), um técnico de EF deverá ser portador de conhecimentos profundos na áreas das ciências do desporto, capaz de realizar uma reflexão crítica às teorias e princípios. Deverá ser revelador de mestria e inovação para dar resposta a problemas complexos e imprevisíveis e ainda deverá adotar uma postura responsável no processo de desenvolvimento profissional individual e coletivo, capaz de gerir as tomadas de decisões.

A título de exemplo, o *American College of Sports Medicine* (ACSM, 2017) desenvolveu um certificado para técnicos de EF que intervenham com população com deficiência – *the Certified Inclusive Fitness Trainer* (CIFT), contudo, mais importante que o certificado é o conjunto de competências/capacidades e o perfil do futuro técnico de EF que irá intervir com a população com DID. Em Portugal, começam a surgir mais opções de formação nesta área, resultado de uma constante busca de aquisição de competências e conhecimentos por parte dos técnicos de EF, cientes da importância da sua função na promoção da QV na população com deficiência, incluindo a DID, bem como uma procura de ferramentas e estratégias que auxiliam nas dificuldades no desenrolar da sua intervenção (Direção-Geral do Ensino Superior, 2022). Uma maior valorização da profissão e da necessidade clara desta formação específica, por parte das entidades empregadoras, aumentava a qualidade das intervenções realizadas, promovendo a sua saúde e longevidade, diminuindo os gastos com a saúde (Robertson et al., 2000) e a taxa mortalidade e morbilidade (Glover et al., 2017), resultando de uma maior QV dos indivíduos.

Aspetos físicos, fisiológicos, psicológicos, sociais e emocionais inerentes à dificuldade intelectual e desenvolvimental

Apenas técnicos que tenham competências adequadas, capazes de garantir a integridade física e humana de qualidade, resultado de uma formação de qualidade, garantida com o ensino superior e formações complementares, devem prescrever EF para indivíduos com DID (ACSM, 2017).

Entre muitas funções e competências do técnico de EF, destaca-se a capacidade de diagnóstico do movimento e das capacidades físicas. No âmbito da avaliação da aptidão física, o técnico de EF terá que possuir competências para dominar as recomendações da *American College of Sports Medicine* (2017) (Tabela 1), especificamente as do capítulo destinado a esta população.

Tabela 1. Avaliação da condição física na dificuldade intelectual e desenvolvimental.

DID	Realizar	Evitar
Aptidão Cardiorrespiratória	Protocolos com velocidades de marcha individualizados em passadeira; Schwinn Airdyne (ergómetro) de braços e pernas com níveis de 25W; 20 min de corrida ("vai e vem"); Teste da milha de Brockport (Winnick & Short, 2014).	Protocolos de corrida em passadeira; Cicloergómetro; Ergómetro de braços; Corrida de 1-1,5 milhas.
Força Muscular e Resistência	Teste de 1RM usando máquinas de musculação; Testes isocinéticos; Contração isométrica voluntária máxima.	Teste de 1RM usando pesos livres; Flexões; Elevações.
Composição Corporal	IMC; Perímetro da cintura; DXA; Pregas adiposas; Pletismografia por deslocamento de Ar.	
Flexibilidade	Senta e alcança; Goniometria.	

Fonte: ACSM (2017).

Ao mesmo tempo, terá que ser conhecedor das recomendações para a prescrição de EF, controlo do treino e da performance dos praticantes (ACSM, 2017) (Tabela 2).

Antes da realização das avaliações físicas ou da execução dos exercícios, em termos sequenciais, é necessária uma familiarização como os métodos e/ou procedimentos, para que o indivíduo compreenda e execute a tarefa com sucesso. Uma demonstração por parte do técnico de EF também é importante para uma melhor execução do movimento (ACSM, 2017).

Também é importante ter em consideração a heterogeneidade da população e a consciência da estrutura e planeamento da sessão de forma individual e adaptada a cada sujeito. Ser adaptada não denota uma desvalorização, ausência de importância sociológica ou desportiva. Pelo contrário, objetiva respeitar as limitações/dificuldades individuais, adaptando a atividade/tarefa, possibilitando a excelência desportiva através da realização plena e potencia benefícios fisiológicos, psicológicos e sociais ao praticante (Instituto Português do Desporto Juventude, 2016).

De acordo com o *American College of Sports Medicine* (2017) os programas de exercícios prescritos e aplicados ao indivíduo com DID devem incidir nas seguintes capacidades físicas: aeróbia, força, resistência muscular e flexibilidade.

O controlo da intensidade de treino terá que ser realizado com apoio a métodos específicos (exemplo: método 3 repetições máximas) ou equipamentos tecnológicos (cardiofrequêncimetros), uma vez que a maioria dos indivíduos com DID tem dificuldades na perceção da intensidade e não têm capacidade para associar uma escala ao esforço percebido e dar uma resposta (ACSM, 2017).

Ao nível fisiológico, o cuidado especial a ter em consideração prende-se essencialmente com os indivíduos com DID e Síndrome de Down, uma vez que, muitas vezes estão associados a uma doença cardíaca congénita e à instabilidade atlantoaxial, apresentando um movimento excessivo entre as articulações das primeiras vértebras cervicais (C1 e C2), causado pela frouxidão ligamentar (ACSM, 2017). É então necessário um especial cuidado na prescrição de exercício que envolvam cargas e impacto, e evitar prescrever exercícios que envolvam saltos, mergulhos, cabecear uma bola, desportos de contato e exercícios de hiperextensão e hiperflexão do pescoço (ACSM, 2017). De igual modo, para os exercícios a prescrever é importante ter em consideração a amplitude e velocidade de movimentos, evitando o descolamento de algumas articulações ou outras lesões, devido a uma hipotonia generalizada, que influencia o sistema musculoesquelético e ligamentar do indivíduo (Morris et al., 1982). Alterações do sistema nervoso simpático e parassimpático podem afetar a frequência cardíaca, pressão arterial, capacidade cardiorrespiratória, capacidade de trabalho e o débito cardíaco (Morrison et al., 1996), sendo necessário uma monotorização e um acompanhamento constante.

A toma de medicamentos, recorrente em indivíduos com DID, prescritos para estabilizar ou melhorar o humor, estado mental ou comportamental, podem causar um aumento do peso corporal, alterações no perfil lipídico ou da glicémia, que, para além de aumentar o apetite, aumenta a sensação de fadiga (Mangurian et al., 2016). Esta medicação pode influenciar ainda o equilíbrio, a capacidade neuromuscular e aeróbica (Perez-Cruzado et al., 2018), resultado da interação entre medicamentos e os recetores neurais de dopamina, serotonina e histamina. Em muitas situações, a toma de medicamentos diminuiu a motivação e a adesão a atividades físicas (Cox & Virués-Ortega, 2016), pelo que o encorajamento e o reforço positivo terá que ser constante.

O Instituto Português do Desporto Juventude (2016) também fornece um conjunto de recomendações ao profissional que intervenha junto desta população que deverá ter em consideração. Entre elas salientam-se: i) não ter receio de

Tabela 2. Recomendações para a prática de EF para adultos com dificuldade intelectual e desenvolvimental.

DID	Aeróbio/Cardiorrespiratório	Força Muscular	Flexibilidade
Intensidade	40%–80% VO2Res	Começar com 12 repetições a 15-20RM durante 1-2 semanas; progredir para 8-12RM (75%-80% de 1RM)	Pelo menos 2-3 vezes por semana.
Duração	30-60 min/dia. Recomendado a realização de períodos mais curtos (10-15min) durante o dia	2-3 séries com intervalos de 1-2 min entre séries	2 a 4 alongamentos, 10 a 30 segundos cada.
Frequência	30-60 min/dia. Recomendado a realização de períodos mais curtos (10-15min) durante o dia	2-3 dias/sem	2 a 4 alongamentos, 10 a 30 segundos cada.
Tipo	Marcha é a principal atividade recomendada especialmente no início do programa, sendo aconselhado a progressão para a corrida; Natação e ergómetro de braços ou pernas	Usar máquinas destinadas aos 6-8 principais grupos musculares; supervisionar o programa nos primeiros 3 meses	Alongamentos estáticos

Fonte: ACSM (2017).

colocar questões; ii) *check up* médico antes de iniciar a prática; iii) planificar atividades e movimentos adaptados aos condicionamentos físicos, cognitivos e relacionados com a idade; iv) conheça os níveis de aprendizagem/cognitivos, socioafetivos, físicos/motores: v) histórico de prática; vi) não sobrecarregar o praticante com informações e/ou instruções; vii) garantir o foco do atleta, mantendo o contato visual; viii) consciência de que o plano inicial poderá ter que ser alterado; ix) garantir a segurança do praticante, estabelecendo uma relação de confiança mútua; x) sabendo que estes indivíduos poderão levar mais tempo a entender as informações e instrução, deveram ser questionados com frequência se entenderam; xi) repetições, estruturas e rotinas são úteis.

Por outro lado, o técnico de EF terá que adotar uma postura repleta de autodeterminação e autoconfiança em todas as tarefas e situações específicas, sendo que estes níveis vão sendo fomentados com o acumular de sucessivas experiências (Bandura, 1986). De igual modo, deverá adotar estratégias (processo de avaliação e acompanhamento da sessão) instrucionais, motivacionais, denominadas como reforços como por exemplo palavras, expressões corporais e faciais, proximidade (física e tocar), objetos (materiais, prémios, brinquedos), privilégios e atividades (Sprinthall & Sprinthall, 1993), objetivando a manutenção da motivação para o exercício de indivíduos com DID. O *feedback* ou as instruções dadas deverão ser o mais personalizado possível e, se possível, recorrer ainda a reforços positivos.

De forma a manter a motivação dos indivíduos e a manutenção nos programas de EF, embora respeitando a periodização e os objetivos definidos, deve-se contemplar a variação dos exercícios evitando causar aborrecimento e desinteresse dos praticantes, atuando com facilitador no processo de ensino-aprendizagem. Recomenda-se a utilização de uma metodologia e/ou uma periodização flexível, sendo ajustada ao longo do desenrolar das sessões de treino e do próprio programa de EF (Jacinto, 2020).

Tão importante como as estratégias a implementar, é o investimento que o técnico de EF terá que realizar para adquirir uma relação para com o indivíduo com DID (Bains & Turnbull, 2020). Para Jacinto (2020), partindo de uma metodologia participante-observador, o técnico de EF terá que ser mais do que o "professor de educação física" ou o *personal trainer*. Esta relação terá que estar assente na base da amizade, respeito mútuo e confiança, levando a que o indivíduo com DID confie no profissional e nas tarefas que lhe propõe, aceitando-as e encarando-as com maior motivação e agrado. A fomentação e aprimoramento da relação técnico de EF–aluno, facilitará o caminho trilhado, o alcance dos objetivos propostos, bem como o sucesso do programa de EF. O técnico de EF terá que conhecer bem o indivíduo com DID e a interação entre ambos deverá ser constante. De igual modo, o técnico de EF deverá ter a oportunidade de observá-lo em diferentes contextos da vida, sendo conhecedor das experiências e circunstância de vida e sendo, para este, uma pessoa de referência (Simões et al., 2017). Nos momentos de maior resistência, se essa relação não se encontrar bem consistente e existir um completo conhecimento do técnico de EF acerca do indivíduo com DID, dificilmente conseguirá cumprir com sucesso o plano de treino prescrito para a sessão ou os objetivos previamente definidos (Jacinto, 2020).

Para que indivíduos com DID alterem os seus comportamentos menos desejáveis, nomeadamente os sedentários e a inatividade física, constata-se a necessidade de os sensibilizar, bem como aos pais/familiares/tutores, profissionais que trabalham junto destes e instituições/organizações que fornecem apoios, educando-as e capacitando-as com conhecimentos e práticas saudáveis e ativas, que irão contribuir para uma vida com saúde e plena na participação social. A título de exemplo, a realização de campanhas de sensibilização (exemplo: comunicação social, palestras, entre outras formas) assente no pressuposto que o EF, para pessoas com deficiência, acrescenta valor à vida, que lhes proporcionam melhor capacidade relacional, mais competência, mais autonomia e melhor aptidão física, bem como uma postura com mais autodeterminação e, consequentemente, QV, auxiliando na prevenção de doenças típicas nesta população. De destacar que os pais/famílias/tutores devem promover a adoção de estilos de vida mais ativos, logo na infância, desde que a condição clínica o permita, de modo que o gosto e prática de AF se mantenham ao longo da vida, promovendo a sua QV e evitando os comportamentos sedentários desta população (Jacinto, 2020).

Técnico de exercício físico como promotor da qualidade de vida de indivíduos com dificuldade intelectual e desenvolvimental

Considerando a definição da Organização Mundial da Saúde, em que a QV "não é apenas a ausência de doença ou enfermidade, mas um estado de completo bem-estar físico, mental e social dos indivíduos" (World Health Organization, 1946), o EF, à imagem da população em geral, pode demonstrar ser um método eficaz e não dispendioso de promover a QV de indivíduos com DID (Jacinto et al., 2021b; Pestana et al., 2018).

Para Schalock et al. (2002), a QV de um indivíduo com DID é um conjunto de vários fatores que englobam o seu bem-estar e a sua perceção sobre o seu posicionamento social, tendo em conta valores socioculturais, necessidades,

expectativas e preferências individuais. Estes autores apresentaram um modelo concetual de QV para a população em foco, que, entre vários fatores a podem influenciar, nomeadamente o bem-estar (Tabela 3).

Se ainda existiam dúvidas sobre o impacto do EF na QV de indivíduos com DID, Pérez-Cruzado & Cuesta-Vargas (2016) demonstram que a intervenção com uma duração de 8 semanas e uma periodicidade de 2 horas semanais tem impacto positivo na QV dos participantes, quando avaliados pela escala *World Health Organization Quality of Life Scale - Disabilities Module* (WHOQOL-DIS). Também Bartlo e Klein (2011) através de uma revisão sistemática de literatura, revelam evidências moderadas a fortes que o EF afeta positivamente a QV dos praticantes com DID. Contudo, devido à escassez de estudo experimentais existentes, é difícil definir a metodologia de treino mais eficaz para promover tal variável.

Segundo o Instituto Português do Desporto Juventude (2016), para além do desenvolvimento das capacidades motoras e físicas, esta prática desportiva tem impacto na autoestima, empregabilidade, capacidade cognitiva e de socialização.

Nesta população, o Índice Massa Corporal e adiposidade abdominal (perímetro da cintura) são marcadores importantes associados a doenças metabólicas e a QV (Kobo et al., 2019). O treino combinado já demonstrou melhorias nestas variáveis (Ayaso-Maneiro et al., 2014), assim como o treino aeróbio (Boer et al., 2014), e o treino de força (Jacinto et al., 2021b). De igual modo, têm impacto noutras variáveis antropométrica, da aptidão física, capacidade cognitiva e perfil lipídico, hemodinâmico e metabólico.

De igual modo, o estudo de Raulino et al. (2014) destaca a importância que o treino de força exerce no desempenho das atividades de vida diária (como por exemplo levantar/sentar, locomoção, entre outros). Ao realizar um estudo experimental de 12 semanas, com uma frequência semanal de 2 vezes, prescrevendo 8 exercício de força, com incidência nos principais grupos musculares (2-3 séries, entre 60% a 90% de 1 RM), o autor concluiu existir uma melhoria do desempenho das atividades de vida diárias, avaliadas pelo Protocolo Andreotti e Okuma (1999).

Por sua vez, a QV também poderá ser afetada por alguma perturbação ao nível da saúde mental. No entanto, já existem estudos que verificaram o impacto significativo e positivo do EF na saúde mental da população em foco, nomeadamente nos sintomas de ansiedade (Jacinto et al., 2021a).

Apesar de ser um método válido que engloba informações amplas, de forma coesa e organizada (Bettany-Saltikov, 2010), o recurso à metodologia de revisão narrativa é a principal limitação do estudo, sabendo que existem outro tipo de revisões com maior rigor e reprodutibilidade. Contudo, a importância da temática e as conclusões são o ponto forte do estudo. De igual modo, futuros estudos devem utilizar uma metodologia experimental para aferir a relação entre a variáveis estudadas.

CONCLUSÃO

A presente revisão narrativa refere um conjunto de fatores e benefícios que justifica o EF estar na base da QV de um indivíduo com DID, devendo ser praticado de forma regular e prescrito por um técnico de EF devidamente credenciado para o efeito. O técnico de EF tem o dever de realizar uma correta avaliação, prescrição adaptada e individualizada, bem como uma implementação e acompanhamento de forma eficaz, sendo que as suas funções e ações devem ser sustentadas pelos conhecimentos teóricos e práticos adquiridos através de uma formação base e complementar, bem como na evidência científica.

Tendo por base uma equipa multidisciplinar, com ligação aos cuidados primários e secundários de saúde, as estratégias de intervenção utilizadas nesta população necessitam de uma atualização, com a integração do EF no seu dia a dia, revelando ser um aspeto fulcral para a manutenção e aumento

Tabela 3. Modelo conceptual de qualidade de vida.

Fator	Domínio	Indicadores
Independência	Desenvolvimento Pessoal	Atividades da vida diária, Comportamento adaptativo
	Autodeterminação	Escolhas, decisões e objetivos pessoais
Participação Social	Relações interpessoais	Atividades sociais e amizades
	Inclusão Social	Inclusão social/envolvimento na comunidade
	Direito	Humanos e legais
Bem-estar	Emocional	Proteção e segurança e ausência de stress
	Físico	Saúde, nutrição, desporto, recreação e lazer
	Material	Emprego e estatuto económico

Fonte: Schalock et al. (2002).

da aptidão física e da capacidade funcional e a consequente melhoria da QV. Contudo, a falta de técnicos de EF com formação em AF adaptada não deve continuar a ser uma barreira à prática de AF pela população com DID, destacando a necessidade desta reflexão quanto às opções de formação de futuros profissionais, nesta área em específico, assim como a intervenção metodológica ou didática dos conteúdos abordados e que serviço/profissional instituições/organizações que apoiam esta população querem oferecer.

AGRADECIMENTOS

Pelas diversas colaborações, um agradecimento aos autores que deram a sua contribuição no processo de construção do documento.

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