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ORIGINAL ARTICLE

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The prevalence and association of motor competence with weight status and bullying: a cross-cultural study

Marcela Almeida Zequinão[1]*, Pâmella de Medeiros[1], Grace Skrzypiec[2], Luis Lopes[3], Maria Teresa Ceron Trevisol[4], Beatriz Pereira[5]

ABSTRACT

The purpose of this study was to compare the prevalence of motor competence among children and adolescents from two metropolitan cities, one in Portugal and one in Brazil, and analyzed the association between motor competence and weight status and bullying roles. A Cross-sectional and cross-cultural study was applied. The sample comprised 785 children and adolescents aged 7-14. Motor competence was assessed using The Körperkoordinationtest Für Kinder (KTK) test, while participation in bullying was assessed using a sociometric test and the students' Body Mass Index (BMI), which was calculated from height and weight and reported as kg/m^2. Portuguese students had a higher prevalence of impairment/disturbance in motor coordination. Also, obese students and bullying victims had higher odds of having a motor competence below normal values in both countries. These findings provide evidence of a link between motor competence and sex and weight status of schoolchildren and suggest that motor competence is associated with bullying roles.

KEYWORDS: motor skills; body composition; peer relationships; school.

INTRODUCTION

Motor competence is a broad and complex concept that encompasses the level of performance of fundamental motor skills, i.e., object control and locomotor skills (Gallahue, Ozmun, & Goodway, 2013; Estevan et al., 2018). Utesch and Bardid (2019) have suggested that motor competence implies a degree of proficient performance in a wide range of motor skills at an individual level alongside underlying mechanisms that include quality of movement, motor coordination and motor control. The study of motor competence, as a distinct topic, is a flourishing area of research, mainly due to the positive implications of motor competence on health and developmental outcomes (Lopes et al., 2021). Motor competence is important for successful participation in physical and sport activities (Barnett et al., 2016; Henrique et al., 2016; Lopes et al., 2019) because, it influences the way children perceive themselves and perceive their peers, and when they experience a fun sensation, satisfaction, and success in physical activities, their self-esteem and motivation levels tend to increase (Ulrich, 2000; Haywood & Getchell, 2004). Therefore, motor competence in childhood and adolescence is fundamental for the perception and feelings that individuals have of themselves (Del Prette & Del Prette, 2017). In addition, children and adolescents who have a wide motor repertoire are coveted partners in physical games and those who can run fast, catch a ball well and are agile, are popular amongst peers (Medeiros, Zequinão, & Cardoso, 2016).

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Thus, success in physical activities and involvement in sports at school contribute to popularity, as well as narrow the possibilities of being intimidated by peers at school (Peguero, 2008; Del Prette & Del Prette, 2017). By contrast, children and adolescents with low motor skills tend to have fewer friends, are rejected by peers, are less often invited to play, are more likely to be intimidated at school and are more susceptible to depression (Campbell, Missiuna, & Vaillancourt, 2012; Scarpa, Carraro, Gobbi, & Nart, 2012; Medeiros et al., 2018).

This intimidation at school, which inclues bullying, often occurs in a context in which the student practices physical activity, whether in the playground and/or in physical education classes (Roman & Taylor, 2013; Medeiros et al., 2016; Martínez-Baena & Faus-Boscá, 2018). These experiences are exacerbated in team sports and instances of collective collaboration and may lead to bullying, as students with poor skills and low motor competence become more vulnerable targets for bullies (Scarpa et al., 2012; Cascales & Prieto, 2019). As such, students with poor motor skills may experience intimidation, aggression, and exclusion from games and activities, as well as receive malicious comments about their poor coordination and performance in activities (Bomfim et al., 2012; Del Prette & Del Prette, 2017).

Because of this, many children withdraw from these situations as they seek to avoid a demonstration of their poor motor skills. This makes this problem even greater and with lasting effects, leading to impairment in motor development, an increasing risk of weight gain and obesity (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006; L. Lopes, Santos, Pereira, & Lopes, 2012; Lopes, Santos, Moreira, Pereira, & Lopes, 2015) and a subsequent loss in interpersonal relationships (Dewey, Kaplan, Crawford, & Wilson, 2002; Del Prette & Del Prette, 2017; Medeiros et al., 2018). Therefore, some researchers have indicated that poor motor skills are closely related to poor social skills (Bejerot, Edgar, & Humble, 2011; Medeiros et al., 2016; Medeiros et al., 2018). Given that human beings are evolutionarily social beings, this relationship indicates that poor motor skills have an independent effect on the likelihood of being bullied or have a role as a mediating factor between involvement in sports and bullying (Bejerot et al., 2011; Bejerot & Humble, 2013; Bejerot, Plenty, Humble, & Humble, 2013).

Studies investigating bullying and motor competence have mainly involved groups with deficits in motor development, such as Developmental Coordination Disorder (DCD) (Lingam et al., 2012; Bejerot & Humble, 2013) and other chronic disorders, for instance, the Tourette Syndrome and Motor Tic (Zinner, Conelea, Glew, Woods, & Budman, 2012), although most recently the Körperkoordination Test für Kinder (KTK) has been used to detect the motor competence of normative samples (Santos et al., 2020). However, studies that have controlled other risk factors or that have included healthy individuals, have shown that poor motor competence is an independent and strong risk factor for victimization among peers in different populations, and as such deserves further investigation (Bejerot et al., 2011; Bejerot & Humble, 2013; Bejerot et al., 2013).

Noteworthy, is that few studies have used general motor assessments in their investigation of motor competence and bullying. Indeed studies have included tests such as the Movement Assessment Battery for Children (MABC) (Lingam et al., 2012), the Movement Assessment Battery for Children Second Edition (MABC-2) (Kennedy-Behr, Rodger, & Mickan, 2013), the McCarron Assessment of Neuromuscular Development (MAND) (Piek, Baynam, & Barrett, 2005), and clinical evaluations of successive vertical jumps (Bejerot & Humble, 2013). Despite their usefulness, these tests are best suited for detecting impairments in motor development that require clinical interventions (Piek, Bradbury, Elsley, & Tate, 2008; Goulardins et al., 2015; Caçola & Killian, 2018).

Moreover, motor competence has not been directly measured in many studies, and has rarely been assessed during childhood and adolescence (Robinson et al., 2015; Lopes et al., 2021). Studies with more objective measures and involving the assessment of motor skills in children and adolescents have been suggested by researchers in this field (Lingam et al., 2012; Scarpa et al., 2012; Bejerot & Humble, 2013). Moreover, studies investigating motor competence and school bullying, particularly with normative groups of children from different countries, are scarce. Since motor competence depends substantially on social contexts, a study involving children from different countries becomes relevant. Although motor competence is primarily seen as a biological factor, a fuller understanding of it should also take into account the context and the individual culture in which it occurs (Karmiloff-Smith, 1991).

This research seeks to fill these gaps in the literature by examining normative children and adolescents from different cultural contexts. Furthermore, for international comparisons, this research employed a widely used test for general motor competence known as the Körperkoordinationstest Für Kinder (KTK) (Iivonen, Sääkslahti, & Laukkane, 2014).

The results of this study may contribute to thinking about public policies for prevention, intervention and combating different types of bullying (Zequinão, Medeiros, Lise, Trevisol,

& Pereira, 2019; Silva et al., 2020; Zequinão, Medeiros, Silva, Pereira, & Cardoso, 2020; Zequinão, Oliveira et al., 2020), low motor competence (Medeiros et al., 2016; Medeiros et al., 2018; Lopes et al., 2021) and obesity (L. Lopes et al., 2012; Pelegrini et al., 2014; Lopes et al., 2019) problems that have been seriously affecting school-age children and adolescents around the world.

Thus, the purpose of this study was to compare the prevalence of motor competence among children and adolescents from two metropolitan cities, one in Portugal and one in Brazil, as well as to analyze the association between motor competence, weight and bullying status.

We hypothesized that motor competence, as well as its relationship to bullying, would vary according to the culture of each country, although the prevalence of bullying was equivalent in both countries. We expected that good coordination would be associated with the role of bullying others and lower body weight, while impairmed/disturbed motor coordination would be associated with the role of victim and bully-victim and greater body weight, when compared to the group that did not participate in bullying.

METHODS

A cross-sectional and cross-cultural study using intentional sampling (schools who showed interest and willingness to participate in the research) was undertaken in the metropolitan city of Braga, in the Minho region, in northern Portugal, and in the metropolitan city of Florianópolis, Santa Catarina, in southern Brazil, between November 2014 and May 2015. The study was carried out in two stages. In the first stage, students completed a sociometric scale to assess bullying status, while the second stage involved the application of a motor test battery (the KTK) and measurement of Body Mass Index (BMI).

Sample

Four public schools and one private school in Braga, and one public school and two private schools in Florianópolis participated in the study. All children and adolescents from 3rd to 6th grade at these primary schools were invited to participate in the study. The only exclusion criteria used for the recruitment of participants was the presence of intellectual or physical disability that prevented students from understanding the instruments used or impaired the performance of motor tasks. This evaluation was undertaken in consultation with the Special Education Service in schools.

A total sample size was calculated from the number of children and adolescents enrolled in public and private schools in each participating city and who were in the age group stipulated by the study. An assumed alpha of 0.05 and power of 80% was used for the sample size calculation separately in each of the strata (stratum 1= total students from public schools in Florianópolis; stratum 2= total students from private schools in Florianópolis, stratum 3= total students from public schools in Braga, stratum 4= total of students from private schools in Braga). The final sample size comprised 785 participants; 390 (49.7%) in Portugal (306 (78.5%) from public schools and 84 (21.5%) from private schools) and 395 (50.3%) in Brazil (266 (67.3%) from public schools and 129 (32.7%) from private schools). Participants' ages ranged from 7 to 14 years, with an average age of 9.89 years (S.D.= 1.30) for Portuguese students (n= 390) and 9.76 years (S.D.= 1.45) for Brazilian students (n= 395). The distribution of students across grades was as follows: 24.1% were in the 3rd grade, 26.2% in the 4th grade, 22.3% in the 5th grade, and 27.4% in the 6th grade.

This research was part of a project approved by an Ethics Committee for Research with Human Beings and an Ethics Committee of Social and Human Sciences, in Brazil and Portugal, respectively. Prior to data collection, parents and their children and adolescents received detailed information about the research. Students only participated if they were interested and assented to the study and if they had an appropriate Consent Form signed by a legal guardian. After returning the signed consent forms, all participants took part individually in both stages of data collection.

Procedures

Data were collected during regular school hours in a room offered by the school, in two different stages, in order not to take children out of their school activities for too long, and to keep students motivated. In stage 1, participants answered questions on the participation of peers in school bullying, in which each participant named the peers who experienced more instances as bullies and, or victims (about 30 minutes). Stage 2 involved the application of the motor test battery and the measurement of body weight and height (about 40 min). All data were collected individually, and researchers were trained in all procedures.

All tests were performed in a venue provided by the school in which there was no interference during the evaluation and without any risk during the tests. Students were evaluated individually and asked to wear appropriate clothes for the tests. Prior to participating in the research, the evaluators were trained to apply all the instruments used in the study.

Instruments

Sociometric scale

To assess bullying status, the Scale Sociometric (Olweus, 1994; Levandoski & Cardoso, 2013) was used in the first stage of the research. This instrument comprises questions about everyday behaviors of students involved in school bullying, either as victims or as bullies (Levandoski & Cardoso, 2013; Zequinão et al., 2017; Zequinão, Medeiros et al., 2020). For example, "Which classmates make MORE THREATS or challenge other classmates?" or "Which classmates are MORE THREATENED by these classmates?"

Each participant indicated the names of three classmates who were more involved in the situations described. Thus, all the students had two scores, one for aggression (sum of six questions) and one for victimization (sum of six questions), generated by the number of times in which they were cited in each block of questions. As the number of participants per class varied, standardized z-scores were used. From these scores, it was possible to establish a classification of participation in school bullying, according to the established method used to set the size of sociometric measures by Coie, Dodge, and Coppotelli (1982).

The names of the bullying role categories used by Coie et al. (1982) were adapted for this study,.

Accordingly, participants were classified into five categories:

- not involved: students who were not nominated by their peers or those nominated in sporadic episodes of aggression or victimization;
- average group: students who were moderately nominated in aggression and victimization situations, but with scores not high enough to be classified into one of the roles played in bullying;
- victims: students with a high number of nominations, but only in victimization;
- bullies: students with a high number of nominations, but only in aggression perpetration ;
- bully-victims: students with a high number of nominations, in both victimization and aggression perpetration.

In order to meet the objective of identifying characteristics of the roles played by students consistently involved in bullying, students in the average group were excluded from further analyses. This sociometric test presented an acceptable level of internal consistency, with a Cronbach's alpha of 0.744.

Körperkoordinationstest für Kinder

Students completed four tasks or the motor competence assessment using the *Körperkoordinationstest für Kinder (KTK)* (Kiphard & Schilling, 2007). Students were required to perform the following tasks:

- Task 1 – Balance while walking backwards;
- Task 2 – Hop on one leg;
- Task 3 – Jump sideways; and
- Task 4 – Shift platforms.

The KTK test uses the same coordination tasks for all ages, so tasks must include additional difficulties for older individuals. In both countries, the KTK was used according to the guidelines established by Kiphard and Schilling (2007) and the normative data of the German sample were used.

The standardized scores were summed and a total motor quotient (MQ) was calculated for each individual. The total MQ allows motor competence to be classified into five categories: impairment in motor coordination; disturbance in motor coordination; normal motor coordination; good motor coordination; and very good coordination. However, for better interpretation of the data, and due to the low prevalence in some motor competence categories, it was decided to categorize the performance into only two categories: impairment/disturbance in motor coordination and normal/good/very good motor coordination. Regarding internal reliability, the KTK battery presented a good level of internal consistency, with a Cronbach's alpha equal to 0.813.

Body mass index

Body weight and height were assessed using the procedures described by Ross and Marffell-Jones (1991) with an anthropometric scale to the nearest 0.1 kg and with a stadiometer to the nearest 0.1 centimeters, respectively. Body mass index (BMI) was calculated using the standard formula of body weight(kg)/height(m^2). BMI was classified according to the cut-off points established by Cole, Flegal, Nicholls, and Jackson (2007), stratifying participants into four categories: underweight and eutrophic, overweight, and obese. Due to the small percentage (1.8%) of underweight children and adolescents, this category was grouped with the eutrophic category for analysis purposes.

Statistical analysis

The association between impairment/disturbance in motor coordination and other independent variables was analyzed using a binary logistic regression model in SPSS (Statistical Package for the Social Sciences), version 20.0. Two models were tested, one simple and the other with adjustment for all the variables in the gross model with $p< 0.20$. The adhesion test explained 60.6% for adjustment. The quality of the adjustment of the final model was evaluated using the Hosmer and Lemeshor test. A level of significance of 5% was adopted in all analyses.

RESULTS

Table 1 shows the general characteristics of Portuguese and Brazilian participants. No significant differences were found between countries regarding gender and age group. Regarding the school system, the majority of Portuguese participants were students in the public school system. There was a significant difference in weight status, with 50.5% of Brazilian children being eutrophic, while Portuguese children had a higher frequency of overweight and obesity. In addition, there was no difference in the frequency distribution of the roles played in bullying and the country of origin, indicating a homogeneous distribution of these roles regardless of context. Finally, there was a difference in motor competence and the country of origin, wherein the Portuguese participants had greater insufficiency/disturbance in motor coordination compared to the Brazilian students.

Table 2 shows the association of impairment/disturbance in motor coordination with weight status and roles played in bullying for Brazilian participants. According to the results of the initial analysis, an association was observed between impairment/disturbance in motor coordination and all independent variables. In the adjusted analysis, all variables remained associated with the outcome. Those who were obese and victimized had 5.53 (95%CI 3.06–9.99) and 2.08 (95%CI 1.12–3.86) greater odds of having impairment/disturbance in motor coordination in relation to underweight/eutrophic participants and those who did not participate in bullying, respectively.

Finally, Table 3 shows the association of impairment/disturbance in motor coordination with weight status and roles played in bullying for Portuguese participants. According to the results of the initial analysis, an association was observed between impairment/disturbance in motor coordination and all independent variables. Similarly, to the previous analysis for the Brazilian participants, in the adjusted analysis all variables remained associated with the outcome. Those who were overweight and obese had 2.61 (95%CI 1.51–4.54) and 4.77 (95%CI 2.62–8.66) greater odds of having impairment/disturbance in motor coordination than those who were underweight/eutrophic, respectively. In addition,

Table 1. General characteristics of Portuguese and Brazilian participants.

Variable	Total	Portugal	Brazil	*p-value***
	n (%)	n (%)	n (%)	
Sex				
Boys	387 (48.5)	192 (49.0)	195 (48.0)	*0.422*
Girls	411 (51.5)	200 (51.0)	211 (52.0)	
Age group				
7-9	339 (42.9)	161 (41.1)	178 (44.7)	*0.579*
10-11	364 (46.1)	187 (47.7)	177 (44.5)	
12-14	87 (11.0)	44 (11.2)	43 (10.8)	
School system				
Public	584 (73.1)	308 (78.6)	276 (67.8)	*< 0.001*
Private	215 (26.9)	84 (21.4)	131 (32.2)	
Weight status				
Underweight / Eutrophic	344 (44.1)	141 (37.2)	203 (50.5)	*0.001*
Overweight	222 (28.4)	126 (33.2)	96 (24.0)	
Obese	215 (27.5)	112 (29.6)	103 (25.5)	
Bullying				
Do not participate	470 (59.9)	225 (57.7)	252 (62.0)	*0.208*
Victim	122 (15.5)	58 (14.9)	64 (16.2)	
Bully	85 (10.8)	52 (13.3)	33 (8.4)	
Bully-victim	108 (13.8)	55 (14.1)	53 (13.4)	
Motor competence				
Impairment/disturbance in coordination	424 (54.0)	228 (58.5)	196 (49.6)	*0.008*
Normal/good/very good motor coordination	361 (46.0)	162 (41.5)	199 (50.4)	

n: number of participants; **Chi-squared.

Table 2. Odds ratios using impairment/disturbance in coordination as the dependent variable for Brazilian participants.

Variable	OR (95%CI)	*p-value*	OR** (95%CI)	*p-value*
Weight status				
Underweight/Eutrophic	1	< 0.001	1	< 0.001
Overweight	1.17 (0.71–1.91)		1.04 (0.61–1.80)	
Obese	4.64 (2.74–7.87)		5.53 (3.06–9.99)	
Bullying				
Do not participate	1	0.078	1	0.072
Victim	1.90 (1.07–3.36)		2.08 (1.12–3.86)	
Bully	0.69 (0.33–1.45)		0.80 (1.10–0.48)	
Bully-victim	1.07 (0.60–1.94)		0.10 (1.78–0.89)	

OR: *odds ratio*; 95%CI: 95% confidence interval; **OR adjusted for variables that presented $p< 0.20$ in the gross model; ***Adjustment quality: $X^2= 5.828$; $p= 0.39$. Adjusted for all variables, plus sex and age group.

Table 3. Odds ratios using impairment/disturbance in coordination as the dependent variable for Portuguese participants.

Variable	OR (95%CI)	*p-value*	OR** (95%CI)	*p-value*
Weight status				
Underweight/Eutrophic	1	*< 0.001*	1	*< 0.001*
Overweight	2.33 (1.42–3.82)		2.61 (1.51–4.54)	
Obese	4.16 (2.42–7.17)		4.77 (2.62–8.66)	
Bullying				
Do not participate	1	*< 0.001*	1	*0.002*
Victim	2.56 (1.28–5.14)		2.35 (1.11–4.95)	
Bully	0.35 (0.18–0.67)		0.38 (0.19–0.77)	
Bully-victim	0.80 (0.44–1.46)		0.77 (0.40–1.50)	

OR: *odds ratio*; 95%CI: 95% confidence interval; **OR adjusted for variables that presented $p< 0.20$ in the gross model; ***Adjustment quality: $X^2= 5.828$; $p =0.999$. Adjusted for all variables, plus sex and age group.

bullying victims had an odds ratio that indicated they were 2.35 (95%CI 1.11–4.95) times more likely to have impairment/disturbance in motor coordination than those who did not participate in bullying. In contrast, participants who were bullies were 0.38 (95%CI 0.19–0.77) times less likely to have impairment/disturbance in motor coordination compared to those who did not participate in bullying.

DISCUSSION

This study sought to compare the prevalence of motor competence with weight status and bullying roles in children and adolescents from two metropolitan cities, one in Portugal and one in Brazil. The main findings of this study highlight the high prevalence of participants with impairment/disturbance in motor coordination, mainly in Portugal, and the associations between this variable and weight status and bullying roles were confirmed.

The high prevalence of participants with motor competence below the expected level for sex and age, although troubling, should be interpreted with caution. Even though the KTK test battery is widely used worldwide, several studies have found that, in general, the MQ values found are lower than the reference values of the original test with German children. This has been verified in studies conducted in Portugal (Lopes, Stodden, & Rodrigues, 2014; Antunes et al., 2015), Brazil (Brasil et al., 2015; Cunha, Macedo, Pereira, Nunes, & Lima, 2015; Medeiros et al., 2016; Medeiros et al., 2018), and also in other countries such as Belgium (Bardid, Rudd, Lenoir, Polman, & Barnett, 2015) and Australia (Bardid et al., 2015).

Researchers provide some explanation for such results, including the question of the impact of cultural differences between countries (Bardid et al., 2015; Magalhães, Cardoso, Guimarães, & Van Petten, 2015; D'Hondt, Venetsanou, Kambas, & Lenoir, 2019). Also, another issue that has been highlighted in the literature is the reduction in physical activity and the increase in overweight and obesity among children and adolescents in the society in question (Lopes et al., 2014; Bardid et al., 2015). As such, these behaviors may be

worsening the motor competence, so that the current normative data might be lower than those data observed about 40 years ago, when the test was created.

Regarding the students' general characteristics, our findings showed that the Portuguese participants had poorer motor competence when compared to the Brazilian participants. In part, this may reflect the daily life of Portuguese children in terms of time and space for play and physical activity. In a cross-cultural study conducted in 16 countries to assess children's mobility (Shaw et al., 2015), in which Brazil and Portugal were part, Brazil occupied the 11th place, while Portugal was only the 14th. Brazilian children reported going to school more often on foot or by bike than the Portuguese children. The problems related to this issue have already been strongly highlighted in the literature regarding the problems related to physical inactivity and obesity in Portugal, reported as one of the countries with the highest obesity rates in Europe (V. P. Lopes, Stodden, Bianchi, Maia, & Rodrigues, 2012).

With regard to the relationship between motor competence and weight status, the results were in line with those presented in the literature. Generally, researchers have found that, regardless of sex, children and adolescents who are overweight or obese tend to have lower levels of motor competence when compared to eutrophic peers (Lopes et al., 2014; Bardid et al., 2015; Chaves et al., 2015). Because it is a cross-cultural study, these results not only reinforce this issue, but also point out that this relationship also seems to be independent of issues related to the context in which children and adolescents are inserted.

Finally, there was association with the roles played in school bullying and impairment/disturbance in motor coordination. These data confirm the hypotheses of previous studies in which the victims were more likely, while bullies were less likely, to have poor motor competence. Many studies have shown that victims who have been characterized as students with poor motor competence, or underdeveloped motor coordination, and who have poor performance in sports, are more likely to be excluded from the fun and games in schoolyards and in physical education (Campbell et al., 2012; Del Prette & Del Prette, 2017; Martínez-Baena & Faus-Boscá, 2018). Children with poor motor skills often exhibit atypical physical characteristics which can be seen as differences and weaknesses, being perceived by peers as a social disability or strangeness. This is likely to reduce sympathy and compassion, and, consequently, increases the risk of the child becoming a bullying victim (Plenty, Bejerot, & Eriksson, 2014; Vianna, Souza, & Reis, 2015).

However, poor motor competence is not necessarily a cause of victimization, as children with poor motor skills also tend to have poor social skills, and these may be more important in understanding the bullying roles than the actual poor motor competence (Bejerot et al., 2013). It is likely however, that these factors are inextricably linked, because from the perspective of the Bioecological Theory of Human Development (Bronfenbrenner, 2011) it is possible to understand bullying as a systemic and relational phenomenon that influences and is influenced by imbricated and interdependent ecological systems. The studies by Bronfenbrenner (2011) highlight the importance of interpersonal relationships in the process of human development. He emphasizes the merit of relationships between people as a way of establishing reciprocal relationships and for training, as the development process of one of the individuals contributes to the process of the other, reinforcing the bonds of healthy coexistence between students, in the case of the environment in question, the school (Monteiro & Asinelii-Luz, 2020). The people with whom the child interacts play an important role in shaping the structures of proximal processes, which favor the development of interpersonal relationships (Monteiro & Asinelii-Luz, 2020).

Although the relationship between being an aggressor and being less likely to have weak motor competence has been found only for Portuguese participants, many studies have also indicated that bullies constitute the group of children and adolescents who present better motor competence and, consequently, also have advantages in certain games, sports and fight (Piek, Barrett, Allen, Jones, & Louise, 2010; Levandoski & Cardoso, 2013; Martínez-Baena & Faus-Boscá, 2018). In addition, good motor skills may be characteristics of the aggressors, both by increasing their popularity among peers and by giving greater physical qualities to intimidate other peers, especially in the early grades (Jansen, Veenstra, Ormel, Verhulst, & Reijneveld, 2011; Cascales & Prieto, 2019). However, this relationship seems to be more fluctuating depending on the context in which children and adolescents are inserted, since this result was not found in Brazilian participants.

One limitation of this study is that there is still no validation of the KTK battery for the Portuguese and Brazilian populations, although its use and importance are highlighted in the assessment of overall motor coordination in children and adolescents (Ribeiro, David, Barbacena, Rodrigues, & França, 2012). Although the KTK battery is used worldwide, it evaluates only German motor skills tested in the 1970s. It is suggested that for future studies other validated test batteries be used, ones that evaluate fine motor skills.

Another limitation is the cross-sectional design of the study, which prevents inferences about the direction of the identified relationships, not allowing the establishment of causal relations. Future research may adopt a longitudinal design, enabling the tracking of changes over time, in order to identify the effects exerted by the impairment/disturbance in the motor coordination on BMI status and involvement in bullying situations, thus identifying cause and effect relationships.

The third limitation concerns the absence of data regarding the socioeconomic status of students. Although we have collected data from samples of public and private schools equivalent to the respective number of students enrolled in education level in both cities investigated, the absence of the socioeconomic status can further restrict reflections on the results found.

It is important that further studies aim to address these limitations so that they can clarify these relationships between motor competence and other study variables. More precise data can improve our understanding of motor competence of children and adolescents and contribute to the prevention and reduction of bullying in schools in different countries. However, the results of this study provide relevant information indicating that poor motor competence can be a common characteristic of bullying victims, indicating that, regardless of cause and effect relationships, this seems to be a typical characteristic of children and adolescents who play this kind of role in bullying, regardless of the country of origin.

The results presented provide relevant information regarding the motor competence of students in different countries, indicating that low motor competence seems to be a global problem among children and adolescents. The data indicate that this variable is not dissociated from the social context in which children and adolescents live, as well as reinforce data already present in the literature concerning the relationship between this variable and weight status.

This study also provides evidence that motor competence, based on a real measure (motor test battery), is associated with the different roles played in school bullying. However, further research is needed and recommended to determine if these characteristics extend to other countries. The data found in this research are very relevant to all teachers, but especially to physical education teachers, as by having information about students' motor competence, they can not only identify students who may be involved in school bullying, but also take measures to prevent and reduce this type of violence.

Therefore, physical education classes can be directed towards a greater inclusion of bullying victims in games and sports, contributing to improved motor competence and, consequently, social skills, making them more accepted by peers, reducing situations of victimization. In the same sense, strongly emphasizing the better motor competence of the aggressors to the detriment of less skilled students should be avoided. Students with better motor competence should be instructed to use their skills in an assertive manner, sharing experiences and contributing to the inclusion of all peers during class and playtime. However, further research is needed and recommended to determine if these characteristics extend to other countries.

CONCLUSION

The main findings of this study highlight factors such as the high prevalence of participants with impairment/disturbance in motor competence in both countries, although greater in Portugal, and the association between motor competence and the odds of being overweight or obese and the odds of being a victim of bullying was found in Brazil and in Portugal, while the relationship between being a bully and being less likely to have weak motor competence was found only for Portuguese participants.

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ARTIGO ORIGINAL

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A importância do treinamento pré-pilates para a realização do exercício Hundred em praticantes de Pilates

The importance of pre-pilates training for performing Hundred exercise in Pilates practitioners

Bruno Rafael Pacheco[1]*, Danilo Santos Rocha[1], Dernival Bertoncello[1]

RESUMO

O Método Pilates tem sido considerado um sistema de exercícios que visa melhorar a flexibilidade, resistência física, força, equilíbrio e coordenação motora. Dessa forma, muitas pessoas têm buscado o Método para melhorar ou manter a saúde. O objetivo do estudo foi verificar o efeito do treinamento de exercícios de pré-pilates na execução do exercício Hundred por meio da eletromiografia de superfície em praticantes de Pilates. Foram avaliados praticantes de Pilates (*N*= 29) de ambos os sexos (idade média de 44,31± 12,807 anos). Trata-se de um estudo quantitativo, analítico e transversal. Foi realizado um protocolo com exercícios pré-pilates e exercícios Hundred. Cem. Foram feitas análises de ativação eletromiográfica de superfície nos músculos reto abdominal, transverso abdominal/oblíquo interno, oblíquo externo e multífido. A percepção subjetiva de esforço foi avaliada por meio da escala de Borg, uma parcela (36,6%) dos voluntários classificou Hundred sem pré-pilates como mais leve que Hundred com pré-pilates. A menor parte (13,3%) considerou Hunderd com pré-pilates mais leve do que sem pré-pilates. Os resultados da análise eletromográfica não comprovaram o aumento da ativação elétrica dos músculos avaliados ao realizar o exercício Hundred com pré-Pilates em relação ao Hunded sem pré-pilates em praticantes.

PALAVRAS-CHAVE: pilates; treinamento de pilates; exercícios baseados em pilates; core; abdominais; eletromiografia.

ABSTRACT

The Pilates Method has been considered an exercise system that aims to improve flexibility, physical endurance, strength, balance and motor coordination. In this way, many people have sought the Method in search of improving or maintaining health. The aim of the study was to verify the effect of pre-pilates exercise training in the execution of the Hundred exercise by means of surface electromyography in Pilates practitioners. Pilates Practitioners (*N*= 29) of both gender (average age of 44.31± 12.807 years) were evaluated. This is a quantitative, analytical and cross-sectional study. A protocol was carried out with pre-pilates exercises (fundamentals) and a Hundred exercise. Surface Electromyographic activation analysis were made in the muscles rectus abdominis, transverse abdominal/internal oblique, external oblique and multifidus. The rate of perceived exertion was assessed using the Borg scale, part (36.6%) of the volunteers rated Hundred without pre-pilates lighter than Hundred with pre-Pilates. The smallest part (13.3%) considered Hundred with pre-pilates lighter than without pre-Pilates. The results of the electromyographic analysis did not prove the increase in the electrical activation of the evaluated muscles when performing the Hundred exercise with pre-Pilates in relation to the Hundred without pre-Pilates in practitioners.

KEYWORDS: pilates; pilates training; pilates-based exercises; core; abdominals; electromyography.

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INTRODUÇÃO

Contrologia é o nome original do método desenvolvido por Joseph Pilates, hoje simplesmente chamado Pilates (Fiasca, 2010). Evidências atuais sugerem que a prática de Pilates é eficaz na reabilitação, orientação e correção postural e na melhora do condicionamento físico (Segal, Hein, & Basford, 2004; Campos et al., 2016; Fernández-Rodríguez et al., 2019). O trabalho focado no centro de forças do Pilates aprimora outras capacidades motoras e práticas cotidianas e desportivas (Vigue, 2018) e, ainda, segundo Galopin (1980), o trabalho dos músculos abdominais exerce influência sobre a digestão, sustentação corporal, respiração e as condições estéticas. Embora, atualmente, o Pilates já seja conhecido e utilizado em clínicas, consultórios e estúdios, verifica-se que indivíduos chegam às sessões sem condições motoras de execução dos exercícios do sistema básico. Portanto, surge uma reflexão: seria necessário um trabalho de base para a execução do método?

O pré-pilates tem como objetivo introduzir o aprendizado dos movimentos do método, promover aquecimento e também para, continuamente, treinar movimentações profundas do centro de forças (Pont & Romero, 2012). Utilizam-se exercícios sequenciais aplicados ao início das sessões e que visam a despertar, para o praticante, a percepção do próprio corpo em relação ao momento presente, explorando ativações do centro de forças, mobilizações e estabilizações de cinturas pélvica e escapular e também coluna, ativação de músculos glúteos, movimentações de membros inferiores e superiores e suas repercussões no tronco e coluna vertebral, posicionamento e controle de coluna cervical e cabeça. Durante o treino de pré-pilates, é essencial concentrar-se no "centro de força" e fortalecê-lo para facilitar a execução dos exercícios dos três sistemas (básico, intermediário e avançado) do método Pilates. Os exercícios de pré-pilates ajudam a compreender a base da Contrologia e a tomada de consciência física e mental do centro de forças pelo praticante, possibilitando a prática dos movimentos no solo e equipamentos de maneira precisa, eficaz e segura (Pont & Romero, 2014).

É importante que certas posturas corporais sejam compreendidas pelo praticante como a postura com a coluna neutra, a curva C do tronco e a postura das pernas em mesa (top table), que serão aplicadas, posteriormente, a movimentos mais complexos e exigentes (Cintas, 2020). Para isso, o pré-pilates traz à prática exercícios respiratórios, basculações pélvicas, elevações de quadril para a ativação de glúteos, isquiotibiais e paravertebrais, movimentações ativas de membros superiores e inferiores, exercícios de flexão, extensão e rotação de coluna, exercícios de cinturas pélvica e escapular, mobilizações articulares ativas e passivas diversas.

O primeiro exercício do sistema básico do método Pilates chama-se *The Hundred*. Este exercício é muito conhecido entre os exercícios abdominais do Pilates e destaca o trabalho do centro de força do corpo. Seu nome é associado ao padrão respiratório e à movimentação de membros superiores, que se caracteriza por cinco extensões e flexões de ombros sequenciadas e ritmadas para toda inspiração e cinco extensões e flexões de ombros sequenciadas e ritmadas para cada expiração. O padrão respiratório repete-se dez vezes e a contagem total é de cem extensões e flexões sequenciadas e ritmadas de ombros (Pilates, 1945; Isacowitz, 2016). Os objetivos do *Hundred* são estimular a circulação sanguínea, ativar o centro de forças, trabalhar respiração e coordenação e aumentar a resistência (Pont & Romero, 2014; Rahn & Lut, 2020).

A contração dos músculos flexores de quadril sustenta os membros inferiores fora do solo contra a gravidade. Devido à inserção destes músculos na coluna vertebral e parte anterior da pelve, é importante observar e corrigir para que o praticante não realize hiperextensão lombar durante o exercício. A eletromiografia de superfície contribui para evidenciar a ação muscular durante a prática de cada exercício de Pilates. Lee (2021) procurou, por meio de eletromiografia de superfície para a avaliação dos sinais mioelétricos de músculos do core, comparar os efeitos de exercícios de Pilates entre um grupo de praticantes de Pilates e outro sem conhecimento sobre o método. Ele verificou maior eficiência em ativação dos músculos abdominais e extensores lombares para o grupo já com experiência em prática de Pilates.

Dentre os músculos primários para a execução do *Hundred*, estão os músculos flexores de quadril e flexores da coluna lombar, sendo este último grupo composto pelos músculos reto, oblíquo externo e oblíquo interno abdominal, enquanto o músculo transverso abdominal possui um papel secundário e é ativado para a estabilização da coluna lombar. Outros músculos atuantes são os adutores de quadril, extensores de joelho, flexores plantares, extensores e flexores de ombro e extensores de cotovelo (Isacowitz & Klippinger, 2013; Kaplanek, Levine, & Jaffe, 2014). Rossi et al. (2014) observaram, por meio de eletromiografia de superfície, maior coativação dos músculos globais (reto abdominal e iliocostal) e locais (multífidos e oblíquo interno) do que do transverso abdominal quando da execução do *Hundred*.

Frente ao exposto acima, considerando a importância que o pré-pilates teria para a prática do exercício, o objetivo deste trabalho foi verificar o efeito do treinamento de exercícios de pré-pilates na execução do exercício Hundred por meio da eletromiografia de superfície em praticantes de Pilates. Como hipótese alternativa, a execução de exercícios de pré pilates contribuiria para maior nível de ativação eletromiográfica dos músculos envolvidos no exercício Hundred.

MÉTODO

Delineamento do estudo

Estudo quantitativo, analítico e transversal.

População e amostra

Participaram da pesquisa trinta voluntários de ambos os sexos (12 homens e 18 mulheres), com idade média 44,31± 12,81 anos, praticantes de pré-pilates e Pilates há, pelo menos, seis meses. Os participantes foram recrutados na cidade de Uberaba, Estado de Minas Gerais, em um estúdio de Pilates, por meio de convites em rede social de mensagem. Todos os voluntários foram informados dos objetivos e da metodologia da pesquisa. O estudo foi realizado após a aprovação do Comitê de Ética em Pesquisa (CEP) da Universidade Federal do Triângulo Mineiro (UFTM) com número do Protocolo 65322617.4.0000.5154 e número do Parecer: 2.175.790.

Os critérios de inclusão aplicados foram indivíduos saudáveis, praticantes de Pilates, que participassem, voluntariamente, da pesquisa e concordassem com o Termo de Consentimento Livre e Esclarecido (TCLE). Não foram inclusos indivíduos que apresentaram queixa de dores lombares e cervicais nos últimos três meses e, como critério de exclusão, indivíduos que não concluíram a execução dos exercícios do protocolo de pesquisa (Figura 1).

Os voluntários concluíram os procedimentos experimentais durante uma única visita ao Laboratório de Análise do Movimento Humano da UFTM com duração de, aproximadamente, 30 minutos. Todos os procedimentos foram realizados por dois fisioterapeutas devidamente capacitados e as avaliações ocorreram no mesmo período do dia. Ainda, devido ao fato de o estudo ter sido realizado em período pandêmico, todas as normas de distanciamento, quando possível, e higiene foram obedecidas durante as coletas, inclusive, o uso de máscaras, bem como todo o processo de higienização do aparelho e materiais utilizados.

Após a devida seleção dos voluntários, todos foram incluídos em dois grupos:

Sem Pré-Pilates (SPP), que representa a primeira parte da coleta de dados em que todos executaram apenas o exercício *Hundred*;

Com Pré-Pilates (CPP), que representa a segunda parte da coleta de dados em que todos executaram pré-pilates, seguido de nova execução do exercício *Hundred*.

Avaliação da atividade elétrica muscular

Dados de ativação muscular foram coletados por meio de Miotool 400 USB (Miotec®) de quatro canais, com ganho de 200x por canal, conversor A/D de 14 bits, uma frequência amostral de 2.000 Hz por canal, CMRR de 110 dB, nível de ruído < 2 LSB (*Bit* Baixo Significante) e uma impedância de entrada de 1.010 Ohm/2pF, com eletrodos Ag/AgCl na forma de um disco com 0,01 m de diâmetro (MAXICOR®). O sinal foi analisado por meio de um *software* de miografia (Miotec®) e filtrado por meio de um filtro de *bandpass butterworth* de quarta ordem (20-500 Hz). Janelas fixas a 0,75 segundos da porção média do sinal eletromiográfico foram extraídas para a análise em ação isomem e concêntrica. Foram analisados os parâmetros *Root Mean Square* (RMS) normalizados pelo MIVM e pela Frequência Mediana (MF) utilizando Transformações Rápidas de Fourier.

Para a captação do sinal eletromiográfico e o posicionamento dos eletrodos em cada músculo avaliado, foram observados, rigorosamente, todos os processos recomendados pelo projeto *Surface ElectroMyoGraphy for the Non-Invasive Assessment of Muscles* (SENIAM) (Hermens, Freriks, Disselhorst-Klug, & Rau, 2000).

Os eletrodos foram colocados sobre o ventre muscular, paralelos às fibras musculares, de forma que ficaram distantes dois centímetros um do outro. Houve posicionamento e fixação dos eletrodos em Reto Abdominal (RA), Transverso Abdominal (TA)/Oblíquo Interno (OI), Oblíquo Externo (OE) em decúbito dorsal e multífidos (MU) em decúbito ventral, todos do lado direito do indivíduo, considerando a simetria entre os lados e a característica bilateral do exercício. Pares de eletrodos de superfície descartáveis, da marca

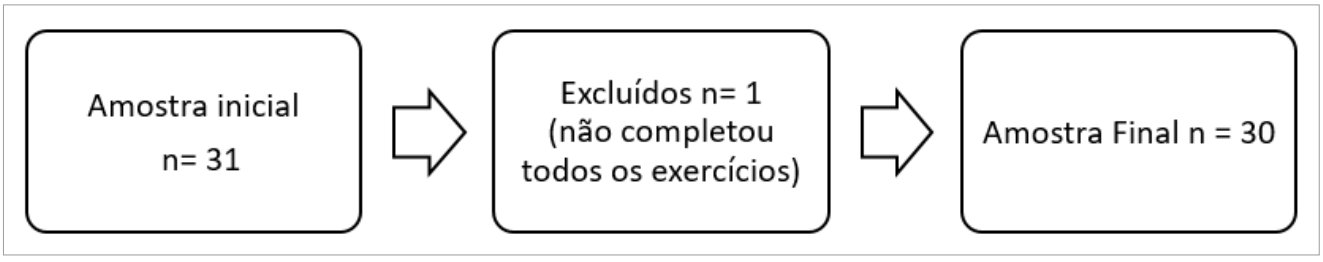

Figura 1. Fluxograma da triagem da amostra.

Solidor, foram utilizados (Ag/AgCl; 44 × 32 mm de tamanho, autofixantes, na configuração bipolar).

Para o RA, os eletrodos foram colocados três centímetros lateralmente ao umbigo. Os eletrodos para o TA e OI foram posicionados horizontalmente a dois centímetros mediais e dois centímetros distais à espinha ilíaca anterossuperior (Snijders, Ribbers, Bakker, Stoeckart, & Stam, 1998). Para o OE, os eletrodos foram posicionados acima da espinha ilíaca anterossuperior no nível da cicatriz umbilical (Escamilla et al., 2006). Para os MU, os eletrodos foram posicionados alinhados com a espinha ilíaca póstero-superior no espaço intermediário entre L1 e L2 de dois a três centímetros da linha média da coluna (Hermens et al., 2000). O eletrodo de referência foi colocado sobre o maléolo medial do lado direito.

Para efeitos de comparação, os sinais EMG foram normalizados com base na Contração Voluntária Máxima Isométrica (CIVM) dos músculos pesquisados. Para isso, antes do início do protocolo de avaliação descrito acima, todos os sujeitos foram submetidos à realização de um teste de CIVM, que consistiu na execução de três Contrações Voluntárias Máximas (CVMs), com duração de cinco segundos, manualmente resistidas e com incentivo verbal (Konrad, 2006). A variância individual e a informação da atividade muscular necessária para a execução da tarefa em relação à capacidade máxima da pessoa só são preservadas com a normalização da eletromiografia pela técnica de CIVM (Silva Jr., 2013).

Para as CVMs do músculo RA, o indivíduo foi posicionado em decúbito dorsal com os braços cruzados sobre o peito e pés imobilizados na alça do Mat (uma plataforma elevada utilizada no Pilates para executar os exercícios de solo). A partir da posição estabelecida, o indivíduo foi orientado a flexionar o tronco cerca de 30°, sem retirar a lombar do solo, e a manter por cinco segundos contra resistência manual sempre do mesmo avaliador. Para o OE, houve flexão do tronco com rotação para o lado esquerdo e, para o OI e transverso do abdome, flexão do tronco com rotação para o lado direito sempre contra a resistência. Para os músculos MU, o indivíduo foi posicionado em decúbito ventral, mãos sobrepostas no solo, testa sobre as mãos e pernas fixas pelos calcanhares em uma alça e pediu-se então o movimento de extensão mantido de tronco por cinco segundos contra a resistência (Konrad, 2006).

Para os exercícios de *Hundred Table Top* SPP e *Hundred Table Top* CPP (após execução dos exercícios de pré-pilates), o voluntário classificou sua Percepção de Esforço (PE) com o uso da escala CR10 de Borg. Segundo Borg (2000), a PE refere-se, principalmente, ao trabalho muscular intenso que envolve uma tensão relativamente grande sobre os sistemas musculoesquelético, cardiovascular e respiratório. Ainda, a PE está intimamente relacionada ao conceito de intensidade do exercício, ou seja, "de quão pesada e extenuante é uma tarefa física", podendo ser definida como sendo a intensidade subjetiva de esforço, tensão, desconforto e/ou fadiga, que são experimentados durante os exercícios físico-aeróbicos e os de força.

Intervenção

O protocolo de exercícios de Pilates e pré-pilates estão descritos no Quadro 1 e foram executados após a coleta das contrações isométricas voluntárias e na seguinte linha do tempo:

- Pilates — *Hundred Table Top* (Figura 2) SPP, dez ciclos respiratórios, resposta à escala de PE de Borg;
- Repouso de um minuto (apenas para demarcar o fim da etapa na qual se obtiveram os dados para o grupo SPP e o início das execuções relativas ao grupo CPP);
- Pré-pilates — *Basic Bridging* (Figura 3) — dez repetições;
- Pré-pilates — *Sternal Curls* (Figura 4) — dez repetições;
- Pré-pilates — *Low Abdominals* (Figura 5) — dez repetições;
- Pilates — *Hundred Table Top* (Figura 2) CPP, dez ciclos respiratórios, resposta à escala de PE de Borg.

Análise estatística

Inicialmente, os dados foram tabulados em pico, média e desvio-padrão (DP) dos exames eletromiográficos de RA, TA, OE e MU durante as execuções de *Hundred*. Os exames foram analisados e divididos em variáveis por dois grupos analisados: SPP e CPP. Portanto, as análises ocorreram intergrupo e intragrupo. Os valores eletromiográficos de cada músculo, normalizados por sua respectiva contração isométrica voluntária máxima, não seguiram uma distribuição normal quando aplicado o Teste de Shapiro-Wilk para a verificação da normalidade. O teste não paramétrico de Mann-Whitney foi aplicado para a análise comparativa dos dois grupos. Para todas as análises, considerou-se $p < 0,05$.

RESULTADOS

Verificou-se aumento dos valores de RMS de ativação muscular em RA e TA, porém, não foram significativos ($p \leq 0,05$) (Figura 6). Optou-se pela análise de RMS para se verificar a média instantânea de ativação para cada músculo recrutado durante o exercício a partir da distribuição do pico pelo domínio tempo.

Na análise gráfica dos valores das médias de ativação muscular, observa-se um aumento da média para três dos quatro músculos pesquisados: RA, TA e OE. Todavia, na

Quadro 1. Descrição dos exercícios do protocolo de pesquisa.

Pilates
Hundred Table Top
Objetivo: fortalecer o abdômen. **Posição inicial:** decúbito dorsal com flexão de quadril e joelhos a noventa graus (*table top*). **Execução:** Inspira e eleva-se a cabeça do solo e mantém-se em flexão isométrica de tronco. Inicia-se movimento para flexão e extensão através dos ombros dos membros superiores estendidos ao longo do corpo. São executadas 10 séries contínuas de 5 movimentos dos braços numa inspiração e 5 outros numa expiração, totalizando 100 repetições dos movimentos dos braços. Finalização é feita com o retorno à posição inicial.
Exercícios de Pré-pilates
1. Basic Bridging
Objetivo: articulação da coluna vertebral e o controle dos músculos glúteos e isquiotibiais. **Posição inicial:** decúbito dorsal, os calcanhares abaixo das articulações do joelho, as pernas na largura do quadril e os braços ao lado do corpo. **Execução**: na expiração, o voluntário rola a coluna vértebra por vértebra a partir do cóccix até a torácica, descarregando seu peso sobre os ombros. Inspira-se e, em nova expiração, o voluntário rola, gradualmente, a coluna vértebra por vértebra do esterno à posição inicial.
2. Sternal Curls
Objetivo: ativar, de forma consciente, os músculos abdominais superiores, melhorar a estabilidade e a força abdominal em posição supina e melhorar a percepção do bom alinhamento da cabeça. **Posição inicial:** em posição supina, joelhos dobrados e pés apoiados. **Execução:** na expiração, realiza-se uma flexão de tronco, levantando a parte superior do corpo até as pontas das escápulas e, na inspiração, retorna-se à posição inicial.
3. Low Abdominals
Objetivo: ativar os músculos abdominais profundos e músculos abdominais inferiores, melhorar a estabilidade e a força abdominal em decúbito dorsal e conscientizar os movimentos isolados dos quadris. **Posição inicial:** posição supina. **Execução:** pernas elevadas pela articulação dos quadris a 90° com os joelhos fletidos também a 90°, pés em flexão plantar, braços são estendidos ao longo do corpo, palmas para baixo. Na expiração, são requisitadas a ativação dos músculos do abdômen e a estabilização da pelve e lombar enquanto há a descida de ambas as pernas pelos quadris com os joelhos e pés imóveis.

Fonte: Fernández, González e Paredes (2008), Pont e Romero (2014), Isacowitz (2016) e Rahn e Lut (2020).

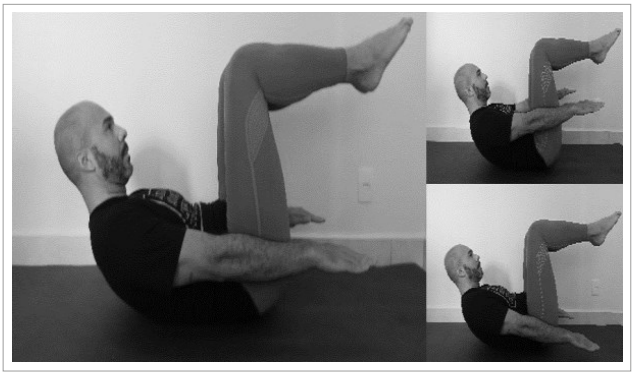

Figura 2. Exercício de Pilates: *Hundred Table Top*.

Figura 4. Exercícios de Pré-Pilates: *Sternal Curls*.

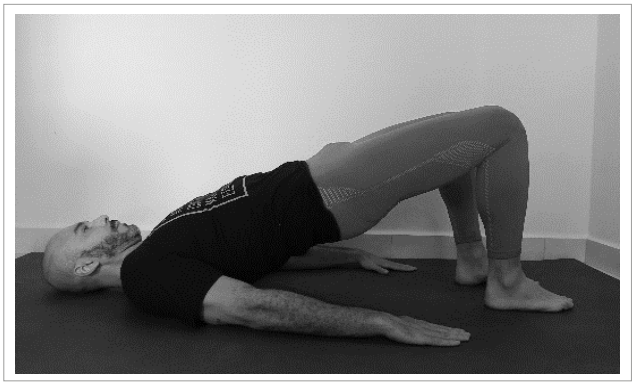

Figura 3. Exercícios de Pré-Pilates: *Basic Bridge*.

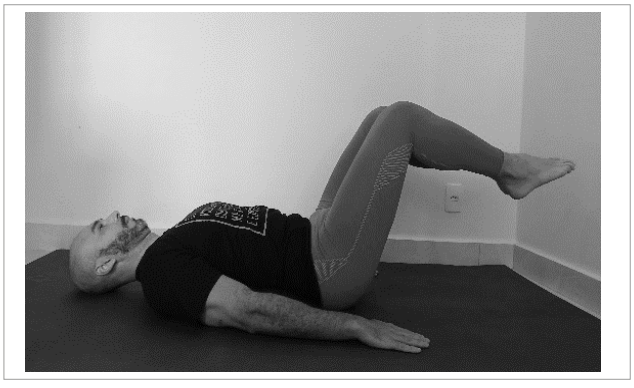

Figura 5. Exercícios de Pré-Pilates: *Low Abdominals*.

análise estatística do teste Mann-Whitney, também não se encontrou significância (Figura 7).

As estatísticas descritivas das médias de RA chamam a atenção (Quadro 2).

Metade dos voluntários avaliou como a mesma a sua PE para Hundred SPP e CPP. Uma segunda parcela (36,6% dos voluntários) avaliou o Hundred SPP como mais leve do que o Hundred CPP. A menor parte (13,3%) considerou o Hundred com pré-pilates mais leve do que SPP (Figura 8).

Quadro 2. Estatísticas descritivas das médias ativação de RA.

	Hundred SPP	Hundred CPP
Mínimo	0,1929µV	0,1928 µV
Máximo	0,6058 µV	3,982 µV
Range	0,4129 µV	3,790 µV
Média	0,3594 µV	0,4918 µV
Variância	0,1125 µV	0,6697 µV
Erro padrão	0,02054 µV	0,1223 µV

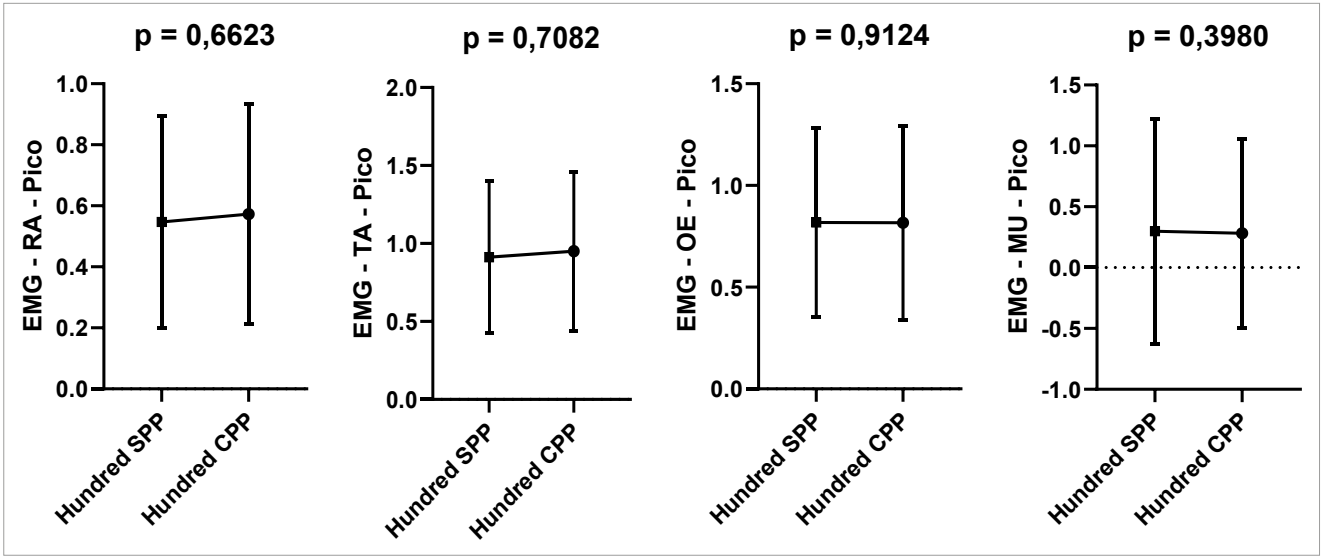

Figura 6. Valores de picos (+-DP) de EMG normalizados comparativos entre *Hundred* sem pré-pilates (SPP) e *Hundred* com pré-pilates (CPP) para músculos reto abdominal, transverso abdominal, oblíquo externo e multífidos e seus respectivos coeficientes p para teste *Mann-Whitney*.

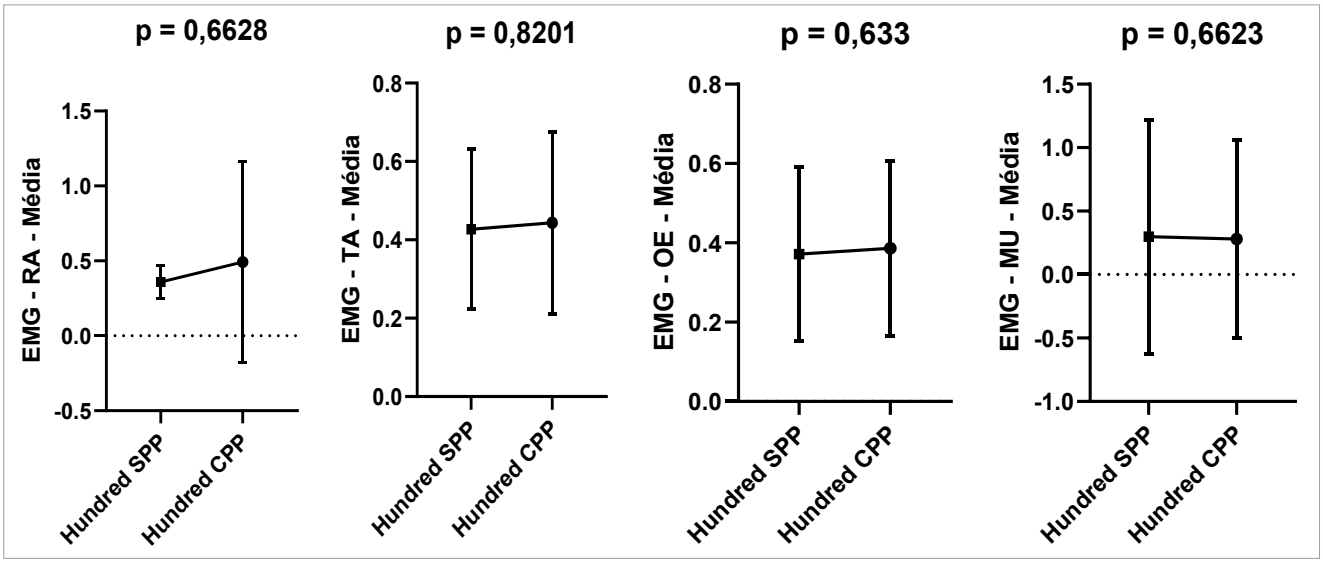

Figura 7. Valores de médias (+-DP) de EMG normalizados comparativos entre *Hundred* sem pré-pilates e *Hundred* (SPP) com pré-pilates (CPP) para músculos reto abdominal, transverso abdominal, oblíquo externo e multífidos e seus respectivos coeficientes p para teste *Mann-Whitney*.

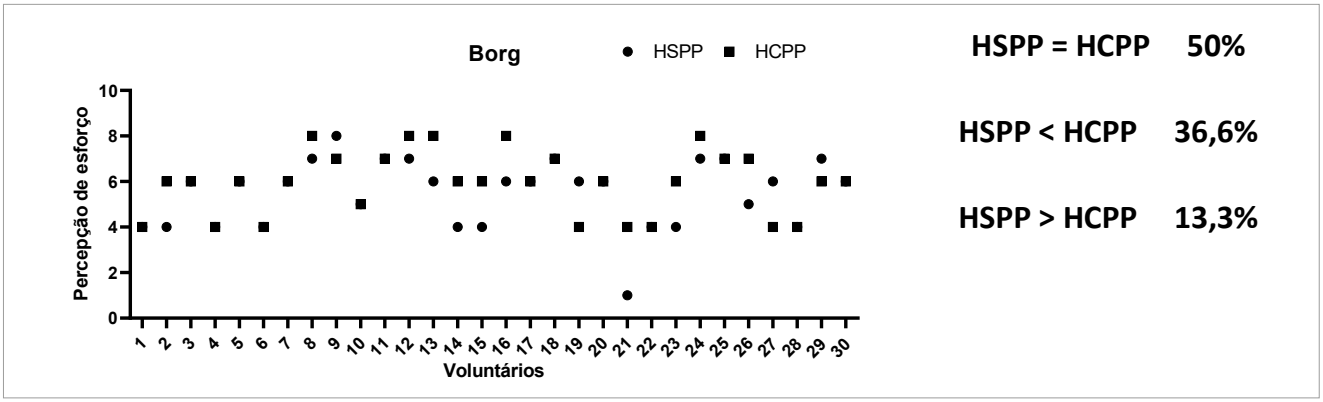

Figura 8. Gráfico de valores atribuídos à percepção de esforço após *Hundred* sem pré-pilates e *Hundred* com pré-pilates e porcentagens das percepções de esforço do grupo ao comparar exercícios.

DISCUSSÃO

O objetivo da execução dos exercícios de pré-pilates previamente ao protocolo geral de exercícios, seja para praticantes iniciantes ou avançados, é trazer à tona a concentração e a percepção corporal, contribuindo, assim, para a qualidade da execução dos exercícios do método Pilates devido ao aprimoramento do controle motor do centro de forças. O objetivo deste trabalho foi alcançado à medida que se verificaram maiores valores nos resultados eletromiográficos, principalmente dos músculos RA e TA, para a execução de *Hundred* pós pré-pilates. Este estudo é um dos primeiros a indicar a importância do pré-pilates para a execução dos exercícios seguintes.

O aumento de ativação muscular em reto abdominal e transverso do abdômen apesar de não significativo estatisticamente apoia uma revisão sistemática recente, a qual sugeriu que o treinamento do tronco parece ser eficaz para restaurar a simetria e melhorar a atividade dos músculos TA e OI (Van Criekinge et al., 2019). Assim, a mesma autora relatou que estudos examinaram o efeito do treinamento do tronco na amplitude mioelétrica da atividade muscular no abdome e nas costas, e a atividade muscular dos MU e RA aumentou após o treinamento do tronco (Van Criekinge, Saeys, Vereeck, Hertogh, & Truijen, 2018).

Para que se tenha melhor direcionamento para o treinamento, é importante a análise dos músculos citados acima. Neste estudo, ao comparar os valores de ativação de picos e médias dos músculos RA, TA/OI, OE e MU, não houve significância. Este fato nega, primariamente, a hipótese de que os exercícios de pré-pilates ajam de forma a incrementar a ativação destes músculos no exercício *Hundred*. Em contrapartida ao coeficiente, os resultados indicam aumento nos picos e médias de ativação em RA e TA e nas médias de OE. É importante considerar que os voluntários são praticantes do método e já possuem níveis satisfatórios de treinamento, força e consciência corporal, fazendo com que os valores de ativação não sejam tão exponencialmente diferentes no *Hundred* SPP e CPP. Portanto, infere-se que o comportamento motor já tenha sido desenvolvido.

Uma fonte de variabilidade dos valores de EMG surge do processo de normalização do sinal EMG. Para permitir comparações individuais, é utilizada a atividade elétrica voluntária máxima que está, consequentemente, sujeita à influência de motivação e aprendizado motor (Baratta, Solomonow, Zhou, & Zhu, 1998; Burden, 2010). Neste estudo, a média de ativação do RA para o grupo HCPP (3,982 μv) mostrou-se superior ao HSPP (0,6058μv). Essas informações vão ao encontro do objetivo do sistema básico do Pilates em que um dos principais músculos motores é o RA para a flexão de tronco. Este movimento também compõe a estruturação do exercício *Hundred* e está ligado, intimamente, à formação da curva "C" da coluna, a qual é recorrente em todo o método. Além do treinamento já existente, o estímulo sensorial e muscular e as mobilizações ocorridas durante o pré-pilates, provavelmente, direcionaram o recrutamento de mais unidades motoras da musculatura flexora do tronco, distribuindo mais os sinais mioelétricos, o que reflete no ganho de funcionalidade. O decréscimo de ativação de MU (Figuras 6 e 7) explicaria o sinal mioelétrico aumentar em flexores, porém, não tanto na execução do *Hundred* CPP.

Quanto às análises realizadas com a finalidade de se verificar a resposta muscular a algum estímulo físico, é importante também ter conhecimento sobre como o voluntário percebe o esforço realizado. Portanto, somando-se às análises, tem-se a comparação da PE da execução do *Hundred* CPP e SPP. A Percepção Subjetiva de Esforço (PSE) é um sentimento cognitivo que poderia ser descrito como "o sentimento particular" da energia despendida em uma ação acompanhada pela

sensação de tensão e trabalho voluntário que se intensifica à medida que a pessoa procura maiores alcances no esforço (Preston & Wegner, 2009). Metade dos voluntários relatou os mesmos valores de percepção para ambos os exercícios. Entre a execução de um e outro, realizaram-se os exercícios de pré-pilates que poderiam colaborar para o processo de desenvolvimento de fadiga ao indivíduo, todavia, mantiveram-no em mesmo nível de percepção. Uma outra parte da amostra (13,3%) referiu menor PE após o pré-pilates. Ao unir os dois grupos já citados, tem-se um total de 63,3% do grupo com percepção positiva em termos de aptidão e condicionamento físico e mental. Ressalta-se que são indivíduos treinados e que possuem técnica, resistência e força para bem executar o exercício *Hundred*, logo, não o percebem como algo exaustivo.

Os programas de treinamento de Pilates têm sido associados a melhorias na força e resistência da musculatura abdominal (Emery, Serres, McMillan, & Côté, 2010; Kloubec, 2010). Estudos demonstraram que o Método Pilates contribui para a hipertrofia muscular da parede abdominal avaliada por ressonância magnética (Dorado, Calbet, Lopez-Gordillo, Alayon, & Sanchis-Moysi, 2012) e ultrassom (Critchley, Pierson, & Battersby, 2011). Os outros 36,3% dos voluntários relataram maior esforço para executar o *Hundred* CPP, mesmo o exercício sendo idêntico ao *Hundred* anterior, exceto pelos exercícios de pré-pilates, o que indica possível desgaste físico devido à execução destes últimos e consequente interferência destes no centro de forças do voluntário e maior sensação de esforço para a mesma tarefa. Esse relato de maior esforço pode ser devido ao menor tempo de treinamento no método, menor resistência, dificuldades técnicas de execução e até mesmo motivação para a execução, visto que é um exercício feito uma única vez por sessão e foram duas execuções, as quais eles não tinham ciência, na coleta de dados.

O estudo realizado apresentou limitações quanto à sua população e recursos. O fato de o estudo ter sido realizado em período de pandemia do Coronavírus necessitou de mais cuidados para os participantes. Os voluntários permaneceram de máscara durante a realização dos exercícios. Portanto, a possível dificuldade em respirar, em alguns momentos, pode ser fator contributivo para os resultados. Nesse contexto, é importante que o protocolo seja realizado também fora dessas condições. Quanto aos recursos metodológicos, não houve avaliação quanto a outras ferramentas, como a dinamometria, por exemplo, o que poderia ser associado à avaliação e permitir a inserção de dados que pudessem ser analisados junto à eletromiografia. Também, embora todos os requisitos fossem criteriosamente seguidos para a definição da amostra, não foi considerada alguma atividade laboral ou de lazer específica.

O presente estudo chama a atenção para o fato de que o pré-pilates é importante para que o protocolo de pilates seja mais efetivo, a partir de prévio conhecimento e da adaptação que o praticante adquire, devendo assim ser utilizado pelos profissionais de Pilates em seus clientes. Os benefícios são no sentido da percepção corporal e que direcionam para a adequação dos movimentos seguintes. Também, surge a premissa de que diferentes indivíduos conseguem executar o mesmo exercício *Hundred* com diferentes predominâncias dos músculos envolvidos. Associar o registro das atividades elétricas dos músculos abdominais e flexores do tronco a outras ferramentas biomecânicas seria importante.

Disseminar os fundamentos do treino de pré-pilates e elucidar sua ação sobre a execução do repertório de exercícios do Pilates é importante para a comunidade praticante do método, tanto profissionais quanto clientes, com o objetivo de maior qualidade, eficácia e segurança da prática e o consequente usufruir de seus benefícios de forma mais expoente. Esse treinamento permite, ao profissional capacitado pelo método Pilates, trabalhar, de forma mais abrangente, a percepção corporal do praticante a fim de que ele consiga, em seus limites, compreender as modificações em cada movimento e trabalhar as possiblidades para melhorias.

CONCLUSÃO

Os exercícios de pré-pilates direcionam para maiores ativações da musculara reto abdominal e de transverso do abdômen do exercício Hundred quando executados antes deste, além de gerar melhora na percepção subjetiva de esforço. Os exercícios de pré-pilates, portanto, agregam para melhor eficácia dos exercícios de Pilates e devem entrar para o escopo das pesquisas científicas dentro do método Pilates, bem como na prática clínica.

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ORIGINAL ARTICLE

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Elite futsal players' perceptions of paths to expertise: a multidimensional and qualitative approach

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ABSTRACT

This study aimed to describe the perception of expert futsal players about the pathway that guides their development to expertise. Twenty-three professional futsal players from Brazil, Spain, Italy, Portugal, and Argentina were interviewed. The participants must have reached the elite in futsal by competing in professional leagues, as well as to have participated in international competitions with the national team. Six categories emerged from qualitative analysis: (1) positive influence of context, (2) Abilities/skills of the young player, (3) Educational background, (4) Training stages, (5) Key aspects of training, and (6) Retirement and post-career. Results revealed similar patterns in the pathway to expertise within futsal. Participants considered their family and coaches as key individuals in their careers. They also highlighted psychological and personal skills as the most relevant for a player to reach the elite. Furthermore, most participants considered that both unstructured play and training with better players positively influenced their careers. Our results could help coaches to adjust their long-term talent development models.

KEYWORDS: expertise; psychological; talent development; transition; interview.

INTRODUCTION

Talent development in sports has been studied by many researchers in the last decades due to the social and economic importance of reaching the elite (Woods, Joyce, & Robertson, 2016). Over the last years, the assumption that talent results from the constant interaction between genes and environment (from macro contextual settings to micro-structure of practice) was reinforced by previous research (Davids, Güllich, Shuttleworth, & Araújo, 2017; Güllich, 2018). This interaction may facilitate the individual development for exceptional sports performance with the risk of identifying different successful paths for talent development (Davids et al., 2017; Baker, Schorer, & Wattie, 2018) due to the influence of differences in macro contextual settings and the micro-structure of practice observed in different sports (Davids et al., 2017; Güllich, 2018).

To uncover the contextual settings and the micro-structure of practice for talent development, one of the most common methods was the analysis of the paths to the expertise of the athletes (Gulbin, Weissensteiner, Oldenziel, & Gagné, 2013). The use of this method leads researchers to create several models of the pathway to the elite. Bloom (1985), for example, highlighted that individuals go through three stages in the pathway to excellence: Early Years and Stage of Initiation, Middle Years and Stage of Development, and Late Years and Stage of Perfection. Later, Côté (1999) and Baker, Cote, and Abernethy (2003) improved the previous work of Bloom and proposed that the development of expertise go through three new stages: Sampling Years, Specializing Years, and Investment Years. One of the main assumptions raised by the authors was that there was such a great difference in both the quality and quantity of training between experts and non-experts during the last stages of development.

In short, during the first years of players' development, they participate in enjoying activities with the only purpose of trying as many activities as parents/teachers can provide them

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(Bloom, 1985). Teachers play a key role in this stage. Later, during the specialisation years, the athlete starts focusing on one or two sports. Their teachers and coaches are technically more prepared, and parents show a gradual interest in the sport chosen by the athlete. The time for training increases as well as the discipline and hardworking. Competition is seen as a measure of evaluation. Finally, during the investment years, athletes reach expertise and spend as much time and effort as they can to be successful. The coach has high importance to them. In this stage, parents are not as relevant as they were previously (Côté, 1999). Despite this, Güllich (2018) recently reinforced that elite and non-elite players were not discriminated by the time of training of specific sport practice but by the variability of practice and interplay during the Sampling years. The Holistic Athletic Career Model (Wylleman & Rosier, 2016), a lifespan perspective of career development, advocated the need to understand career development as a sequence of phases in a multilayer process (Battochio, Stambulova, & Schinke, 2016; Stambulova & Wylleman, 2019).

Within football, the paths for talent development have been studied with some attention in the last decades (Collins & MacNamara, 2012). Thus, meanwhile there is considerable evidence of studies about talent development in football; it does not seem to exist the same literature when it comes to futsal. To our best knowledge, only one study compared the long-term athlete development of elite and non-elite Portuguese futsal players (Serrano, Santos, Sampaio, & Leite, 2013). Interestingly, contrary to previous research in football (Güllich, Kovar, Zart, & Reimann, 2017), results revealed that elite players are differentiated from non-elite futsal players by higher competitive level for a progressive specialisation since the age of 14 with a corresponding increase in the quantity (i.e., time of formal practice and number of formal games) and quality of futsal practice (Serrano et al., 2013).

Nevertheless, in line with Coutinho, Mesquita, and Fonseca (2016), a detailed contextual description of practice is required to capture different factors that can positively or negatively influence players' career development. Retrospective interviews with expert players allow the mobilisation of their empirical knowledge and feelings about their own experiences in a first-person view, which can be very reached and informative to understand the process (Sosniak, 2006).

Therefore, this qualitative study aimed to describe the perception of expert futsal players about the pathway that guides their development to expertise. Our research questions were 1) how is the development process of talented futsal players? And 2) why do some players reach the elite level and others do not? Thus, the purposes of this study were: (1) to gain depth knowledge about the influence of the context and the people who influenced players' careers through all stages. And (2) to identify the individual skills that characterise a potential futsal player and its development, (3) to identify the sporting life of participants at different stages of talent development, (4) to understand the perspectives of career retirement and post-career of elite athletes.

METHOD

Participants

The criteria for considering a potential participant were the following: (1) to have reached the elite in futsal by competing as senior players in the best clubs of their country or other, and (2) to have participated in international competitions. Twenty-three professional futsal players took part in the study (M_{age}= 30.60, SD= 3.56). They belonged to five nationalities: Brazil (5), Spain (5), Italy (5), Portugal (5) and Argentina (3). They were contacted in person by the authors of the study.

Measures

A semi-structured interview composed of 50 questions was developed based on previous literature (Côté, Ericsson, & Law, 2005; Carapinheira, Torregrossa, Mendes, Carvalho, & Travassos, 2018; Monteiro, Monteiro, Nunes, Torregrossa, & Travassos, 2020). The interview guide (Table 1) was written in the English language and sent by email to five experts (one of each nationality) in the field of talent identification and development. All of them approved the interview and translated it into their native language.

Procedures

Prior to data collection, the aim of the study was explained, and participants gave their verbal consent to the interview being recorded. Interviewers ensured the anonymity of the data and guaranteed that the information would be used exclusively for research purposes.

Interviews were scheduled at times convenient for the participants and were conducted by telephone or video call by three researchers between 2018 and 2020. Participants were interviewed for approximately 45-60 minutes in their native language. All interviews were audio-recorded, transcribed verbatim and translated into English to be coded and analysed by the second and third authors.

Qualitative analysis

Transcribed material was uploaded into the qualitative software Atlas.ti 8.4.15 for coding and analysis. A qualitative

Table 1. Final interview guide.

Warm-up questions
1. What is your home city?
2. Was any of your parents a professional futsal or other sports professional?
3. Can you tell us how you consider your family structure?
4. How many siblings do you have? Do they practice any sport?
Questions about the beginning and training in the futsal
5. How did you start playing futsal? What is the reason that led you to play it?
6. At what age did you start playing futsal in an unstructured way? (Street, schoolyard, with friends, etc.) Where? Did you play with peers of the same age?
7. At what age did you start playing structured futsal (clubs, schools, etc.)? Have you always played in your age group or sometimes with higher category teams?
8. How many years have you been training futsal until reaching the elite?
9. How many years have you been competing professionally in futsal?
10. How many days and hours did you train per week when you were in the following stages: Promotion stage (6 to 11 years old), initiation stage (12 to 14 years old), technification stage (15 to 17 years), and performance stage (18 years or over).
11. How many days and hours do you currently train per week?
Questions about the sports career
12. Since childhood, have you always loved playing sports? Which ones have you practiced? How often?
13. Have you done other artistic / cultural activities (music, painting, etc.) besides sports?
14. When did you begin to realise that you wanted to be a professional soccer player?
15. Did you leave home to continue your sports career? At what age?
16. Who gave you the first opportunity to play on a professional team?
17. At what age did you debut in the first division? What has been your career before playing in the first division?
Questions about the influence of the context
18. Who was the first person to tell you that you could be a professional futsal player?
19. During your career, did you drop out of school to continue your development process in futsal? What are the difficulties in reconciling your studies with your profession as a footballer?
20. How important was your family to studying? Do you consider it important to have good qualification to reach the elite of futsal?
21. Did your family have to make sacrifices for your sports career?
22. Has your family pressured you to become a professional soccer player?
23. What influence does your partner have on your participation in futsal and in the development process? In addition, your friends?
24. What influence did your coaches have? Did they pressure you to stand out from other players?
25. In which area (technical knowledge, leadership or motivational) was the coach more important for you? Why?
26. What influence did the Physical Education teacher have on your involvement with sport?
27. If you had to choose, who would be the person who most influenced your career as a futsal player? why?
28. Who was the person who most helped you not give up on your dream?
Questions about the training
29. What do you consider most important in training, the quality or quantity of it?
30. What is the value you place on physical training? (Strength, endurance, flexibility, agility, speed). Do you prefer to do it in the club or individually?
31. Is it better to train under pressure? (For example, playing a final) Why?
32. What is the role of psychological / mental training?
33. What is the importance of viewing videos of your team and the opposing teams?
34. Do you prefer to train and play with colleagues that are more physically and technically trained than you? Why?
Questions about key aspects in the development process
35. What characteristics must a young player have to reach and remain in the elite?
36. What is the importance of knowing how to cope with competitive stress?
37. What is the importance of competitiveness with oneself to reach the elite?
38. What is the importance of having a good relationship with teammates?
39. What is the role of self-confidence in this development process?
40. How important is the confidence that other coaches or colleagues have placed in you?
41. Do you consider commitment important in the development process?
42. What characteristic / ability / talent do you think coaches have seen in you to give you the opportunity to debut in the first division?
Questions about the future perspectives
43. At what age do you plan to retire as a professional futsal player?
44. Do you think about that time? Have you ever suffered from burnout syndrome? How do you feel when you think about the end of your career?
45. What do you plan to do after leaving futsal?
Questions about available resources
46. Do you consider it important to have had the material resources necessary to train (facilities, balls, cones, etc.)? Why?
47. Were the financial aid important? Why?
48. Since you started playing futsal, did you have enough opportunities to compete whenever you wanted?
49. What influence does your country have on your participation in futsal and in the training process?
Question to finish
50. Is there anything you would like to add that you consider important that was not said during the interview? (Importance of other aspects, luck, injuries, etc.).

content analysis was conducted, using a descriptive approach by interpreting data and measuring the frequencies of the categories and subcategories (Vaismoradi, Turunen, & Bondas, 2013). The analysis was conducted following the steps established by Elo and Kyngäs (2018).

The second and fourth authors independently read the same five interviews, representing 20% of the total, to familiarise themselves with the data. Each one highlighted the important ideas, grouped similar information into main categories/subcategories, and elaborated an initial codebook that was commented on with the other author in a meeting. After discussing the codifications that arose from their data readings, both authors resolved discrepancies and generated the final codebook, which the first author approved. This codebook included the categories and subcategories as well as their descriptions. Once the final codebook was created, the second author coded the entire data set using Atlas.ti.

The following section will show the main results and frequency of the categories (%).

RESULTS

Six categories emerged from the analysis of participants' responses: (1) Positive influence of context, (2) Abilities/skills of the young player with potential to reach the elite, (3) Educational background, (4) Training stages, (5) Key aspects of training, (6) Retirement and post-career. Table 2 provides the descriptions and frequencies of each category and subcategory.

Positive influence of context

This category shows how different agents have influenced futsal players' careers. Overall, the context was found to have a positive influence on them. As 92% of players revealed, family and coaches were the most determinant agents in their pathway to the elite. Within this category, seven subcategories were observed and considered in the following order of frequency: family and coaches (92%), professional teammates (72%), home country (68%), material and financial resources (60%), friends (44%) and PE teacher (40%).

Concerning family, parents were those that exerted the highest influence on their careers. A Brazilian player (P7) said, "My parents were key, they always supported and encouraged me…, and they always fought for me not to work [in other jobs]." Regarding siblings, a Portuguese player (P23) said, "He [His brother] was the first person to tell me that I would reach the elite". However, although all players agreed on the importance of family in general, some members appeared to have lower or even negative influence (e.g., "When I had a partner she bothered me a lot… I was not able to be concentrated on my work. It hurt me a lot at that time;" P6, Spanish).

Regarding coaches, all players acknowledged their importance since they are responsible for their training and guiding their development. As a Spanish player (P19) explained: "My coaches devoted 60-70% [of training time] to tactical… 20-30% to technical and 5-10% to psychological aspects."

Apart from family and coaches, professional teammates were also considered a key influence by many players. Participants mentioned that teammates help reach better outcomes and make the training easier. A Portuguese player (P16) said: "I don't think everyone has to be friends outside of the team environment, but you must always have respect between all colleagues and coaching staff. I think a good atmosphere brings good results more easily."

Finally, from the players' view, friends and PE teachers influenced their careers to a lesser extent. In fact, a Spanish player (P18) explained that the influence of PE teacher could have been negative: "I think the influence that he [PE teacher] had could have been even negative, because he [PE teacher] was from the old school [traditional]…and PE lessons were like military lessons."

Home country and material and financial resources were also highlighted as important positive contextual aspects. Some players explained that the home country is decisive in terms of the national recognition of futsal, as well as the available equipment and economic recognition. In this sense, an Argentine player (P21) said: "I think being comfortable and calm is very important, just focusing on sports, without being worried about having food one day, paying a bill or something like that. I believe that economics is also very important for futsal players."

Conversely, some players think that becoming a professional does not depend on their home country or financial support but on their commitment to reaching the elite. An Argentine player (P11) shared: "I believe that being a professional doesn't depend on having economic retribution…It seems to me that [being a professional player] depends on you, on what you want to do and how you want to do it." Similarly, a Spanish participant (P18) explained that home country or material and financial resources are not extremely decisive for being a professional player: "… He [one Brazilian colleague] appeared barefoot to play. He told me that he had learned to play barefoot and shoes were a luxury for him. It's, certainly, an example of a colleague who trained without shoes and equally reached the first division."

Table 2. Frequency and descriptions of each category and subcategory*.

Categories	Subcategories	Description	Frequency	%
1. Positive influence of context	1.1 Family	Their parents, siblings and/or partner have had a great influence on their professional careers.	23	92
	1.2 Coaches	Their coaches, from all the categories, have had a great influence on their professional careers.	23	92
	1.3 Physical Education (PE) teachers	Their primary and secondary PE teachers had a great influence on their professional careers.	10	40
	1.4 Friends	Their friends have had a great influence on their professional careers.	11	44
	1.5 Professional teammates	The relationship with their teammates has a great influence on their professional careers.	18	72
	1.6 Home country	They think that the home country is decisive in terms of access to facilities and sport materials.	17	68
	1.7 Material and financial resources	The access to material and financial resources has notably helped them in their careers.	15	60
2. Abilities/ skills of the young player with potential to reach the elite	2.1 Physical abilites	They mention some basic physical abilities (e.g., endurance, speed).	3	12
	2.2 Technical-tactical skills	They consider both technical and tactical aspects as important.	8	32
	2.3 Psychological and personal skills	They mention some psychological aspects: coping with stress, engagement, motivation, self-confidence, humility and persistence	22	88
3. Educational background	3.1 Difficulties to combine studies and sport	Players explain that they had limitations to combine sport (training and competitions) with study from the deliberated play stage.	19	76
	3.2 Importance of being qualified to reach the sporting elite	They place value on having a good qualification to reach the elite.	18	72
4. Training stages	4.1 Deliberated play	Unstructured and informal play that took place in the street and playground with friends.	22	88
	4.2 Structured practice	Teams that participated in regulated and competitive leagues.	17	68
	4.3 Participation in other sports or activities	Apart from training futsal, they did another activities or sports.	20	80
	4.4 Promotion among categories	Players were promoted to higher categories because of their precocity in futsal (e.g., a U10 player trained and competed with the U12 team).	10	40
5. Key aspects of training	5.1 Quantity	They consider that quantity of training (i.e., more hours of training) is a key aspect in their professional careers, even more than quality.	4	16
	5.2 Quality	Contrary to the previous subcategory, players think that training quality is decisive for being a professional futsal player.	22	88
	5.3 Physical-condition	Same description as in 2.1	20	80
	5.4 Technical-tactical	Same description as in 2.2	2	8
	5.5 Psychological	Same description as in 2.3.	23	92
	5.6 Video display	Viewing videos, both of their rivals and their own matches.	20	80
	5.7 Training with better players	They reveal their preference for training and playing with better players.	22	88
6. Retirement and post-career	6.1 Remain associated with the futsal context	They have the intention to remain associated with futsal, developing other roles, such as sport manager, sport director or coach.	16	64
	6.2 Managing a business	They have the intention to set up a business, but not related to futsal.	10	40
	6.3 Resume studies	They have the intention to resume studies that they did not finish before because of their lack of time.	4	16

*Frequency is based on the number of players who talked about each category or subcategory.

Abilities/skills of the young player with the potential to reach the elite

The second category that emerged from the data was the identification of abilities/skills of the young player with the potential to reach the elite. Within this category, Psychological and personal skills (88%) were the most highlighted aspects by players, followed by technical-tactical skills (32%) and Physical abilities (12%).

Most players emphasised the personality and psychological characteristics (88%), such as coping with stress, engagement, commitment, motivation, self-confidence, humility and persistence as skills that young players need to develop to reach the elite. For example, a Spanish participant (P15) explained, "he has a minimum of skills, but especially he listens and wants to learn. He was a boy who really listens the coach, who asks, who is lively and really listens to the opinions of other players and coaches.", or "especially enthusiasm and passion" (P18, Spanish player), or

> [Young players] must be very persevering and respectful. He must respect his teammates a lot, both those who play with him and those who play against him. For me, it is important to be humble and train, train, train. Train what you are good at, obviously. Train what you are not so good and always try to improve. That humility of knowing that you are never perfect, that you can always improve. Therefore, that is what can lead the person to reach the elite (P9, Brazilian player).

In opposition to the category of key aspects of training, players emphasised more the technical-tactical skills of youngers and only at the end their physical abilities. An Argentine player (P11) shared:

> By doing the basics (controlling, guiding, passing, and kicking), being physically and mentally well, you can play on the elite level." Another one stated that "It is true that in futsal, control and passing are essential. Without control and pass, you cannot get anywhere, but well, you must differentiate the quality in terms of control and pass. I believe that physical aspect and tactical rigor, having a technical basis of control and passing, and competitiveness with oneself is what matters.

Finally, some players also acknowledged the key role of physical abilities for the development as futsal players (e.g., "The main thing is that guys are physically well, that they take care of themselves... I think that having that, they can get to play in a league." P21, Argentine player).

Educational background

The third category that emerged from the data was the players' educational career. Within this category, two subcategories were observed and considered in the following order of frequency: Difficulties in combining studies and sport (76%) and the importance of being qualified to reach the sporting elite (72%).

Players revealed the value they place on studying and the difficulties they handled combining studies and a futsal career, which led some of them to leave their undergraduate studies. A Spanish player (P18) said:

> The main problem is the physical fatigue caused by the training sessions. After that, you must have the willpower to dedicate yourself to study. Moreover, you might miss many classes due to the training sessions, but especially for trips around the country each weekend. It's true that we have a lot of free time, but it isn't easy to invest that free time in studying.

However, sometimes this decision was voluntary and not forced by the situation. An Argentine player (P11) stated: "It was a choice of mine not to continue studying at the university level, but it was a mistake."

There was no consensus about the importance of being qualified to become futsal players (78.26%). Most of them claimed that qualification is not necessary but recommendable. In this sense, one of the Spanish players (P18) explained that he was signed by a professional team because of his high qualification: "The coach considered they [coaches] must have qualified people in a team because they had many bumpkin [players]."

Training stages

This fourth category included an insight into the players' training stages throughout their lives. Participants were asked about the deliberated play and structured practice to gain such insight. They were also asked about their participation in other activities and possible promotion among categories.

Within this category, four subcategories were established: deliberated play (88%), participation in other sports or activities (80%), structured practice (68%), and promotion among categories (40%).

Deliberated play and participation in other sports or activities were considered very important in developing the expertise. However, such a process was not linear, and some players started to play futsal at an older age (e.g., "I started playing futsal when I was 16, directly in the first team;" P1, Italian player).

On average, futsal players in our study had only 6.2 years of training until reaching the senior level. Almost all players participated in other sports or activities during their childhood and adolescence, such as other sports, music or painting.

Finally, nearly half of the players (40%) were usually promoted to superior categories because of their precocity and talent (e.g., a U10 player trained and competed with the U12 team). Regarding this, a Portuguese player (P12) said: "When I started in futsal with 13 years, I played many times in my category, but also in the superior one. As I became older, I played more and more times on a higher level than on mine."

Key aspects of training

Participants pointed out several aspects of training that play an essential role in the pathway to the elite. Within this category, seven subcategories were observed and considered in the following order of frequency: psychological (92%), quality and training with better players (88%), video display and physical condition (80%), quantity (16%) and technical tactical aspects (8%).

Almost of the players highlighted the relevance of psychological characteristics (e.g., coping with stress, engagement, motivation, self-confidence, humility and persistence), as a Brazilian player (P22) described:

> The psychological aspect has a vital role because currently the psychological influences have a high impact on sports. The pressure is good, but it is also bad. When you feel too much pressure, if the person do not have the psychological aspect very well worked out, or if the person is having any problem at home, or problems in any area of their life, I think it will greatly influence your performance on the pitch. I think the person must be always concentrated. When I go to the pitch, the thought is just on the pitch because any lapse in concentration could cause a defeat for my team.

Other respondents supported the key role of the psychological dimension. An Argentine player (P11) explained that he had seen some very good players at technical level that could be pro players. However, they do not reach the elite because of their lack of psychological skills.

Regarding the ongoing debate about quantity vs quality of training, almost all players highlighted that quality is more determinant than quantity. A Spanish player mentioned that "The quality. Training a lot and without any kind of criteria… .is like doing nothing" (P10). Furthermore, a Spanish player (P19) stated: "Generally the quality, and at specific moments it can be the quantity. Generally, out of 100% of the season, 85% must be quality."

Also, they reinforced the importance of competitivity in the team and the training sessions, by training with better players, as a fundamental issue. A Spanish player (P13) explained: "I think you learn more, if you consider you are at a much higher level than the average, you could settle down. I believe that the better the colleagues, the more you push yourself, day after day, and in the end, you improve."

Players also clearly stated that physical-conditional training and video display are key issues in their development, especially as complements to athlete's preparation.

Also, players mentioned that physical condition is vital for the development of elite players: "I think it's [physical training] an essential complement in the athlete's training." (P18, Spanish). Regarding the value of video display to improve their knowledge about the game and their tactical performance, a Portuguese player (P14) shared:

> I think it [video display] is a mental preparation for what you are going to find [in a match]. It helps you to have more knowledge of what could happen. Knowing what type of movements and individual and collective characteristics helps you to stay one-step ahead of your opponent.

In opposition, the great expertise in technical-tactical skills was not identified as important as other aspects of training. An Argentine player (P11) explained: At technical level, it is confused that a good player is a player who plays one for one, or who makes bicycle kick goals or "rabona" passes… He [the participant mentions the name of a player] knows how to do many things that many players are not able to do, but he also does the basics very well. However, there are guys who want to do what he does, that's beyond the reach of many, without doing the basics well. Do you understand? ...the basic thing is to control, guide, pass and shoot, that is the basic... simple things are not easy and one thinks that simple [things] are easy and they aren't. Simple [things] are simple, but making them easy is difficult.

Retirement and post-career

This category included the participants' future expectations after retiring from futsal as professional players. Within this category, three subcategories were observed and considered in the following order of frequency: Remain associated with the futsal context (64%), managing a business (40%), and resume studies (16%).

Most of the players revealed their intention to remain associated with the futsal context, developing other roles such as sports manager, sports director or coach. For example, an Italian participant (P3) said: "I would like to actively participate in the development of this field." Similarly, another respondent shared his intention to remain associated with futsal: "Anything related to futsal. Trying to give back some of what futsal gave me." (P7, Brazilian player).

Another mentioned prospect by nearly half of the players (43.58%) was to manage a business not related to futsal. A Spanish player (P13) said: "I'd like to set up something [a business] of my own…because I'm studying business administration." Finally, a reduced number of players would like to resume studies that they did not finish before because of their lack of time. A Portuguese player (P14) stated: "When I retire, I'll take some sabbatical months to enjoy my family and continue some courses that during the professional career were impossible to take. I'll evaluate what possibilities may arise from these studies."

DISCUSSION

This study aimed to describe the perception of expert futsal players about the pathway that guides their development to expertise. Through a qualitative content analysis, we identified six categories that contribute to explain the career pathway of futsal players to expertise.

The analysis of the category *positive influence of context* allows us to broaden our understanding of the impact of the context and people who influenced players' careers through all stages. In line with previous research, family members and coaches were mentioned as key individuals for futsal players' development, especially in their careers' initial and developmental stages (Bloom, 1985; Côté, 1999).

Additionally, teammates seem to be very influential for many players but only during the process of professionalisation. These findings suggest that while the family is a key factor during the Sampling Years, by supporting and encouraging the practice, coaches contribute later on in the Specialising years to promote goals' achievement and create a good environment that guides players' development. Teammates, for their part, seem to contribute at the Investment Years to promote competitiveness, a good atmosphere, and a motivational climate to improve performance and career development (Keegan, Spray, Harwood, & Lavallee, 2010).

Interestingly, unlike previous research (Bloom, 1985; Côté, 1999), PE teachers were barely identified by players as an important influence on their initiation and development as a player. In fact, some players stated that PE teachers had a negative influence on their careers. This may be because Futsal is a recent sport not included in the PE curriculum in most countries. An alternative explanation could be the lack of qualification of PE teachers in teaching and training Futsal during their bachelor courses in Universities.

In line with the previous proposals that highlighted the contextual influences on talent development (Davids & Baker, 2007; Hancock, Coutinho, Côté, & Mesquita, 2018), futsal players also pointed out that the Home country, sports development and national recognition of futsal, and the available equipment and economic support contribute to improving and sustaining their goal to be elite players in the future.

Regarding individual skills that characterise a potential futsal player and its development, participants highlighted psychological and personal skills, followed by technical-tactical skills and physical abilities of players. As in previous research, most players emphasised that some psychological abilities, such as coping with stress, engagement, commitment, motivation, self-confidence, humility, and persistence, are decisive in reaching the elite (Sarmento, Anguera, Pereira, & Araújo, 2018). Accordingly, the development of psychological mentoring services from the beginning of the sports career might contribute to the sustainable development of players (Baron-Thiene & Alfermann, 2015; Ekengren, Stambulova, Johnson, & Carlsson, 2020). However, in practice, psychology is a misprised area not only in academies but over the entire career of players.

Regarding technical-tactical skills, players stressed that the capability of youth players to control and pass is essential to start to explore the game. Interestingly, such results were quite different from those observed in soccer, as coaches and scouts usually emphasised the dribbling as the main information for talent identification (Sarmento et al., 2018). Such difference could be related to the specificity and dynamics of soccer and futsal.

Contrary to the trend of research in which anthropometric and physiological factors were the most studied factors in soccer for players identification and development (Williams & Reilly, 2000), futsal players stated that these aspects are not vital for player identification and should only be considered at a later moment of players career development.

The educational background could also be considered an individual factor that characterises a potential futsal player. Participants in our study acknowledged the value of continuing to study during their sporting career and considered that the qualification is advisable to reach the sporting elite. However, as observed in other sports, most players find it difficult to combine studies and sport (Ekengren et al., 2020). Indeed, when players achieve a

demanding process of training and competition tend to focus their attention on improving the aspects related with the sport, developing a great athletic identity that does not allow them to do anything more (Torregrosa, Boixados, Valiente, & Cruz, 2004).

Regarding the sporting life of participants at different stages of talent development, futsal players highlighted that unstructured and informal play with friends, and the practice of other activities are very important for the development of a Futsal player. Previous research in soccer also revealed that involvement in play activities or deliberate sports activities in different contexts is very enjoyable for kids (Baker et al., 2003). Indeed, the unstructured and informal play in the streets and the playground with friends during childhood seems to be a great predictor of high levels of expertise (Roca, Williams, & Ford, 2012). Also, regarding these results, the practice of other sports or activities is very well documented in other sports (Baker et al., 2003; Coutinho et al., 2016) as well as in futsal (Serrano et al., 2013).

The category of the key aspects of training reinforced that psychological aspects of players, quality of training and training with better players were considered key aspects to be successful, particularly in Specializing and Investment years. With less frequency, futsal players mentioned video display and physical fitness as complements to athlete's preparation. In line with previous results, players' commitment to their own career and the definition of goal achievement seems to be a key issue to success (Baron-Thiene & Alfermann, 2015; Ekengren et al., 2020). Also, as other authors argue, it is not required a great number of activities but quality and competitive activities (Coutinho et al., 2016). Players in our study mentioned the need for quality both in the process and in practice. Thus, training with high quality and better players is vital, as it requires constant adaptations and exploration of new possibilities of play (Davids et al., 2017).

To better understand what "quality of practice" means for players, further research should examine the microstructure of practice over different player career stages (Low, Williams, McRobert, & Ford, 2013; Coutinho et al., 2016). The development of different activities associated with visual display, physical conditioning or technical-tactical aspects should be considered in relation to the different stages of players' development. Interestingly, while physical abilities were the last criteria mentioned by players regarding the individual skills of the young player, these abilities were more important in the category of key aspects of training. Therefore, this finding suggests that physical skills are not criteria for identifying potential players but should be considered a key aspect of their development.

Finally, concerning players' retirement perspective, most players showed their intention to remain associated with futsal developing other roles (e.g., sports manager, director, or coach). However, other players would prefer to manage a business or finish their studies. Due to the players' great athletic identity (Torregrosa et al., 2004), few participants in our work finished their studies or developed other activities during their careers. Due to the great amount of emergent professional competitions worldwide, further analysis of career retirement is required to know better the preparation of players for their post-futsal life (Monteiro et al., 2020). This analysis could anticipate possible transition problems in the near future (Carapinheira et al., 2018). The development of mentoring support could contribute to sustaining players' development and their transition into a professional career after sport (Hallmann, Breuer, Ilgner, & Rossi, 2020).

To the best of our knowledge, the present study is the first attempt to explain the pathway that supports the career development of futsal players to expertise. All participants came from the top 10 best ranking countries in Futsal in this research. Interestingly, participants from different countries did not reveal so many differences in their perception of the aspects that could contribute to the support of futsal players' careers. Considering the results obtained, those people in charge of the developmental process of young futsal players must give importance not only to technical-tactical skills but also to psychological and personal aspects (motivation, self-confidence, determination), as they have been shown as the most relevant for a player to reach the elite.

Despite the strengths, these findings must be considered despite some limitations. One limitation was the language, as participants were from different nationalities and all the interviews had to be translated into English for codification. Furthermore, only three Argentine players participated in this study, while the subsample of the other nationalities (i.e., Spanish, Italian, Portuguese, and Brazilian) were composed of five futsal players. Finally, we should mention the difficulties of accessing this sample, as it comprises elite players.

It would be valuable to further conduct a multicultural approach to explore how the level of practice of each country contributes to the development of different paths to the expertise. Also, further research with coaches should be considered to compare the perspectives between players and coaches.

CONCLUSIONS

This study revealed that expert futsal players from different countries have similar perceptions about the pathway

that guides youth futsal players' development to expertise. Regarding the influence of context, family, coaches, and teammates are crucial to the players' career development. Furthermore, home country futsal development contributes to sustaining their goal achievement. This study also showed that psychological and personal skills, followed by technical-tactical skills, are the most important characteristics of a futsal player. Regarding sporting life, it appears that unstructured and informal play is very important for the development of a futsal player. Also, during their process of becoming professional players, the quality of training and training with better players seem to be key aspects of success. Finally, concerning players' perspectives of retirement, it has been seen that most players have the intention to remain associated with futsal. Such information is paramount for futsal coaches and academies to adjust their long-term development models.

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ORIGINAL ARTICLE

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Autonomous fundamental motor skills in the school environment: a cross-sectional study

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ABSTRACT

Autonomous fundamental motor skills (A_{FMS}) are understood as movements practiced in a spontaneous, voluntary manner, without any instruction or command. The aim of the study was to compare the frequency of occurrence and the quality of performance of A_{FMS} in children during recess and Physical Education (PE) classes. Elementary school students (n= 148) from a private school were observed during recess and PE classes, and had their A_{FMS} classified by stages (initial; elementary-emergent; proficient). All A_{FMS} were identified in recess and PE classes, except jump. Most skills were classified in the elementary-emergent stage and were slightly more frequent during PE classes, both in the locomotor (27 *vs* 23%) and manipulative (31 *vs* 13%) categories. The A_{FMS} frequency of occurrence was low and the classification showed poor quality at all times observed. Recess was statistically (p< 0.05) less favorable for motor development in 60% of A_{FMS}. The low frequency of A_{FMS}, especially during recess, and poor classification of motor repertoire suggest the need for measures to reverse the motor deficit in the school environment. Strategies are needed to promote A_{FMS} in the school context so that they are more diverse and challenging.

KEYWORDS: autonomous fundamental motor skills; motor development; school; physical education.

INTRODUCTION

Fundamental motor skills (FMS) are understood as a serial organization of basic movements performed by children (Rebelo, Serrano, Duarte-Mendes, Paulo, & Marinho, 2020). They can be classified as locomotor (run, gallop, hop, leap, horizontal jump and slide) and object control (striking a stationary ball, stationary dribble, catch, kick, overhand throw and underhand roll) skills (Gallahue, Ozmun, & Goodway, 2013; Utesch & Bardid, 2019). FMS have a scale of development classified into three stages (initial, elementary-emergent, and proficient). It is desirable that children reach the proficient stage by the age of seven years, as it characterizes mechanically efficient, coordinated and controlled movement performance (Gallahue et al., 2013; Morgan et al., 2013; Wick et al., 2017). Children with proficient FMS are more likely to participate in physical activity (PA) due to their proper motor performance (Barnett, Salmon, & Hesketh, 2016; Utesch, Dreiskämper, Naul, & Geukes, 2018). At this stage, children will have greater control of autonomous FMS (A_{FMS}), which are skills practiced in an autonomous, voluntary way, without any instruction (Morgan et al., 2013).

Early childhood is characterized as a fruitful time for children to improve their FMS (Utesch & Bardid, 2019; Bolger et al., 2021). In this phase, playing, creativity, and the discovery of infinite movement possibilities lead children to value PA participation (Dobell, Pringle, Faghy, & Roscoe, 2020). The new guidelines of the World Health Organization establish that for children with a minimal practice of PA (60 minutes/day; moderate to vigorous intensities) and less sedentary behaviour, the odds of developing chronic diseases

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are smaller (WHO, 2020). In addition, this practice is associated with motor development (MD) (Dobell et al., 2020; Carvalho et al., 2021). Therefore, ensuring the children had an adequate PA level may further to a rich opportunity for developing your FMS. And as they grow up, they are expected to constantly work on their motor skills to acquire a diversified motor repertoire that will enable them to live their daily lives (Palma, Camargo, & Pontes, 2012; Rebelo et al., 2020).

The school environment is an important moment for children's MD, because they offer diverse contexts for movements (Morgan et al., 2013). School physical education (PE) classes are ideal for the free expression of movements and make children aware of the importance of PA in life (Ericsson, 2011). Recess, in turn, is an important moment for autonomous expression of leisure activities, where children share ideas and movements with others (Simões Neto & Almeida, 2020). PE classes and recess are moments of freedom for children to express any movement (Gallahue et al., 2013). The literature indicates that these moments are unique for children's MD, as children are expected to spend 12 years in the school environment (Lopes, Lopes, & Pereira, 2006; Coolkens, Ward, Seghers, & Iserbyt, 2018).

The acquisition and good MD in children depend on the variety of A_{FMS}. For example, the developing A_{FMS} may be considered words in a learner's book. These words may be used in a variety of combinations in the construction of sentences and paragraphs (sport and specialized skills) (Gallahue et al., 2013). If children do not develop the basic principles of letters and words, they will have difficulty with their linguistic development. Similarly, this could happen with children's MD, as children's ability to easily move (a combination of many A_{FMS}) is compromised when they don't acquire basic motor competence during childhood (Bardid et al., 2016, 2017).

The decrease in motor practice impacts the motor deficit in childhood, reducing participation in games/play at school, at home, and in parks (Burns, Fu, Hannon, Brusseau, 2017). Therefore, ensuring children reach the proficient stage in childhood (whether for recreational, competitive, or daily use) can support the adoption of a physically active and healthier lifestyle for life (Gallahue et al., 2013; Vernadakis, Papastergiou, Zetou, & Antoniou, 2015). However, for this to occur, benchmarks and A_{FMS} levels need to be better understood. A relevant contribution to the area would be to identify the manifestation of children's A_{FMS} during specific periods, such as recess and PE classes (Torre, Zacarias, Rezende, & Pereira, 2011; Cafruni, Valadão, & Mello, 2012). Understanding the level of ability and autonomy of children's movements at different times can indicate the influence of the school context on children's autonomous movements.

Given these assumptions, the hypotheses for this study are the recess environment, although facilitating greater freedom of autonomous movement, may restrict motor practice; during PE classes the feeling of freedom in a specific environment for movement should favor the performance of A_{FMS}. However, there is no information on which of these moments promote more A_{FMS}; which A_{FMS} are most manifested, and at what levels of performance. Thus, this study aimed to identify children's $_{A}$FMS and classify/compare performance levels during recess and PE classes.

METHODS

Participants and ethical aspects

This cross-sectional study was conducted at a private school, located in a suburban area of a city in Southeast Brazil. All children (*n*= 174) regularly enrolled in Elementary Education (1st to 5th grades) were invited to participate voluntarily, through an invitation letter and meetings with parents/guardians. Parents/guardians of 153 children agreed to participate in the study. The inclusion criteria for the study were: a) being between six and 10 years old; b) being apparently healthy without medical restrictions, clinical treatment, or taking medicine that could affect metabolism, appetite, or growth (checked with their parents/guardians); and c) without having motor restrictions (e.g., wheelchair users, cerebral palsy) or amputated body parts (both conditions observed by the researcher). Data were excluded from children who: a) did not complete at least 80% of the procedures; and b) were suffering from illnesses or physical limitations during the study. After applying the exclusion criteria, data from five children were excluded from the analysis. Therefore, 148 children were analyzed, 70 boys and 78 girls.

The study was approved by the Institution Research Ethics Committee (CAAE 53535616.0.0000.5393) according to the Helsinki declaration. The parents/guardians received and signed the Free and Informed Consent Form and the children an Informed Consent Form.

Procedures

A_{FMS} were registered during recess and PE classes during a five-month period through direct observation of children's movements to identify and classify FMS stages. Anthropometric measurements (height and weight) were also taken to characterize the children. The researcher (physical education professional) attended the school environment (recess and PE class) for a month before data collection.

This period of familiarization contributed to the development of rapport between researcher and children, to minimize risks of bias by modifying children's habitual motor behavior routines.

Measures

Body mass in kg and height in centimeters (cm) were measured according to standard protocol (Lohmann, Roche, & Martorell, 1988).

The locomotor and manipulative A_{FMS} observed during recess and PE class were recorded and classified according to the current performance stages (initial, elementary-emergent, or proficient (Supplementary Material 1) (Gallahue et al., 2013). This test shows efficiency in classifying FMS as adequate reliability, low cost, and easy applicability (Torre et al., 2011; Gallahue et al., 2013). Its qualitative approach for direct subjective assessment of A_{FMS} considers children in their routine, with no interference in natural movement patterns (Gallahue et al., 2013). In this study, the elementary-emergent stages 2, 3, and 4 (Supplementary Material 2) were grouped to simplify the comparison of levels (1 to 3). This strategy is justified in that some A_{FMS} have similarities between stages (elementary-emergent) (Carvalho, 2019). The categories and performance stages of A_{FMS} considered are described in Table 1.

Recording of A_{FMS} was performed during three school days in the morning or afternoon. First, children were observed during recess for 20 min, totalling 60 minutes of observation at the period of familiarization appointed above. He played the role of assistant PE teacher. Second, students were observed during PE classes for 50 minutes, totalling 150 minutes of observation. The researcher evaluated two groups of five children (one in the morning and one in the afternoon) per day. No child knew when he/she would be observed. The classification of the stages of each skill was recorded, but only the best stage recorded was counted for statistical analysis.

Table 1. Fundamental motor skills according to categories (Locomotors and Manipulatives) and stages of developmental sequences proposed by Gallahue et al. (2013).

Locomotors (5)		Manipulatives (5)	
Run	(Stages 1 to 3)	Throw	(Stages 1 to 3)
Gallop	(Stages 1 to 3)	Catch	(Stages 1 to 3)
Leap	(Stages 1 to 3)	Kick	(Stages 1 to 3)
Hop	(Stages 1 to 3)	Volley	(Stages 1 to 3)
Jump	(Stages 1 to 3)	Strike	(Stages 1 to 3)

Stage 1: Initial; Stage 2: Elementary-emergent; Stage 3: Proficient. Source: adapted of Gallahue et al. (2013).

Statistical analysis

Descriptive statistics with measures of central tendency, 95% confidence interval (95%CI), and relative frequency were used to characterize the sample and describe the stages of A_{FMS} according to each moment (recess and PE class). A normality test (Kolgomorov-Smirnov) was made for quantitative data and normality was present for all variables (not shown). Due to the qualitative nature of A_{FMS} data, the Mann–Whitney U test was used to compare the variance of this variable between the different moments and genders, considering the categories (locomotive/manipulative) at the stages (initial/elementary-emergent/proficient). A Quade's analysis of covariance (ANCOVA) was performed to compare stages of A_{FMS} between recess and PE class, controlling the age effect. All analyzes were performed in SPSS, v. 20.0 (Inc., Chicago, IL, USA), with a previously established level of significance (α= 5%). This manuscript has been produced in accordance with the requirements of the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) checklist for cross-sectional studies.

RESULTS

The flowchart in Figure 1 reports the sample selection and the study stages.

The descriptive statistics of the stages of A_{FMS} observed at different times (recess and PE class) are shown in Table 2 with values of mean, standard deviation (SD), minimum and maximum, range, and 95%CI. The total number of children in the sample (n = 148) had an average age without large age ranges (8.51 SD= 1.34 [95%CI 8.29–8.73] years). The frequency of age was also distributed across the children (6 years= 17.4%; 7 years= 22.1%; 8 years= 20.1%; 9 years= 20.1%; 10 years= 20.1%). Regarding anthropometric measures, the average height (1.33 SD= 0.11 [95%CI 1.31–1.35] m) and weight (33.53 SD= 11.32 [95%CI 31.69–35.44] kg) were within the expected normality and without outliers. The means of all variables are within the 95%CI, revealing the probability that the real value will be different in only 5% of other samples of the population of origin.

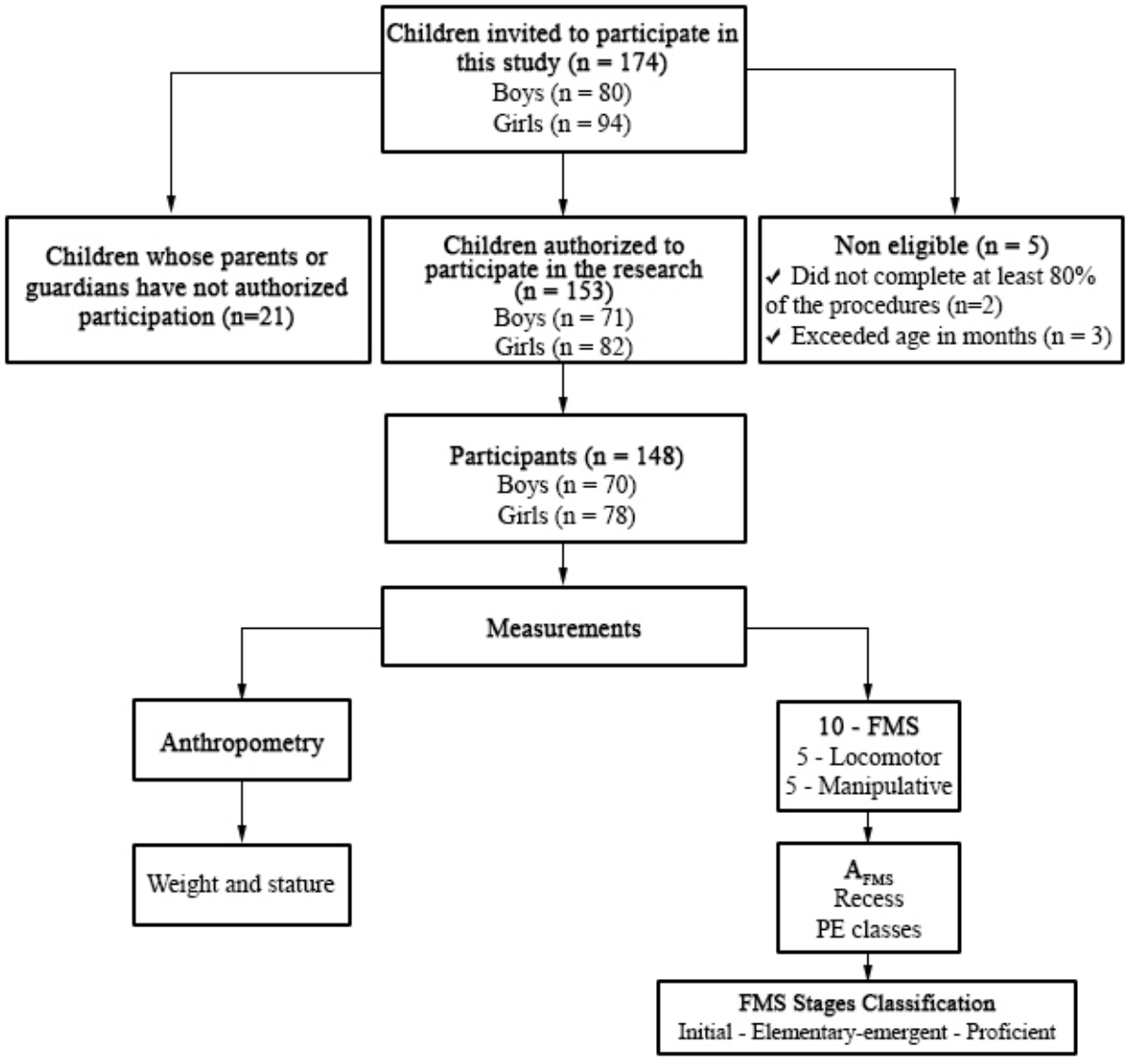
The average of most observed skill scores was less than 1, suggesting the poor qualitative performance of these children's A_{FMS}. Only one skill reached an average compatible with the elementary-emergent stage (run), while three of them were not even executed (leap, volley and strike). No skill achieved a proficient quality level during recess or PE class. When comparing moments (recess vs. PE class), the locomotor run A_{FMS} (Z= -2,120; p= 0.034) and jump (Z= -2,424; p= 0.015) presented higher averages during PE class.

Gallop (Z= -1.508; p= 0.132), leap (Z= 0.001; p= 0.999) and hop (Z= -1.329; p= 0.184) showed no differences between recess and PE class. The manipulative A_{FMS} of throw (Z= -7,939; p<0.001), catch (Z= -6,640; p< 0.001) and kick (Z= -4,716; p< 0.001) had higher averages during PE class, while strike (Z= -2.598; p= 0.009) had the highest average at recess. The volley skill (Z= -1,414; p= 0.157) did not differ between recess and PE class. There is an age effect only for the throw, receive and strike (p< 0.05) during recess, while PE class reported an effect for the hop, jump and kick (p< 0.05). Also, we compared the A_{FMS} between boys and girls, but they presented a very similar profile of these skills (Supplementary Material 1). The unique differences were run, throw (PE classes), gallop (recess), and kick (both moments), always better in boys.

The stages of A_{FMS} were also described quantitatively by relative frequency (%) of occurrence at recess and PE class (Table 3), according to the classification of the observed stages.

The A_{FMS} had a predominance of non-execution in around 70% of the observed movements, except for the skills of running at both times and the skills of catching and throwing in PE classes.

The locomotor A_{FMS} had a higher frequency of execution during PE classes (27% vs. 23% of recess). The proficient stage was present only for the skills run and hop. There was greater proficiency in the skill run in relation



FMS: Fundamental motor skills; A_{FMS}: Autonomous fundamental motor skills; PE: Physical education.

Figure 1. Flowchart of development on the research.

to the other skills, for both moments (Recess= 13%; PE =16%). The skill leap showed a low frequency in the proficient stage (Recess= 3%; PE= 1%). In jump, the children showed a greater predominance of the initial stage (Recess= 0%; PE= 12%), observed only during PE classes. However, when the average frequency was analyzed, the elementary-emergent stage was where most children were classified (17% and 19% for recess and PE, respectively).

The manipulative A_{FMS} (Table 3) were also more frequently performed during PE class when compared to recess (31 to 13%). The proficient stage occurred in most skills (Recess≤ 5%; PE≤ 6%), except for the skills volley and strike that did not show frequency of execution during PE classes. The elementary-emergent stage was also predominant in this category when analyzing the average frequency (7% and 28% for recess and PE, respectively). A_{FMS} at recess and PE classes were a

Table 2. Autonomous fundamental motor skills (A_{FMS}) stages of children (*n*= 148), age effect and differences between recess and Physical Education (PE) classes moments.

Variables	Recess					PE class				
	Mean	SD	95%CI			Mean	SD	95%CI		
Motor Development Sequence (stages, 1-3)										
Locomotor Category										
Run	2.0*	0.5	1.9	to	2.1	2.1	0.5	2.0	to	2.2
Gallop	0.1	0.6	0.04	to	0.2	0.1	0.4	0.03	to	0.2
Leap	-	-	-	-	-	-	-	-	-	-
Hop	0.2	0.7	0.1	to	0.3	0.3 #	0.8	0.2	to	0.5
Jump	0.04*	0.3	0	to	0.1	0.1 #	0.4	0.1	to	0.2
Manipulative Category										
Throw	0.6*#	1.0	0.4	to	0.7	1.5	0.9	1.4	to	1.7
Catch	0.3*#	0.8	0.2	to	0.5	1.0	1.0	0.9	to	1.2
Kick	0.2*	0.7	0.1	to	0.3	0.6#	1.0	0.4	to	0.8
Volley	0.04	0.3	0	to	0.1	-	-	-	-	-
Strike	0.1*#	0.5	0.04	to	0.2	-	-	-	-	-

*(p< 0.05) vs PE class; #(p< 0.05) age effect; Stage 1: Initial; Stage 2: Elementary-emergent; Stage 3: Proficient; SD: Standard deviation; CI: confidence interval.

Table 3. Relative and mean frequency (%) of autonomous fundamental motor skills (A_{FMS}) in locomotor and manipulative categories during recess and Physical Education (PE) class.

A_{FMS}	Not executed		Initial		Elementary-emergent		Proficient	
	Recess	PE	Recess	PE	Recess	PE	Recess	PE
Locomotor Category								
Run	1	0	10	8	76	76	13	16
Gallop	95	96	0	0	5	4	0	0
Leap	100	100	0	0	0	0	0	0
Hop	90	82	3	1	4	16	3	1
Jump	98	87	0	12	2	1	0	0
Mean Frequency	77	73	3	4	17	19	3	3
Manipulative Category								
Throw	71	24	4	4	21	70	4	2
Catch	87	47	1	2	7	50	5	1
Kick	91	73	0	1	7	20	2	6
Volley	99	100	0	0	0	0	1	0
Strike	95	100	3	0	0	0	2	0
Mean Frequency	87	69	2	1	7	28	3	2

little diversified, and slightly more frequent in PE classes. It was also possible to identify the divergence in the classification of A_{FMS} stages expected for age as not all children achieved proficiency in most A_{FMS}, including older children.

DISCUSSION

The frequency of A_{FMS} and the average classification of the motor stages observed were low, both during recess and PE classes. However, higher quantity (frequency observed) and quality (proficiency) of A_{FMS} were observed during PE classes. Although run and hop (Table 3) were the most frequently performed locomotor skills during the observations, it suggests that the children in our study showed a level of motor repertoire considered poor (Ulrich, 2000). Throw and catch (Table 3) were the most performed manipulative skills. In general, children had the highest mean frequencies of A_{FMS} in the elementary-emergent stage. The more complex skills showed a predominance in the initial stage ('jump' and 'strike'), showing a motor deficit for age and suggesting low opportunities for children to practice these A_{FMS}.

The A_{FMS} registered most frequently during PE classes reinforces the argument of how this moment promotes greater opportunities for the development and learning of skills through games and activities conducted indirectly (Fernandes et al., 2017; Quitério et al., 2017; Sgro, Quinto, Platania, & Lipoma, 2019). However, most children did not show proficiency in these and other A_{FMS} and many did not even execute them. This result is worrisome as children are expected to perform these skills at a proficient level between six and seven years of age. The age of the children in this study was (six to 10 years) compatible with that expected for proficiency in FMS (Table 2). This suggests a negative impact of the low levels of locomotor and manipulative FMS on children's motor performance (Ridgers, Carter, Stratton, & McKenzie, 2011, Ridgers, Salmon, & Timperio, 2018). If the skills were well learned, they would possibly manifest themselves proficiently and spontaneously in different contexts (Morgan et al., 2013; Fernandes et al., 2017; Dobell et al., 2020; Bolger et al., 2021).

In the locomotor category, the higher frequency of the skill run was confirmed as the favorite among children (Burns et al., 2017). The A_{FMS} 'hop' had the second highest frequency of execution through the hopscotch game since the schoolyard had paintings on the floor for this activity. Thus, the importance of adapting the school environment to encourage children's acquisition of motor skills is evident (Brauner & Valentini, 2009). It was also possible to observe that the manipulative A_{FMS} "throw" and "catch" (Table 3) had a higher percentage of execution in PE classes compared to recess. In classes, the teacher had different materials and encouraged the participation of all children; while at recess, materials were scarce, often reduced to just a ball and a few jump ropes. In addition, the school "beadle" (children's monitor at recess) was instructed to inhibit children from running, jumping, or performing other movements during this time. In this context, it is possible to infer that the low frequency of manipulative A_{FMS} observed in this study is explained, in part, by the restriction of the environment itself, through a low supply of suitable materials and restricted spaces for free actions (Morgan et al., 2013; Zeng et al., 2017).

Our study showed a smaller average for age, weight, and height (8.5 years; 33.5 kg and 1.33 m) than that of Sgro et al. (2019) study (10 years; 38 kg and 1.40 m), although with similar results in FMS. Even though our sample showed a greater age range (6 to 10 years) compared to the study of Quitério et al. (2017) (6 to 7 years), the gender influence showed that the boys were better in some A_{FMS} (notably for manipulative skills) than girls in both studies. On the other side, our study denotes motor deficiency for both genders when analyzing the average (< 1) of the classifications of the skills observed at recess or PE class (Table 2), where there should be= 3, a value that indicate proficiency (Gallahue et al., 2013; Morgan et al., 2013; Wick et al., 2017). Only a few skills were performed more frequently in the 'elementary-emergent' stage compared to the 'early' stage and three of them were not even performed ('leap', 'strike', and 'volley'). Thus, when the proficient stages of FMS are not reached at the expected age, it is necessary to review the entire educational and environmental context in which the child is inserted and what types of motor tasks they are performing (Dobell et al., 2020). Researchers advise that children do not reach the desired stage of FMS because the curricular focus of school PE can be on pedagogical factors and extended to coexistence contexts. In other words, the focus of the classes should use the movement to develop social, moral, and educational aspects and not only to improve FMS in a purely developmental approach (Loprinzi & Frith, 2017).

One strength of this study was the observation of natural and free (autonomous) task executions. These types of assessments influence minimally children's behavior, improving the ecological validity of data collected and analyzed. However, one limitation of this test is the difficulty of observing children all day. Indeed, considering out-school sports activities or other physical activity participation is important to understand the MD and have a better profile of FMS. In addition, the researcher's presence may cause changes in children's behavior (if the familiarization period is not carried out, as

adopted in this study). Another limitation is the subjective qualification of FMS stages. This implies the possibility of underestimating (or overestimating) a given FMS when the child is in an intermediate zone of category 1, 2, or 3. However, there was a low prevalence of proficiency and high hegemony in the classified skills in this study, which reduced the occurrence of this type of error. The current study had only one observer researcher, and it would be important to calculate inter-observer reliability. However, the school did not allow video recording of the children and the presence of more than one researcher during recess, which did not allow calculation of this error.

Due to the proposals for the organization of PE classes reported in the literature, the suggestion is that we are failing in the way the planning and offering of the 'teaching' of movements in the school PE class is carried out (Barbosa, Coledam, Stabelini Neto, Elias, & Oliveira, 2016; Fernandes et al., 2017; Brusseau & Burns, 2018; Ridgers et al., 2018). It is necessary to rethink the processes of school PE classes, as well as the whole context of daily PA practice. The best results seem to denounce a motor deficit in our children with a low frequency of proficient A_{FMS} for the expected ages. In addition, our findings call attention to the time of sedentary behavior, considering that, unlike in other countries, in Brazil, the child remains in school only part-time (part-time/day). Generally, during this period outside school, the tendency would be for even fewer chances of movement (Raudsepp & Päll, 2006; Barbosa et al., 2016). Still, children with a lack of competence in locomotor and manipulative skills are less likely to access the range of PA options available to establish an active lifestyle (Lloyd, Saunders, Bremer, & Tremblay, 2014). The school would be your biggest opportunity of the day for independent motor practices. Given this, it is necessary to propose activities that challenge children, based on strategies for teaching progressive movements (Strotmeyer, Kehne, & Herrmann, 2021). Regarding recess, the adequacy of the environment and infrastructure should enable children to perform more diversified movements during this period (Raudsepp & Päll, 2006; Strotmeyer et al., 2021). Future research should evaluate the quality of PE classes around the world, to identify which countries have the best strategies for the development of A_{FMS}. As well as the amount of PA practiced by students, observing the influence of PA practice on A_{FMS}.

CONCLUSION

The frequency of A_{FMS} not performed during recess and PE classes was ≅ 76% of the observed time. The run in the locomotive category confirmed the children's preference for this skill, being more frequent during PE classes. The manipulative skills, twice more performed at the time of the PE class, confirmed the importance of offering space and materials available. The low quality of the A_{FMS} and the classification of most children in the elementary-emergent stage indicated that they present a motor deficit. Because most children did not reach the proficient stages, even at the most advanced ages. These results suggest that it is necessary to develop effective strategies to reverse this situation of MD deficit, such as the diversification of school activities, and adaptation of the environment and infrastructure to encourage children to reproduce more diverse and challenging autonomous movements.

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ARTIGO ORIGINAL

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Eutonia, Ginástica Holística e Pilates na qualidade de vida de meninas pré-adolescentes: ensaio clínico randomizado

Eutonia, Holistic Gymnastics and Pilates on the quality of life of pre-adolescent girls: randomised clinical trial

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RESUMO

A prática de exercício físico é importante para a saúde de meninas pré-adolescentes. O objetivo do estudo foi investigar o efeito da Eutonia, Ginástica Holística e Pilates na qualidade de vida de meninas pré-adolescentes matriculadas em escolas públicas do município de Campinas/SP. Realizou-se um ensaio clínico aleatorizado de abordagem quantitativa, com intervenção, comparando três métodos de práticas corporais Eutonia, Ginástica Holística e Pilates na qualidade de vida de meninas pré-adolescentes. A amostra constituiu-se de 80 meninas divididas em: 26 Grupo Eutonia, 27 Grupo Ginástica Holística e 27 Grupo Pilates. Para avaliação da qualidade de vida foi aplicado o questionário Kidscreen-52 e os dados foram analisados estatisticamente, adotando-se nível de significância 5%. Os resultados do estudo mostraram que houve melhor percepção da qualidade de vida em todas as práticas corporais na dimensão atividade física e a Eutonia também proporcionou melhor percepção em relação à dimensão emocional, amigos e escola. Exercício físico ampliou a percepção da qualidade de vida das participantes.

PALAVRAS-CHAVE: qualidade de vida; terapia por exercício; prevenção primária.

ABSTRACT

Physical exercise is important for the health of pre-adolescent girls. The objective of the present study was to investigate the effect of Eutonia, Holistic Gymnastics and Pilates on the quality of life of pre-adolescent girls enrolled in public schools in the city of Campinas/SP. It was conducted a randomised clinical trial of quantitative approach with intervention, comparing three methods of body practices Eutonia, Holistic Gymnastics and Pilates on the quality of life of pre-adolescent girls. The sample consisted of 80 girls divided into 26 Eutonia Group, 27 Holistic Gymnastics Group, and 27 Pilates Group. To evaluate the quality of life, the Kidscreen-52 questionnaire was applied, and the data were statistically analysed, adopting a 5% significance level. The results of the study showed a better perception of quality of life in all body practices in the physical activity dimension, and Eutonia also provided better perception in relation to the emotional dimension, friends, and school. Physical exercise broadened the participants' perception of quality of life.

KEYWORDS: quality of life; exercise therapy; primary prevention.

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INTRODUÇÃO

O termo "Qualidade de Vida" (QV) engloba vários significados que refletem conhecimentos, experiências e valores de indivíduos de diferentes culturas (Minayo, Hartz, & Buss, 2000) e pode ser definido como a percepção do indivíduo no que se refere a sua posição na vida, no aspecto social, no contexto da cultura na qual está inserido e sistema de valores nos quais ele vive, seus objetivos, expectativas, padrões e preocupações, bem-estar físico, emocional e social (Whoqol Group, 1995). No Brasil, a QV começou a ser considerada importante na área da saúde a partir de 1990, abrangendo tanto as avaliações médicas quanto as pesquisas acadêmicas (Martini, Perosa, & Padovani, 2019) e, atualmente, avaliar a qualidade de vida nas pesquisas da área da saúde é um fato irreversível (Martini et al., 2019; Minayo et al., 2000).

Em crianças e adolescentes, avaliar a qualidade de vida relacionada à saúde (QVRS), examinar o funcionamento físico, o aspecto psicológico ou mental, a condição social e o bem-estar representando a saúde geral de um indivíduo, tem sido cada vez mais usual e tem por objetivo detectar problemas de saúde e desenvolver estratégias por meio de orientações e programas de intervenção eficazes (Wu et al., 2017). Alguns aspectos que indicam menor percepção da qualidade de vida em crianças e adolescentes são: estilo de vida sedentário (Gordia, Quadros, Silva, & Campos, 2015; Wu et al., 2017), baixos índices de exercício físico (Gordia et al., 2015; Wu et al., 2017), consumo de álcool, tabaco e outras drogas, excesso de peso e o relacionamento social alterado com pais, amigos e a escola (Gordia et al., 2015).

Há evidências de que a prática regular de exercício físico contribui para a saúde física e mental de crianças e adolescentes, reduzindo o risco de doenças cardiovasculares, diabetes, vários tipos de cancro e obesidade (Lee et al., 2012; Sallis et al., 2016). Segundo a Organização Mundial da Saúde, a prática de exercício físico proporciona o aumento da capacidade cardiorrespiratória, força muscular, densidade óssea, bem como favorece a redução dos níveis de lipoproteína e da obesidade (OMS, 2010; Salvo, Aguilar-Farias, Jauregui, & Varela, 2020), dos sintomas depressivos (Korczak, Madigan, & Colasanto, 2017), melhora do sono (Lang et al., 2016) e desenvolvimento cognitivo nas atividades acadêmicas (Esteban-Cornejo, Tejero-Gonzalez, Sallis, & Veiga, 2015). No entanto, a maioria dos adolescentes não atende as atuais diretrizes de atividade física. No Brasil, adolescentes entre 11 e 17 anos não cumprem os níveis mínimos recomendados de exercício físico apresentando diferenças entre os sexos com 78% de meninos e 89,4% de meninas (Guthold, Stevens, Riley, & Bull, 2020).

Partindo-se do pressuposto que, na transição da infância para a adolescência ocorre redução da prática de exercício físico de forma regular (Condessa, Chaves, Silva, Malta & Caiaffa, 2019; Salvo et al., 2020), que meninas são mais sedentárias que meninos, tanto no dia a dia (Condessa et al., 2019; Piola et al., 2019) quanto nos momentos de lazer (Cureau et al., 2016) e que o exercício físico é considerado por muitos como a melhor aquisição para a saúde pública (Morris, 1994), é importante apresentar e tornar acessível projetos de exercício físico na escola e que estejam em consonância com o Programa Saúde na Escola (PSE) lançado no Ministério da Saúde no ano de 2007 como estratégia de associação e articulação permanente entre as políticas de educação e saúde aos estudantes da rede pública de ensino (Sousa, Esperidião, & Medina, 2017).

Como a prática de exercício físico proporciona benefícios à saúde (Lee et al., 2012; Esteban-Cornejo et al., 2015; Sallis et al., 2016; Korczak et al., 2017) no presente estudo foi desenvolvido um projeto de intervenção na escola por meio das práticas corporais de Eutonia, Ginástica Holística e Pilates. A Eutonia e a Ginástica Holística são métodos de Educação Somática que têm o objetivo de desenvolver a consciência corporal por meio de vários movimentos e automassagens com o auxílio de diversos materiais, estando o aluno atento às sensações produzidas pelos estímulos (Maeda, Martinez & Neder, 2006; Niaradi & Batista, 2016, 2018). A diferença entre os métodos de Educação Somática é que a Ginástica Holística abrange um repertório de 800 movimentos e muitos deles são realizados no tempo expiratório (Niaradi & Batista, 2018). Já a Eutonia tem as posições de controle, que revelam o grau, a presença e a localização das tensões e são realizadas a partir da respiração natural (Brieghel-Müller, 1998). O método Pilates tem por objetivo o fortalecimento e o alongamento dos músculos e os princípios desse método são: a concentração (Eliks, Zgorzalewicz-Stachowiak, & Zenczak-Praga, 2019; Roh, 2019), o centro (Roh, 2018, 2019), a precisão (Eliks et al., 2019) o controle da respiração (Roh, 2018; Eliks et al., 2019) e a destreza (Roh, 2018; Eliks et al., 2019) além disso, já está descrito na literatura que a Ginástica Holística (Lacombe, Ricobenne, & Nogueira, 2015) a Eutonia (Maeda et al., 2006) e o método Pilates proporcionaram melhor percepção da qualidade de vida (Gandolfi, Corrente, De Vitta, Gollino & Mazeto, 2020; Hornsby & Johnston, 2020).

Considerando que existem poucos estudos sobre Eutonia, Ginástica Holística e Pilates envolvendo pré-adolescentes e que é nesta faixa etária que as meninas começam a adotar estilo de vida sedentário, favorecendo as disfunções musculo esqueléticas, dores e menor percepção da QVRS, é importante

estimular a prática de exercício físico que possam atuar de forma preventiva e terapêutica, além de estimular hábitos saudáveis nessa população e reduzir o encargo social e financeiro nos serviços de saúde. Além disso, em 2018 a OMS lançou uma ação global denominada "Mais Pessoas Ativas para um mundo mais Saudável" com objetivo de reduzir em 15% da prevalência global de atividade física insuficiente até 2030 entre adolescentes e adultos (Guthold et al., 2020). A hipótese desse estudo é que as três intervenções influenciem na percepção da qualidade de vida de pré-adolescentes. Desta forma, o objetivo deste estudo foi investigar se Eutonia, Ginástica Holística e Pilates influenciam a percepção da qualidade de vida de meninas pré-adolescentes.

MÉTODO

Ensaio clínico randomizado e prospectivo, realizado em seis escolas públicas de Campinas, São Paulo, Brasil. Os pais e/ou responsáveis assinaram um termo de consentimento livre e esclarecido, o qual foi aprovado pelo Comitê de Ética e Pesquisa da Universidade Estadual de Campinas sob o protocolo nº 1869.831 CAEE 61623316.1.0000.5404 e registrado no Registro Brasileiro de Ensaios Clínicos-RBR-25w6kk.

Amostra

Foram elegíveis para compor a amostra 481 pré-adolescentes, das quais 378 foram excluídas por não ter idade entre 10 e 13 anos, ou por não poder permanecer na escola fora do período escolar, ou a não autorização dos pais na participação do estudo e desinteresse das pré-adolescentes. A amostra foi composta por 103 pré-adolescentes saudáveis, do sexo feminino, com idade entre 10 e 13 anos, com o termo de consentimento livre e esclarecido assinado pelos pais ou responsável. As pré-adolescentes com deficiência, sequela de doença ortopédica, reumática ou neurológica e uso de prótese de membros foram excluídas. Durante o desenvolvimento da pesquisa houve perda de acompanhamento de 23 participantes sendo a amostra final constituída por 80 pré-adolescentes divididas em grupos: Eutonia (26), Ginástica Holística (27) e Pilates (27). O protocolo do estudo é apresentado pelo CONSORT (2010) na Figura 1.

A caracterização das participantes foi apresentada na Tabela 1. Verificou-se que a média de idade das pré-adolescentes foi de 11 anos± 1, a estatura foi de 1.51 (m)± 0.10, o peso foi de 44.60 (k)± 13.64 e o Índice de massa corporal (IMC) de 19.40 (kg/cm^2)± 4.50.

Foi feita a caracterização sociodemográfica das pré-adolescentes e foi possível verificar que, em relação à escolaridade dos pais, a maioria das mães tinha entre 1 e 8 anos de estudo (ensino básico completo) e, no caso dos pais, a maioria das pré-adolescentes desconhecia o nível de escolaridade. Foi possível constatar que as profissões da maioria das mães e pais possuem rendimentos superiores ao salário-mínimo, a maioria mora em casa com quatro pessoas e vivem juntos.

Em relação às pré-adolescentes, 66,25% delas não praticavam atividade física fora da escola, 61,25% relataram que os momentos de lazer eram vividos de forma sedentária, sendo que 65% utilizam seu próprio telemóvel e passavam longos períodos sentadas assistindo TV e/ou frequentando a igreja. Os resultados mostraram ainda que 65% das meninas não haviam menstruado e que o peso da mochila escolar representava até 10% do seu peso corporal (Tabela 2).

Instrumentos

Os pais ou responsáveis responderam a um questionário sobre aspectos pessoais e sociais das pré-adolescentes e estas responderam ao questionário de qualidade de vida Kidscreen-52 (Gaspar & Matos, 2008). Este questionário é um instrumento válido para estudos da população brasileira e utilizado em crianças e adolescentes entre oito e dezoito anos (Guedes & Guedes, 2011). O questionário reconhece a frequência de comportamentos/sentimentos ou em alguns casos, a intensidade de atitudes específicas e é composto por 52 questões direcionadas à percepção de dez dimensões de (QVRS) – "Saúde e atividade física"; "Sentimentos", "Estado de humor global"; "Autopercepção"; "Autonomia e Tempo Livre"; "Família e ambiente familiar"; "Questões económicas"; "Amigos"; "Ambiente escolar e aprendizagem" e "Provocação e Bullying".

Procedimentos

A recolha de dados foi realizada em seis escolas públicas (três municipais e três estaduais) do município de Campinas/SP, por meio de avaliação, intervenção das práticas da Eutonia, da Ginástica Holística e do Pilates. As avaliações foram agendadas por telefone e foi realizada antes ou após o período escolar em ambientes como: sala de aula, de vídeo, de informática ou dos professores. A pesquisadora responsável mediu a massa corporal por meio de balança antropométrica digital, graduada de 0 a 150 Kg, com resolução de 0,05 Kg anotada em quilograma. Já a estatura foi mensurada com uma fita métrica estendida e fixada na parede. As pré-adolescentes permaneceram em trajes de banho, em posição vertical, encostavam os calcanhares e o tronco na parede e mantinham o olhar horizontal e essa medida foi anotada em centímetros.

A randomização foi realizada através de um sorteio: foram colocados os nomes das pré-adolescentes em um saco de papel e a secretária de cada escola sorteava e as

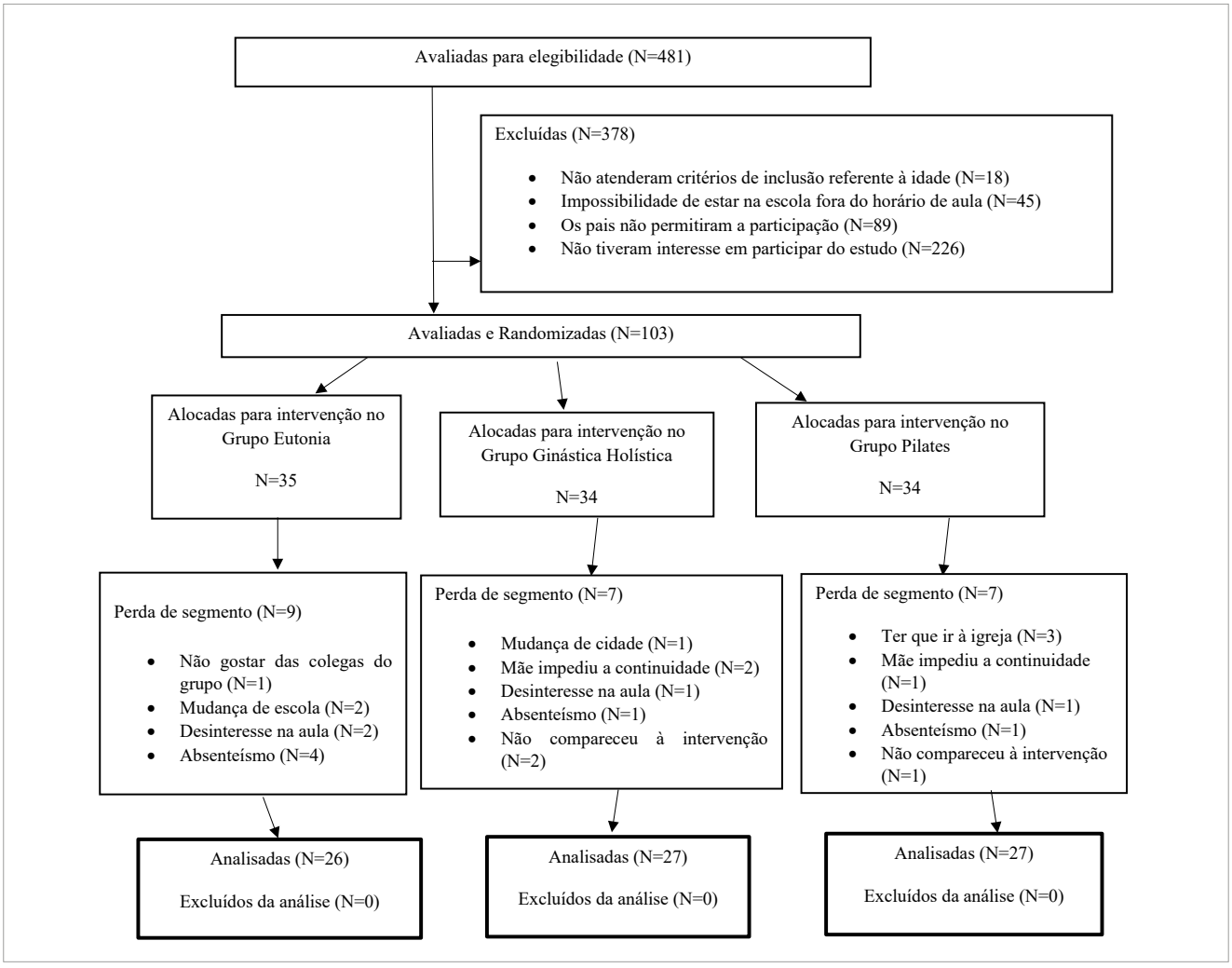

Figura 1. Fluxograma do plano de amostragem.

Tabela 1. Caracterização das pré-adolescentes.

	Grupos de Práticas Corporais	Pré-intervenção M± DP IC95%	Pós-intervenção M± DP IC95%	Valor p
Idade (anos)	Eutonia (*n*= 26)	11.15± 1.08	11.38± 1.02	0.65
	Ginástica Holística (*n*= 27)	10.96± 1.02	11.22± 1.09	
	Pilates (*n*= 27)	10.89± 0.93	11.15± 1.03	
Massa Corporal (kg)	Eutonia (*n*= 26)	45.21± 13.22	46.14± 13.27	0.83
	Ginástica Holística (*n*= 27)	43.96± 13.59	44.89± 13.68	
	Pilates (*n*= 27)	44.65± 14.55	45.58± 14.96	
Estatura (m)	Eutonia (*n*= 26)	1.52± 0.10	1.54± 0.10	0.46
	Ginástica Holística (*n*= 27)	1.51± 0.11	1.52± 0.11	
	Pilates (*n*= 27)	1.49± 0.10	1.50± 0.10	
IMC (kg/cm$^{2)}$	Eutonia (*n*= 26)	19.31± 4.75	19.27± 4.32	0.82
	Ginástica Holística (*n*= 27)	19.01± 4.04	19.00± 4.00	
	Pilates (*n*= 27)	19.88± 4.82	19.89± 4.91	

ANOVA para medidas repetidas; M: média; DP: desvio padrão; IC95%: intervalo de confiança 95%.

distribuía pelas três práticas corporais (Eutonia, Ginástica Holística e Pilates). As práticas corporais foram realizadas antes ou depois do período escolar em salas de aula adaptadas para as atividades (afastamento das carteiras), de informática e dos professores, em biblioteca, sala de vídeo, sala de materiais, na quadra desportiva e em áreas abertas da escola.

Foram formados três grupos para as práticas corporais com composição que variou de 3 a 9 participantes. Cada grupo realizou uma hora de aula semanal durante 10 semanas, totalizando 10 horas aula de intervenção em cada modalidade. Após as 30 horas de intervenção foi realizada a reavaliação nas pré-adolescentes de forma semelhante às avaliações. Para as pré-adolescentes que faltaram em alguma

Tabela 2. Caracterização sociodemográfica das pré-adolescentes.

Variáveis	Categorias	Eutonia N (%)	Ginástica Holística N (%)	Pilates N (%)
Escolaridade Mãe	Não frequentou escola	0 (0)	0 (0)	0 (0)
	Nível fundamental (1° a 8°série)	6 (23.07)	9 (33.33)	13 (48.14)
	Nível médio (1° ao 3° ano)	12 (46.15)	9 (33.33)	6 (22.22)
	Nível superior (faculdade)	1 (13.84)	3 (11.11)	5 (18.51)
	Não sabe	7 (26.92)	6 (22.22)	3 (11.11)
Escolaridade Pai	Não frequentou escola	1 (13.84)	1 (3.70)	0 (0)
	Nível fundamental (1° a 8°série)	7 (26.92)	6 (22.22)	14 (51.85)
	Nível médio (1° ao 3° ano)	8 (30.76)	6 (22.22)	3 (11.11)
	Nível superior (faculdade)	1 (13.84)	1 (3.70)	1 (3.70)
	Não sabe	9 (34.61)	13 (48.14)	9 (33.32)
Profissão mãe	Sem renda (do lar)	4 (15.38)	7 (25.92)	6 (22.22)
	Com renda (com ou sem vínculo)	19 (73.07)	20 (74.07)	20 (74.07)
Profissão pai	Sem renda (do lar)	2 (7.69)	2 (7.40)	1 (3.70)
	Com renda (com ou sem vínculo)	23 (88.46)	23 (85.18)	20 (74.07)
Renda familiar	Até 1 salário-mínimo	2 (7.69)	4 (14.81)	5 (18.51)
	Maior que 1 salário-mínimo	20 (76.92)	16 (59.25)	21 (77.77)
Habitação	Casa	24 (92.30)	22 (81.48)	25 (92.59)
	Apartamento	2 (7.69)	3 (11.11)	1 (3.70)
	Barraco em favela	0 (0)	2 (7.40)	1 (3.70)
Tipo de união	Vivem juntos	16 (61.53)	18 (66.66)	17 (62.96)
	Separados ou viúvos	10 (40)	9 (33.33)	10 (37.03)
Lazer	Sedentário	17 (65.38)	18 (66.66)	14 (51.85)
	Ativo	8 (30.76)	9 (33.33)	10 (37.03)
Menstruação	Sim	9 (34.61)	9 (33.33)	7 (25.92)
	Não	17 (65.38)	18 (66.66)	20 (74.07)
Celular	Possui celular	17 (65.38)	18 (66.66)	17(62.96)
	Não possui celular	9 (34.61)	9 (33.33)	0 (37.03)
Peso da mochila	Mais que 10% do peso corporal	4 (15.38)	7 (25.92)	10 (37.03)
	Até 10% do peso corporal	22 (84.61)	20 (74.07)	17(62.96)
Irmãos	Até 2 irmãos	23 (88.46)	20 (74.07)	20 (74.07)
	Acima de 2 irmãos	3 (11.53)	7 (25.92)	7 (25.92)
Quantas pessoas vivem na casa	4 pessoas	16 (61.53)	12 (44.44)	17 (62.96)
	Acima de 4 pessoas	10 (40)	15 (55.55)	10 (37.03)

N: número de pré-adolescentes; o salário-mínimo no Brasil em 2017 é de R$ 937 e em 2018 R$ 954.

aula, foram ministradas reposições de conteúdo específico e foram permitidas até três reposições. As pré-adolescentes que ultrapassaram este limite foram automaticamente excluídas do projeto.

Intervenção

A prática da Ginástica Holística e do Pilates foi realizada pela pesquisadora responsável e a prática da Eutonia foi realizada por outra pesquisadora.

Eutonia

A prática de Eutonia foi realizada por meio da seguinte dinâmica de aula: uma sequência de movimentos denominada Posições de Controle no início (20 minutos) e no final da aula (10 minutos) e no tempo restante, foram realizadas 10 estimulações proprioceptivas a cada encontro 1: com os seguintes objetivos: tocar com a mão alguma parte do corpo; 2: passar algodão no rosto e braços; 3; bola de borracha nos ísquios; 4; bambu nas costas e pés; 5; bola de espuma na musculatura paravertebral; 6; rolo de areia no trapézio e esterno; 7; almofada de areia no sacro, na lombar e na cervical; 8; sementes nos dedos dos pés; 9; massajar com bola de borracha a planta do pé; 10; bambu na musculatura paravertebral e percutir ossos.

Ginástica holística

Em cada aula da Ginástica Holística foram praticados cerca de 9 a 10 movimentos diferentes. O primeiro movimento foi feito na posição em pé, com objetivo de estimular os membros inferiores ou superiores. O relaxamento ativo foi o objetivo do exercício seguinte por meio de movimentos ou sensibilização da pele com ajuda de materiais variados como: saco de semente ou de areia, bola de borracha, de tênis ou de espuma, bambu, bastão de madeira, tubo de PVC e rolo de espuma. Em seguida, foram praticados movimentos de reeducação postural e alongamento. Na parte final da aula foram realizados movimentos de equilíbrio e movimentos mais tônicos conforme apresentado nas pesquisas de (Niaradi & Batista, 2016, 2018).

Pilates

Para a prática de Pilates foram realizados os seguintes movimentos: Pelvic Clock; Dead Bug & Femur Arcs; Arm Arcs; Bent Knee Opening; Bridging; Assisted Roll Up; The Hundred; Single Leg Stretch; Side to Side; Side lying; Mermaid; Quadruped Series; Dart; Prone Press Up; Swan Dive I; Rolling; Spine Stretch; Standing Roll Down. Em cada aula, foram realizados em torno de 11 a 12 movimentos com modificação da sequência.

Análise estatística

Para a caracterização da amostra foi realizada análise descritiva geral dos dados e a comparação das variáveis entre grupos e tempos. Para descrever o perfil da amostra, foram realizadas estatísticas descritivas com média e desvio padrão. Para comparação dos resultados numéricos entre grupos e tempos foi utilizada ANOVA de medidas repetidas conhecida como modelo não paramétrico para análise de perfis longitudinais, essa decisão foi devido a características dos dados, pois os mesmos, não apresentam distribuição normal e para contornar isso as técnicas não paramétricas, que não pressupõe distribuição para os dados, são mais robustas. Os dados foram transformados em postos (*ranks*). Para comparação das variáveis categóricas entre grupos e tempos foram utilizadas as equações de estimativa generalizada (Generalized Estimating Equations — GEF). Foram utilizados os testes de Kruskal-wallis e foi delimitado o nível de significância de 0,05 para análises. As análises foram realizadas utilizando o programa: The SAS System for Windows (Statistical Analysis Sistem), versão 9.4. SAS Institute Inc, 2002-2008, Cary, NC, USA

RESULTADOS

O estudo verificou que tanto na primeira quanto na segunda aplicação do questionário Kidscreen-52, os resultados foram positivos, com média de 66,73% na primeira aplicação e 68,48% na segunda, no entanto, não houve uma melhora significativa entre o momento pré e pós-intervenção (Tabela 3).

No que se refere aos domínios do questionário, o resultado indicou que a percepção da qualidade de vida em relação à prática de exercício físico teve um aumento no momento pós-intervenção em todas as práticas corporais (Eutonia, Ginástica Holística e Pilates). A prática da Eutonia proporcionou melhor percepção da qualidade de vida no momento pós-intervenção nas seguintes dimensões: emocional, amigos e escola (Tabela 4).

DISCUSSÃO

O presente estudo detectou que a Eutonia, Ginástica Holística e Pilates proporcionaram aumento da percepção da QVRS na dimensão atividade física e a Eutonia nas dimensões estado emocional, amigos e escola.

No domínio "Saúde e Atividade Física", no presente estudo, houve melhora significativa da percepção da QVRS pelas pré-adolescentes, no momento pós-intervenção em todas as práticas corporais de Eutonia, Ginástica Holística e Pilates, indicando que esses exercícios físicos favoreceram

Tabela 3. Resultado da percepção da Qualidade de Vida no questionário Kidscreen-52 no momento pré e pós-intervenção

Variáveis		N	Média	Mediana	D.P.	Mínimo	Máximo	Valor p
Eutonia	pré	26	66.26	67.48	13.38	39.69	88.50	0.3107*
	pós	26	71.89	69.28	13.14	47.96	99.00	0.1149**
Ginástica Holística	pré	27	64.84	69.37	11.69	40.23	79.80	0.2600***
	pós	27	64.02	66.60	15.41	33.57	89.45	
Pilates	pré	27	69.06	70.96	13.76	40.12	88.44	
	pós	27	69.66	73.13	15.07	36.51	89.35	
QV geral	pré	80	66.73	68.94	12.93	36.69	88.50	
QV geral	pós	80	68.48	70.10	14.78	33.57	99.00	

N: número de participantes; DP: desvio padrão; *Grupo; **Tempo; ***Tempo × grupo. Teste Kruskal-wallis.

Tabela 4. Resultados da percepção da Qualidade de Vida nas dimensões do KIDSCREEN-52 distribuídas pelas práticas corporais.

Dimensões do Kidscreen-52	Práticas Corporais	Pré-intervenção	Pós-intervenção	Valor p
		M± (DP)	M± (DP)	
Atividade Física	Eutonia (*n*= 26)	63.85 (20.16)	75.58 (20.36)	0.7875*
	Ginástica Holística (*n*= 27)	67.22 (18.31)	68.07 (16.84)	**0.0003****
	Pilates (*n*= 27)	65.37 (17.37)	73.70 (18.94)	0.0617***
Sentimentos	Eutonia (*n*= 26)	75.16 (17.46)	80.54 (15.09)	0.6136*
	Ginástica Holística (*n*= 27)	75.09 (19.18)	72.84 (21.35)	0.9990**
	Pilates (*n*= 27)	79.63 (20.32)	77.16 (16.84)	0.0689***
Estado emocional	Eutonia (*n*= 26)	62.77 (21.88)	76.10 (21.06)	0.9813*
	Ginástica Holística (*n*= 27)	69.71 (17.51)	68.43 (24.30)	0.1034**
	Pilates (*n*= 27)	68.65 (26.60)	66.53 (26.60)	**0.0456*****
Autopercepção	Eutonia (*n*= 26)	65.77 (15.54)	68.46 (14.27)	0.7371*
	Ginástica Holística (*n*= 27)	68.33 (14.41)	66.67 (17.32)	0.1145**
	Pilates (*n*= 27)	64.26 (14.46)	67.50 (19.75)	0.3515***
Autonomia	Eutonia (*n*= 26)	69.42 (20.61)	66.92 (21.96)	0.0316*
	Ginástica Holística (*n*= 27)	56.67 (23.57)	56.30 (20.17)	0.3949**
	Pilates (*n*= 27)	69.44 (20.11)	69.07 (22.62)	0.8167***
Ambiente Familiar	Eutonia (*n*= 26)	70.19 (21.37)	75.32 (19.15)	0.0565*
	Ginástica Holística (*n*= 27)	62.65 (23.10)	62.65 (26.29)	0.2859**
	Pilates (*n*= 27)	75.93 (19.76)	75.93 (22.06)	0.7241***
Financeiro	Eutonia (*n*= 26)	50.32 (32.53)	57.05 (27.46)	0.1953*
	Ginástica Holística (*n*= 27)	39.81 (27.38)	47.22 (30.05)	**0.0402****
	Pilates (*n*= 27)	55.86 (25.61)	58.33 (35.51)	0.7670***
Amigos	Eutonia (*n*= 26)	61.06 (20.55)	72.92 (18.79)	0.1113*
	Ginástica Holística (*n*= 27)	60.65 (23.47)	56.94 (23.94)	0.3869**
	Pilates (*n*= 27)	71.05 (20.01)	67.90 (24.48)	**0.0268*****
Ambiente Escolar	Eutonia (*n*= 26)	65.87 (18.26)	67.15 (25.34)	0.5862*
	Ginástica Holística (*n*= 27)	71.14 (19.33)	70.68 (21.86)	**0.0425****
	Pilates (*n*= 27)	77.28 (19.74)	73.15 (22.21)	
Provocação/ Bullying	Eutonia (*n*= 26)	78.21 (19.16)	78.85 (22.64)	0.3107*
	Ginástica Holística (*n*= 27)	77.16 (24.09)	70.37 (25.98)	0.1149**
	Pilates (*n*= 27)	63.58 (27.85)	67.28 (29.68)	0.2600***

Diferença estatisticamente significante em negrito. Teste Kruskal-wallis; N: número de participantes; M: média; DP: desvio padrão; *Grupo; **Tempo; ***Tempo × grupo.

a melhor percepção da QVRS nesse domínio. Esse achado está de acordo com os resultados do estudo de (Casey et al., 2014) que nessa dimensão mostrou que os alunos do grupo experimental (GE) apresentaram níveis um pouco mais elevados (83.90) se comparados ao grupo controle (GC) (79.90). Por outro lado, estudos recentes mostraram que intervenção por meio de exercício físico não favoreceu a percepção QVRS nessa dimensão (Resaland et al., 2018; Kvalo & Natlandsmyr, 2020; Gall et al., 2020; Bandeira et al., 2021). Outros estudos encontraram evidências de que crianças e adolescentes que praticam exercício físico apresentam melhor percepção da QVRS em comparação com as que não praticam exercício físico (Wu et al., 2017; Ferrari Junior et al., 2018; Costa, Barreto, Silveira, Silva & Silva, 2020; Pacífico, Peressute, Piola, Camargo, & Campos, 2020). Pesquisas futuras justificariam examinar o tipo de exercício físico ou desporto que influencia à percepção da QVRS nessa dimensão. No entanto, é importante ressaltar que a recomendação da Organização Mundial da Saúde (OMS) é de 60 minutos diários de exercício físico de intensidade moderada a vigorosa para crianças e adolescentes entre 5 e 17 anos, mas tal recomendação não é atendida em todo o mundo (Guthold, Stevens, Riley, & Bull, 2020). Para a resolução desse problema, a orientação da OMS é a de que todos os países atualizem a política nacional priorizando o desenvolvimento de projetos de exercício físico voltados para crianças e adolescentes, especialmente para as meninas (Guthold et al., 2020). Esses dados sugerem que sejam desenvolvidas políticas públicas de saúde com investimento em programas de exercício físico nas escolas com objetivo de melhorar a saúde e a QVRS de crianças e adolescentes.

A prática de Eutonia proporcionou melhor percepção das pré-adolescentes em relação à QVRS no domínio emocional que analisa o estado psicológico da criança e adolescente com relação às emoções positivas como a satisfação com a vida e os sentimentos de tristeza e solidão. A fase da pré-adolescência, o bem-estar pode ser alterado pelos desequilíbrios hormonais com novos processos biológicos e como as meninas são mais afetadas do que os meninos isso pode contribuir para a redução do bem-estar psicológico (Bisegger et al., 2005). Na transição entre a adolescência e a fase adulta há uma tendência de adolescentes mais velhos apresentarem mais emoções depressivas, estressantes e sentimentos de solidão (Agathão, Reichenheim & Moraes, 2018).

No presente estudo as pré-adolescentes que participaram do grupo Eutonia apresentaram média de 62,27 no momento pré-intervenção e 76,10 no momento pós-intervenção, demonstrando que essa prática corporal influenciou positivamente o aspecto emocional das pré-adolescentes. Resultados semelhantes foram encontrados no estudo de (Kvalo & Natlandsmyr, 2020) em que a intervenção na escola proporcionou efeitos positivos nessa dimensão com níveis mais altos para o grupo intervenção (56,52) se comparados ao grupo controle (53,50). Casey et al. (2014) concluíram que o grupo intervenção apresentou pontuações maiores nesse domínio com resultados de 79,90 em comparação com o grupo controle com escores de 76,10 e (Wu, Ohinmaa, & Veugelers, 2012) observaram que estudantes praticantes de exercício físico apresentaram melhor percepção QVRS nessa dimensão com média dos escores para os estudantes ativos de 84.20 e para os inativos 79.10.

Por outro lado, dois estudos mostraram que exercício físico não proporcionou melhora na percepção da QVRS nessa dimensão. Bandeira et al. (2021), constataram que no momento pré-intervenção o GE obteve escore de (46.10) e o GC (45.60) e no momento pós-intervenção GE (43.90) e GC (45.80). Kriemler et al. (2010) concluíram que no momento pré intervenção os índices foram de 52.50 (GE) e 53.00 (GC) e no momento pós-intervenção 52.30 (GE) e 52.00 (GC). Os resultados desses estudos sugeriram que não houve modificações significativas da percepção da qualidade de vida nessa dimensão. No entanto, a literatura aponta que crianças e adolescentes que fazem exercício físico apresentam maior facilidade em lidar com o estresse (Lee et al., 2012; Sallis et al., 2016) e tem menos sintomas depressivos (Korczak et al., 2017).

No presente estudo, a Eutonia manifestou-se satisfatória favorecendo melhor percepção da QVRS nas pré-adolescentes na dimensão emocional por ser uma técnica psicológica que tem na sua essência uma característica pedagógica (Maeda et al., 2006). Os estímulos sensoriais realizados em cada aula prática promovem ampliação da consciência corporal e dessa forma o aluno, pouco a pouco, descobre o tónus mais adequado para as atividades de vida diária. Este tónus muscular é acompanhado por um tónus psíquico (psicotônus) que é a mudança emocional em decorrência das atividades do seu quotidiano e da sua história de vida (Maeda et al., 2006).

O domínio amigo analisa a natureza das relações da criança ou adolescente com outras crianças ou adolescentes. No presente estudo as pré-adolescentes que participaram do grupo Eutonia apresentaram média de 61.06 no momento pré-intervenção e 72.92 no momento pós-intervenção, indicando que essa prática corporal influenciou positivamente o aspecto das relações das pré-adolescentes com outras pré-adolescentes. Outros dois estudos de intervenção demonstraram que o GE obteve melhores resultados se comparados ao GC, no entanto não apresentaram resultados significativos. Kvalo e Natlandsmyr (2020) constataram que, após a

intervenção, as médias de pontuação do GE foi de 54.50 e os do GC com média de 51.76. Casey et al. (2014) sugeriram que os participantes do GE apresentaram escores de 79.90 e os do GC de 76.10.

Contrariando esses achados, dois estudos concluíram que a prática de exercício físico não favoreceu a percepção da QVRS nessa dimensão. Bandeira et al. (2021) indicaram que, no momento pré-intervenção, o GE apresentou escores de 50.30 e o GC 49.60 e, no momento pós-intervenção, o GE apresentou 47.30 e o GC 49.80. Gall et al. (2020) apresentaram no momento pré-intervenção resultados para GE de 49.90 e para GC de 46.60 e no momento pós-intervenção GE de 46.60 e GC de 48.00.

Uma das hipóteses para o resultado do presente estudo é a realização dessa prática corporal em grupo. Considerando que a prática de Eutonia prioriza a vivência e pode ser realizada em grupo, podemos utilizar essa atividade física para favorecer a inserção do indivíduo no seu meio ambiente (Maeda et al., 2006). Nas aulas de Eutonia as pré-adolescentes relataram sensações corporais, sentimentos e vivências como determinadas doenças e os relatos foram compartilhados com o grupo. O exercício físico em grupo favorece as relações sociais e os vínculos de amizade (Kvalo & Natlandsmyr, 2020). No entanto, não há condições de explicar porquê esse resultado não foi confirmado nas outras práticas corporais que também foram realizadas em grupos. Os achados preconizam uma ampliação dessas intervenções na escola, de modo a explicar por que algumas práticas corporais realizadas em grupo possibilitam as relações sociais e outras não favorecem os vínculos de amizade.

O domínio 'Ambiente Escolar' explora a percepção da criança/adolescente sobre sua capacidade cognitiva, de aprendizagem e concentração, bem como os seus sentimentos pela escola e professores. Neste estudo, as pré-adolescentes que praticaram a Eutonia tiveram resultados positivos nessa dimensão. No momento pré-intervenção apresentaram escores de 65.87 e no momento pós-intervenção 67.15. O estudo de (Kvalo & Natlandsmyr, 2020) demonstrou que nesse domínio, os resultados foram melhores no GE (57.15) se comparados ao GC (54.76).

Por outro lado, o estudo de (Bandeira et al., 2021) concluiu que nesse domínio no momento pré-intervenção os resultados foram: GE (48.80) e GC (48.30) e no momento pós-intervenção o GE (46.30) e o GC (48.40). Gall et al. (2020) apresentaram resultados semelhantes nesse domínio bem como no momento pré-intervenção GE (57.40) e GC (53.80) e no momento pós-intervenção GE (51.60) e GC (53.30).

Dessa forma, observa-se que ainda precisa ser esclarecido o tipo de exercício físico que promove melhor percepção da QVRS nessa dimensão. Uma das hipóteses do resultado do presente estudo é que a prática de Eutonia pode facilitar a capacidade de atenção e concentração. Isso ocorre pela instrução verbal na execução dos movimentos em que o professor nunca demonstra o movimento, mas o descreve de forma verbal. O aluno tem que estar atento, escutar, entender e realizar o movimento de acordo com suas possibilidades cognitivas. Também durante a prática o participante direciona sua atenção em variadas partes do corpo e ao mesmo tempo muda a direção do seu foco. No entanto, é importante ressaltar que a prática de Ginástica Holística também se dá pela instrução verbal e pelo foco na atenção em várias partes do corpo, no entanto, não teve efeito na melhora da percepção da QVRS nessa dimensão. Sugere-se que mais estudos clínicos experimentais sejam desenvolvidos com as práticas de Educação Somática visando ampliar o conhecimento científico sobre a influência dessas práticas corporais na atenção e concentração para melhorar o desempenho escolar.

Na pontuação total do questionário de Qualidade de Vida, Kidscreen-52, o resultado do presente estudo mostrou que as práticas corporais de Eutonia, Ginástica Holística e Pilates não promoveram modificações significativas na percepção da QVRS das pré-adolescentes com médias de 66.73% no momento pré-intervenção e 68.48% no momento pós-intervenção. Resaland et al. (2018) sugeriram que a intervenção não mostrou efeito significativo na percepção da QVRS em todas as dimensões do instrumento.

Outros estudos não revelaram efeitos significativos da intervenção nas dimensões do questionário de QVRS e além do mais, alunos que apresentaram níveis mais altos em todas as dimensões da QVRS no início do estudo, demonstraram redução no final do estudo (Bandeira et al., 2021). Kriemler et al. (2010) detectaram que no momento pré intervenção o GE obteve resultado de 286 e o GC de 170 e no momento pós-intervenção houve redução de 264 no GE 173 no GC 173. Gall et al. (2020) concluíram que no momento pré-intervenção as médias para os grupos foram: GE (49.40) e GC (47.80) e no momento pós-intervenção as médias foram: GE (47.50) e GC (48.60).

Por outro lado, o estudo de Casey et al. (2014) indicou maiores pontuações das participantes do grupo intervenção em relação à QVRS com média de 83.30 do que as participantes do grupo controle, que apresentaram média de 79.80. Dessa forma, observa-se que os resultados apresentados se devem às hetero geneidades metodológicas, sociodemográfica, do tipo de exercício físico e esportes, frequência, intensidade e duração de intervenção. Os achados preconizam estudos futuros com medidas padronizadas tanto na metodologia quanto na

intervenção para avaliar o efeito dos programas de exercício físico na percepção da QVRS de crianças e adolescentes.

No entanto, as pré-adolescentes percebem sua QVRS de forma positiva, sendo que, os índices do questionário de QVRS exibiram média de 66.73% no momento pré-intervenção e 68.48% no momento pós-intervenção. Resultados semelhantes foram encontrados no estudo de (Gaspar & Matos, 2008) que apresentaram boa percepção de QVRS com escores gerais de 69.64% e (Agathão et al., 2018) que determinaram que a percepção da qualidade de vida foi satisfatória. Existe uma tendência dos adolescentes entre 10 e 11 anos terem uma percepção da QVRS de forma mais positiva se comparados com os adolescentes que estão próximos da fase adulta e a hipótese para esse resultado são as alterações biopsicossociais específicas desta fase. Conforme os adolescentes avançam na idade vão apresentando valores mais baixos de QVRS na maior parte das dimensões (Agathão et al., 2018). Os achados preconizam uma ampliação dessas avaliações, em diferentes faixas etárias, de modo a desenvolver estratégias de ação no ambiente escolar que favoreça os grupos mais vulneráveis.

Esse estudo foi realizado em escolas públicas de regiões menos favorecidas no aspecto socioeconômico e é interessante ressaltar que 66.25% das pré-adolescentes não fazem exercício físico ou esporte fora da escola, concordando com os resultados da pesquisa de (Guthold et al., 2020). Estudos mostraram que em países subdesenvolvidos os adolescentes residentes em áreas desfavorecidas apresentam níveis mais baixos de participação em atividade física pela dificuldade de acesso a academias e centros esportivos (Casey et al., 2014; Gall et al., 2020). Dessa forma, é importante estimular políticas de prevenção primária em saúde pública no ambiente escolar de forma a reduzir o sedentarismo e promover estilo de vida ativo nesta população.

As limitações do estudo foram: a redução das participantes durante o desenvolvimento do estudo, falta de estrutura adequada de algumas escolas para as aulas práticas (alguns dos espaços abertos com circulação de pessoas, sala de aula suja e colchonetes rasgados e deteriorados), as avaliações de atividade física foram baseadas em relatos das pré-adolescentes e a sequência de movimentos idênticos proposta às pré-adolescentes sem atender as necessidades individuais de cada participante.

CONCLUSÃO

As práticas corporais de Eutonia, Ginástica Holística e Pilates proporcionaram melhor percepção da QVRS na dimensão atividade física e a Eutonia nas dimensões psicológico, amigos e escola.

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ORIGINAL ARTICLE

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Body image, muscle dysmorphia, and muscularity concerns: a comparison of crossfit athletes, weight-trainers, and non-athletes

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ABSTRACT

CrossFit is a strength-and-conditioning physical activity programme that some studies have shown results in healthier body image outcomes. However, prior studies have typically examined CrossFit in isolation, without adequate group comparison. This study aimed to investigate body image experiences in CrossFit athletes in comparison to weight-trainers and non-athletes. The study used a cross-sectional design in which CrossFit athletes, weight-trainers, and non-athletes from Brazil were asked to complete a measure of positive body image (i.e., body appreciation), negative body image (i.e., body dissatisfaction), and gender-specific muscle-oriented body image (i.e., muscularity concerns in women and muscle dysmorphia symptomatology in men). Between-group comparisons showed that CrossFit athletes and weight-trainers had healthier body image than non-athletes, but differences between the two groups were small. There were no significant between-group differences in muscularity concerns in women, whereas weight-training men had a significantly higher drive for size compared to both CrossFit athletes and non-athletes. Male CrossFit athletes and weight-trainers also showed significantly higher functional impairment as a result of exercise compared to non-athletes. These results suggest that participation in CrossFit may be a route to promoting a healthier body image while mitigating unhealthy muscularity-related attitudes and behaviours. More broadly, our results support the suggestion that physical activity is associated with a healthier body image.

KEYWORDS: body appreciation; body dissatisfaction; sport; physical activity; muscle concerns; crossfit.

INTRODUCTION

Body image refers to a multidimensional and multifaceted construct consisting of affective, cognitive, perceptual, and behavioural components (Cash, 2012). While decades of research on body image have focused on its negative aspects, such as weight and appearance dissatisfaction, body image disturbance, and body dysmorphia (Cash, 2012), scholars have more recently turned their attention to positive experiences that include body appreciation and functionality appreciation (Tylka, 2018; Andersen & Swami, 2021). There is now increasing recognition that both negative and positive body images are uniquely associated with a wide range of downstream outcomes, including eating behaviours, weight management, and psychosocial functioning (Tylka, 2018). Given such associations, body image researchers have sought to identify factors and activities that confer protection against negative body image and/or promote more positive body experiences.

One factor that may be particularly important in terms of body image is sport and physical activity behaviour. Meta-analyses have consistently reported that participation in physical activity and sport is associated with lower body image concerns in both genders (e.g., Campbell & Hausenblas, 2009; Bassett-Gunter, McEwan, & Kamarhie, 2017) and that athletes have lower body image concerns compared to non-athletes (Varnes et al., 2013). These findings were further supported in a recent scoping review (Sabiston, Pila,

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Vani, & Thogersen-Ntoumani, 2019), which found that participation in physical activity and sport was associated with a more positive body image. Although theoretical explanations of these effects remain fragmented (Sabiston et al., 2019), sport and physical activity likely affect body image directly by allowing individuals to close the gap with idealised appearance ideals and/or by promoting embodying experiences that generate a more connected relationship with one's body (Piran, 2016). Indirect pathways have also been postulated, with lower self-objectification and greater self-esteem having been suggested as mediating factors of positive body image (e.g., Piran, 2017).

Beyond these broad-stroke findings, however, researchers have also suggested that the specific type of sport is important when considering body image outcomes (Varnes et al., 2013). For instance, some researchers have noted that participation in sports types that are "judged" (i.e., where physical appearance has an influence on performance evaluation, such as gymnastics and figure skating) and sports that promote stringent appearance ideals (e.g., synchronised swimming and aerobics) are associated with higher levels of negative body image (e.g., Kong & Harris, 2015). For instance, Swami, Steadman and Tovée (2009) reported that female track athletes in the United Kingdom had significantly greater body dissatisfaction than martial artists and non-athletes. However, not all studies have supported this conclusion, with some recent research indicating that athletes in aesthetic sports have significantly lower negative body image compared to those in non-aesthetic sports (e.g., Jankauskienė & Bacevičienė, 2019) or reporting no significant differences as a function of sport type (Prnjak, Jukiv, & Tufano, 2019).

The equivocal nature of extant findings might, in part, reflect differences in methodology (e.g., the way in which body image is operationalised), researcher-defined criteria for categorising aesthetic versus non-aesthetic sports, and a focus on a limited range of sport types. Importantly, one sport that has been touted as having the potential to promote healthier body image is CrossFit. According to Glassman (2002), CrossFit is a type of strength-and-conditioning programme that aims to develop broad, general, and inclusive fitness and physical power. To achieve these goals, the CrossFit programme has athletes performing constantly varied, high-intensity, functional movements that fall into the modalities of gymnastics, Olympic weightlifting, and metabolic conditioning (or "cardio"). In a typical CrossFit workout, athletes participate in a warm-up, a skill or strength development segment, and a variable "workout of the day" (WOD) conducted at high intensity and in a group environment. The focus on functional training for everyday activities and its supportive and tight-knit community have both contributed to the global popularity of CrossFit among both amateur and elite athletes (Dawson, 2017; Lautner, Patterson, Spadine, Boswell, & Heinrich, 2021).

A notable feature of the CrossFit programme is its attention to both health- and skill-related fitness over body aesthetics; that is, CrossFit explicitly de-emphasises a focus on appearance and frames its focus instead on performance (Dominski, Serafim, Siqueira, & Andrade, 2021). Emerging evidence has suggested that involvement in CrossFit may benefit the body image of athletes. For example, in a prospective study with novice CrossFit athletes (N= 63) in the United Kingdom, Swami (2019) reported significant and large (η_p^2= 0.22-0.36) improvements in positive body image (body appreciation, functionality appreciation) and body acceptance by others after 3 months. Similarly, a study of female CrossFit athletes from Canada (N= 149) reported that self-identified CrossFit skill and frequency were associated with lower body dissatisfaction (Coyne & Woodruff, 2020). Conversely, however, a cross-sectional study with a Norwegian sample of adult CrossFitters (N= 186) reported that CrossFit experience (operationalised as duration x weekly frequency) was not significantly associated with body awareness, body dissatisfaction, and body competence (Köteles, Kollsete, & Kollsete, 2016).

There is also some evidence of the gendered impact of CrossFit participation on body image. For example, content analyses of CrossFit online content (Washington & Economides, 2016) and *CrossFit Journal* (Knapp, 2015a) have suggested that CrossFit simultaneously affords the space to actively resist heteronormative appearance ideals for women (e.g., through the development of body musculature to symbolise feminine strength) while reproducing hegemonic feminine expectations (e.g., to be attractive for others and a focus on body aesthetics). Likewise, interviews with female athletes have suggested that CrossFit challenges and subverts traditional expectations of feminine appearance, promoting body confidence (Knapp, 2015b; Podmore & Paff Ogle, 2018). Athletes spoke of how their CrossFit community promoted inclusive appearance ideals (e.g., cultivating strength and muscularity) that disrupted normative expectations and de-emphasised appearance while focusing on performance and body functionality (Podmore & Paff Ogle, 2018). At the same time, however, women athletes also described difficulties managing expectations of conforming to an athletic ideal of female muscularity while staying thin, particularly regarding the coaches' and members' gaze over their bodies (Podmore & Paff Ogle, 2018; Malcom, Edmonds, Gipson, Haudd, & Bennett, 2021; Schrijnder, van Amsterdam, & McLachlan, 2021).

Although these studies suggest that CrossFit may have the potential to promote healthier body image, it is important to note that quantitative studies to date (Köteles et al., 2016; Swami, 2019; Coyne & Woodruff, 2020) have typically relied on relatively small samples, have not considered gendered differences, and have not included adequate comparison groups. The latter is important because it limits the extent to which reported findings are the result of CrossFit specifically or engagement with specific elements of the CrossFit programme; that is, it may be possible that outcomes reported in previous studies are not the outcome of participation in CrossFit *per se*, but rather engagement with specific elements of the CrossFit programme, such as weight-training. Indeed some evidence indicates that functional workouts in isolation (i.e., the training aimed at improving performance in daily neuromuscular activities) are associated with reduced negative body image (Aukštuolytė, Mauricienė, Daunoravičienė, Knispelytė, & Berškienė, 2018). Likewise, weight training (i.e., strength training for developing the strength and size of muscles) in isolation has been found to result in reductions in negative body image (SantaBarbara, Whitworth, & Ciccolo, 2017; Waldorf, Erkens, Vocks, McCreary, & Cordes, 2017).

The present study

Much more can be done to fully understand the CrossFit programme's impact on body image outcomes. In the present study, therefore, we conducted a study examining aspects of body image in a sample of CrossFit athletes and, for comparative purposes, weight-trainers and non-athletes. While non-athletes provide an appropriate "baseline" comparison insofar as they are not involved in any organised physical activity (Swami et al., 2009; Jankauskienė & Bacevičienė, 2019), we also included a sample of weight-trainers given that strength development is an important component of the CrossFit programme (Glassman, 2002). Worth noting that some work has suggested that weight-training athletes report greater appearance-related motives than CrossFit athletes suggesting that the former may represent a useful comparison group in terms of being a more aesthetic-focused sport (Popp Marin, Polito, Foschini, Urtado, & Otton, 2018). Here, we operationalised body image in terms of an index of positive body image (i.e., body appreciation) and two indices of negative body image, namely body dissatisfaction and gender-specific muscle-oriented body image (i.e., muscularity concerns in women and muscle dysmorphia in men). Based on previous work (Swami, 2019; Coyne & Woodruff, 2020), we hypothesised that CrossFit athletes would have significantly greater positive body image and lower body dissatisfaction and muscularity concerns and/or muscle dysmorphia than both weight-trainers and non-athletes.

METHODS

Participants

In this cross-sectional study, the initial participant group consisted of 1,074 individuals; however, data from 458 individuals were omitted because they did not return a signed informed consent form (n= 13), did not meet inclusion or exclusion criteria (n= 234), or were missing substantial (i.e., > 80%) item-level data (n= 207). The final sample, therefore, consisted of 620 adults (319 women, 301 men) who were recruited in-person and online. A total of 32 CrossFit athletes (14 women, 18 men), 107 weight-trainers (42 women, 65 men), and 105 non-athletes (71 women, 34 men) were recruited in-person at university campuses (non-athletes), CrossFit boxes, and weight-training gyms. All remaining participants were recruited online: 105 CrossFit athletes (56 women, 49 men), 130 weight-trainers (62 women, 68 men), and 141 non-athletes (74 women, 67 men).

Participants ranged in age from 18 to 40 years (M= 27.07, SD= 5.63) and in self-reported body mass index (BMI) from 15.35 to 46.17 kg/m^2 (M= 24.51, SD= 4.05). Regarding race, 81.1% of the sample were White, 14.4% were Brown, and the remaining 4.6% were Black, Asian, or Indian, in accordance with official race/ethnicity categories in the Brazilian census (Brazilian Institute of Geography and Statistics, 2020). Regarding marital status, 80.3% of the sample were single, 18.9% were married/living together, and the remainder 0.8% were divorced. In terms of educational attainment, 1.0% had completed middle school, 10.5% had completed high school, 50.5% had an undergraduate degree, and 38.1% were attending college. Regarding the frequency of sport, 5.9% were engaged 1-2 times per week, 45.9% were engaged 3-4 times per week, and 48.3% were engaged 5 or more times per week. The sociodemographic characteristics of each group are reported in Table 1.

Measures

Sociodemographic questionnaire

Participants were asked to report their gender identity, age, race, highest educational qualification, and marital status. They were also asked to self-report their height and weight, which we used to compute BMI as kg/m^2. In addition, participants who engaged in CrossFit or weight-training were asked to report how long (in months) they had been active in the sport (duration) and how many times per week (frequency) they engaged in the sport (1= 1-2 times per week, 2= 3-4 times per week, 3= 5 or more times per week).

Body appreciation

To measure a facet of positive body image, we used the 10-item Body Appreciation Scale (BAS-2; Tylka & Wood-Barcalow, 2015; Brazilian Portuguese translation, Junqueira et al., 2019). The BAS-2 measures acceptance of one's body, respect and care for one's body, and protection of one's body from unrealistic beauty standards. All items were rated on a 5-point scale, ranging from 1 (never) to 5 (always), and an overall score was computed as the mean of all items. Higher scores on this measure reflect greater body appreciation. Scores on the Brazilian Portuguese version of the BAS-2 have been shown to have a 1-dimensional factor structure and have been judged as adequate in terms of internal consistency estimates, test-retest reliability after 3 weeks, and indices of convergent validity (Junqueira et al., 2019). In this study, McDonald's ω for scores on this scale was 0.93 (95%CI 0.92–0.93).

Body satisfaction

To measure a facet of negative body image, we asked participants to complete the 9-item Body Areas Satisfaction Scale (BASS) of the Multidimensional Body-Self Relations Questionnaire (MBSRQ; Cash, 2000; Brazilian Portuguese translation, Laus, Vales, Oliveira, Braga Costa, & Almeida, 2020), which measures the degree of (dis)satisfaction with various body parts. Items were rated on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree), and an

Table 1. Demographic Characteristics of Participants as a Function of Sport Type and Gender.

	CrossFit athletes		Weight-trainers		Non-athletes	
	Men (*n*= 67)	Women (*n*= 70)	Men (*n*= 133)	Women (*n*= 104)	Men (*n*= 101)	Women (*n*= 145)
Age (years)						
M (SD)	28.73 (6.10)	26.54 (6.02)	24.35 (4.81)	24.82 (5.58)	26.37 (6.17)	22.59 (4.12)
Range	18-40	18-40	18-38	18-39	18-40	18-40
BMI (kg/m^2)						
M (SD)	26.36 (1.93)	23.84 (3.05)	25.23 (3.13)	22.59 (3.47)	26.71 (4.91)	23.16 (4.31)
Range	20.52-29.94	19.13-41.41	17.92-37.86	15.67-35.64	17.92-38.74	15.78-36.20
Duration (months)*						
M (SD)	28.96 (23.22)	26.5 (17.91)	53.68 (54.79)	40.32 (41.23)	-	-
Range	6.00 – 120.00	6.00 – 75.00	6.00 – 312.00	6.00 – 240.00	-	-
Education level	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Middle school	0 (0.0%)	1 (1.4%)	2 (1.5%)	3 (2.9%)	0 (0.0%)	0 (0.0%)
High school	10 (14.9%)	7 (10.0%)	14 (10.5%)	10 (9.6%)	16 (15.8%)	8 (5.5%)
Attending college	43 (64.2%)	37 (52.9%)	43 (32.3%)	42 (40.4%)	40 (39.6%)	31 (21.4%)
Bachelor's degree	14 (20.9%)	25 (35.7%)	74 (55.6%)	49 (47.1%)	45 (44.6%)	106 (73.1%)
Race	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
White	52 (77.6%)	66 (94.3%)	111 (83.5%)	80 (76.9%)	81 (80.2%)	113 (77.9%)
Black	0 (0.0%)	0 (0.0%)	5 (3.8%)	3 (2.9%)	3 (3.0%)	5 (3.4%)
Brown	12 (3.0%)	3 (4.3%)	15 (11.3%)	19 (18.3%)	16 (15.8%)	24 (16.6%)
Asian	2 (3.0%)	1 (1.4%)	2 (1.5%)	2 (1.9%)	1 (1.0%)	3 (2.1%)
Indian	1 (1.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Marital status	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Single	49 (73.1%)	51 (72.9%)	120 (90.2%)	77 (74.0%)	71 (70.7%)	130 (89.7%)
Married	16 (23.9%)	18 (25.7%)	12 (9.0%)	27 (26.0%)	30 (29.7%)	14 (9.7%)
Divorced	2 (3.0%)	1 (1.4%)	1 (0.8%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
Frequency of sport**	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
1-2 times	3 (4.5%)	2 (2.9%)	6 (4.5%)	11 (10.6%)	-	-
3-4 times	17 (25.4%)	36 (51.4%)	60 (45.1%)	59 (56.7%)	-	-
5+ times	47 (70.1%)	32 (45.7%)	67 (50.4%)	34 (32.7%)	-	-

BMI: Body Mass Index; *Training duration; **Frequency per week.

overall score was computed as the mean of all nine items. Scores were reverse-coded for analyses so that higher scores reflect greater body dissatisfaction. Laus et al. (2020) reported that scores on the Brazilian Portuguese version of the BASS are 1-dimensional and have adequate psychometric properties. In the present study, McDonald's ω for scores on the BASS was 0.82 (95%CI 0.80–0.84).

Muscle dysmorphia

Men in the present study were asked to complete the Muscle Dysmorphic Disorder Inventory (MDDI; Hildebrandt, Langenbucher, & Schlundt, 2004; Brazilian Portuguese translation, Gomes et al., 2020). The MDDI is a 13-item measure assessing a pathological fear of being too small and a pursuit of muscularity. All items were rated on a 5-point scale ranging from 1 (never) to 5 (always). Like the original version, scores on the Brazilian Portuguese version of the MDDI have been found to reduce to three dimensions measuring drive for size (DS; 5 items), appearance intolerance (AI; 4 items), and functional impairment (4 items) (FI; Gomes et al., 2020). Subscale scores were computed as the mean of the items, such that higher scores reflect greater muscle dysmorphia. Scores on the Brazilian Portuguese version have been shown to have adequate internal consistency coefficients and construct validity, as well as good test-retest reliability up to two weeks in men (Gomes et al., 2020). In the present study, McDonald's ω was 0.78 (95%CI 0.75–0.80) for MDDI-DS, 0.76 (95%CI 0.72–0.78) for MDDI-AI, and 0.85 (95%CI 0.81–0.85) for MDDI-FI.

Female muscularity

Women in the present study were asked to complete the Female Muscularity Scale (FMS; Rodgers et al., 2018; Brazilian Portuguese translation: Campos et al., 2021). The FMS is a 10-item measure assessing muscularity concerns in women along two dimensions indexing attitudinal dispositions (5 items) and behavioural aspects (5 items). All items were rated on a 5-item scale ranging from 1 (never) to 5 (always). Scores on the Brazilian Portuguese version of the FMS have been shown to reduce to two dimensions mirroring the original scale (Campos et al., 2021). In the present study, therefore, we computed subscale scores as the mean of the items, with higher scores reflective of greater muscularity concerns. Scores on the Brazilian Portuguese version have been shown to have adequate internal consistency coefficients and construct validity, as well as good test-retest reliability up to two weeks in men (Campos et al., 2021). In the present study, McDonald's ω was 0.87 (95%CI 0.84–0.87) for the Attitudes subscale and 0.90 (95%CI 0.88–0.90) for the Behaviours subscale.

Procedure

The project was approved by the relevant Institutional Review Board (approval code: CAAE 21607019.0.0000.5498). Potential participants were invited to complete a survey that was advertised as being on sports participation and well-being. Inclusion criteria included being between the ages of 18 and 40 years (as most of our instruments were validated for use in populations of this age range), being sedentary for the non-athletes, and, for the sports groups, having engaged in CrossFit or weight-training for at least six months prior to the point of the survey. The latter criterion was included to ensure a minimum period in which participants would begin to exhibit the psychological and physical transformations required to meet the challenges of CrossFit or weight-training (Swami, 2019). Exclusion criteria included practising any type of sport other than CrossFit or weight training, being pregnant at the time of recruitment, having given birth within twelve months of recruitment, and having any medical condition that may directly or indirectly influence one's physical appearance (e.g., cancer, amputation).

Beginning in January 2020, participants were recruited in places of congregate activity on university campuses (non-athletes), CrossFit boxes, and weight-training gyms in São Paulo state, Brazil. Six trained research assistants approached the potential participants directly and, following a brief explanation of the project, those who agreed to participate were invited to take home a sealed envelope (which contained a written informed consent sheet, the survey materials with the order of presentation of scales counter-balanced, and debriefing information). The sealed envelopes were returned to researchers within 7 days. However, due to the novel coronavirus (COVID-19) pandemic and attendant measures to limit virus transmission, we paused recruitment in March 2020 due to the closure of all gyms and training facilities. Although these re-opened in mid-2020, we elected to continue online recruitment to facilitate participation. The online collection was performed via advertisements placed on social media between August 2020 and February 2021. Inclusion and exclusion criteria were identical to those used for face-to-face recruitment. Potential participants were provided with brief information about the project, and those who agreed to participate provided digital informed consent and completed an online survey. The survey was hosted on SurveyMonkey, and the order of presentation of scales was counter-balanced, using the "block randomisation" option. IP addresses were checked to ensure that no participant completed the survey more than once. The survey was entirely anonymous for both online and offline recruitment, and data were treated confidentially. All participants took part voluntarily and were not reimbursed for participation.

Statistical analysis

All study variables were analysed using descriptive statistics (mean, standard deviation, and frequencies). Between-group differences were analysed using chi-square tests and univariate analyses of variance (ANOVAs). A series of analyses of covariance (ANCOVAs) or multivariate analyses of covariance (MANCOVAs) were conducted to test the study hypothesis, and multiple linear regressions were conducted for exploratory purposes. All statistical analyses were performed using the Software Statistical Package for Social Sciences (SPSS) v. 23.0. A significance level of $p \leq .05$ was adopted for all analyses.

RESULTS

Preliminary analysis

Descriptive statistics for all sociodemographic and study variables are reported in Tables 1 and 2.

We first examined between-group differences in the distribution of gender, race, highest educational qualifications, and marital status to verify if the groups were similar in terms of sociodemographic characteristics. There were significant differences in the distribution of gender, $\chi^2(1)= 10.97$, $p= .004$, and highest educational qualification, $\chi^2(2)= 45.98$, $p< 0.001$, but not of race, $\chi^2(2)= 10.56$, $p= 0.228$, and marital status, $\chi^2(2)= 8.81$, $p= 0.066$. There were also significant between-group differences in mean age, $F(2, 617)= 19.36$, $p < 0.001$, $\eta_p^2= 0.06$, but not BMI, $F(2, 617)= 2.81$, $p= 0.061$, $\eta_p^2= 0.01$. Finally, weight-trainers had been training for significantly longer than CrossFit athletes, $t(371)= 4.52$, $p< 0.001$, $d= 0.47$, and were also more likely to train more frequently per week, $\chi^2(2)= 8.42$, $p= 0.015$.

Main analyses

To test the study hypotheses, we conducted a series of ANCOVAs or MANCOVAs. When gender, educational qualifications, training duration, and training frequency were

Table 2. Means and standard deviations of the study variables as a function of sport type and gender.

	CrossFit athletes		Weight-trainers		Non-athletes	
	Men (*n*= 67)	Women (*n*= 70)	Men (*n*= 133)	Women (*n*= 104)	Men (*n*= 67)	Women (*n*= 70)
BAS-2						
M (SD)	4.06 (0.56)	3.75 (0.70)	3.91 (0.60)	3.75 (0.74)	3.57 (0.79)	3.33 (0.87)
Range	2.40-5.00	1.50-5.00	2.10-5.00	1.60-5.00	1.10-4.90	1.00-5.00
MBSRQ-BASS						
M (SD)	2.10 (0.65)	2.41 (0.58)	2.41 (0.59)	2.50 (0.68)	2.60 (0.63)	2.80 (0.71)
Range	1.00 – 4.00	1.22 – 3.67	1.00 – 3.78	1.22 – 4.56	1.44 – 4.11	1.00 – 4.67
FMS-AS						
M (SD)	-	4.01 (0.81)	-	4.13 (0.79)	-	3.89 (0.96)
Range	-	2.40 – 5.00	-	2.00 – 5.00	-	1.00 – 5.00
FMS-BS						
M (SD)	-	3.29 (0.91)	-	3.47 (0.96)	-	1.89 (0.99)
Range	-	1.40 – 5.00	-	1.20 – 5.00	-	1.00 – 5.00
MDDI - DS						
M (SD)	2.24 (0.78)	-	2.88 (0.78)	-	2.20 (0.84)	-
Range	1.00 – 4.20	-	1.20 – 5.00	-	1.00 – 4.20	-
MDDI - AI						
M (SD)	1.91 (0.85)	-	1.99 (0.71)	-	2.20 (0.95)	-
Range	1.00 – 4.50	-	1.00 – 4.00	-	1.00 – 4.75	-
MDDI - FI						
M (SD)	2.50 (0.93)	-	2.32 (0.91)	-	1.30 (0.53)	-
Range	1.00 – 4.74	-	1.00 – 5.00	-	1.00 – 3.50	-

BAS-2: Body appreciation scale-2; BASS: Body areas satisfaction scale of Multidimensional body-self relations questionnaire – appearance scales; FMS: Female muscularity scale; FMS – AS: attitudes subscale of FMS; FMS – BS: behavior subscale of FMS; MDDI: muscle dysmorphic disorder inventory; MDDI – DS: drive for size subscale of MDDI; MDDI – AI: appearance intolerance subscale of the MDDI; MDDI – FI: functional impairment.

entered as covariates in these analyses, none of these variables had significant covariate or interaction effects (all $\eta_p^2 \leq 0.01$). For this reason, we have omitted the reporting of covariate results below for the sake of brevity.

In the first set of analyses, we conducted a ANCOVA with gender (women *vs*. men) and sport type (CrossFit athletes *vs*. weight-trainers *vs*. non-athletes) as independent variables and participant age and education as covariates. When body appreciation was entered as the dependent variable, there was a significant main effect of sport type, $F_{(2, 612)} = 22.28$, $p < 0.001$, $\eta_p^2 = 0.07$. CrossFit athletes and weight-trainers were not significantly different from each other in mean body appreciation, $t(372) = 0.82$, $p = 0.412$, $d = 0.09$, but both groups had significantly higher body appreciation than non-athletes (ts= 5.68-5.97, ps< 0.001, ds= 0.54–0.58). There was also a significant effect of gender, $F_{(1, 612)} = 12.09$, $p < 0.001$, $\eta_p^2 = 0.02$ (men had significantly higher body appreciation than women), but the interaction was not significant, $F_{(2, 612)} = 0.381$, $p = 0.684$, $\eta_p^2 < 0.01$.

When body dissatisfaction was entered as the dependent variable, we found a significant main effect of sport type, $F_{(2, 612)} = 21.64$, $p < 0.001$, $\eta_p^2 = 0.07$. CrossFit athletes had significantly lower body dissatisfaction compared with weight trainers, $t(372) = 2.82$, $p = 0.005$, $d = 0.30$, and non-athletes, $t(381) = 6.53$, $p < 0.001$, $d = 0.67$, whereas weight-trainers had significantly lower body dissatisfaction compared with non-athletes, $t(481) = 4.55$, $p < 0.001$, $d = 0.42$. There was a significant main effect of gender, $F_{(1, 612)} = 11.67$, $p < 0.001$, $\eta_p^2 = 0.02$ (men had significantly lower body dissatisfaction than women), but the interaction between sport type and gender did not reach significance, $F_{(2, 612)} = 1.14$, $p = 0.320$, $\eta_p^2 < 0.01$.

Next, we ran a MANCOVA with symptoms of muscle dysmorphia (i.e., the three MDDI subscales) in men as the dependent variables, sport type as the independent variable, and age and education entered as covariates. There was a significant omnibus effect of sport type, $\lambda = .63$, $F_{(6, 558)} = 24.16$, $p < 0.001$, $\eta_p^2 = 0.21$. Examination of the univariate results indicated a significant effect of sport type on drive for size, $F_{(2, 281)} = 19.05$, $p < 0.001$, $\eta_p^2 = 0.12$, with weight-trainers having significantly higher scores than both CrossFit athletes and non-athletes (ts= 5.44-6.07, ps< 0.001, ds= 0.77-0.82), whereas CrossFit athletes and non-athletes did not differ significantly, $t(151) = 0.31$, $p = 0.758$, $d = 0.05$. There was also a significant effect of sport type on functional impairment, $F_{(2, 281)} = 52.66$, $p < 0.001$, $\eta_p^2 = 0.27$. CrossFit athletes and weight-trainers were not significantly different in functional impairment, $t(198) = 1.28$, $p = 0.201$, $d = 0.18$, but both groups had significantly higher scores than non-athletes (ts= 9.43-10.07, ps< 0.001, d= 1.28-1.64). There effect of sport type on appearance intolerance did not reach significance, $F_{(2, 281)} = 2.98$, $p = 0.053$, $\eta_p^2 = 0.02$.

Finally, we ran a MANCOVA with muscularity concerns (i.e., the two FMS subscales) in women as the dependent variables, sport type as the independent variable, and age and education as covariates. The results indicated a significant omnibus effect of sport type, $\lambda = 0.60$, $F_{(4, 494)} = 35.37$, $p < 0.001$, $\eta_p^2 = 0.22$. Analysis of the univariate results indicated a significant effect of sport type on the behaviours dimension, $F_{(2, 248)} = 64.85$, $p < 0.001$, $\eta_p^2 = 0.34$. However, tests of simple effects indicated that none of the between-group comparisons reached significance (ts= 0.83-1.87, ps= 0.063– 0.404, ds= 0.14-0.28). There was no significant effect of sport type on the attitudes dimension, $F_{(2, 248)} = 1.76$, $p = 0.174$, $\eta_p^2 = 0.01$.

Exploratory analyses

For exploratory purposes, we examined whether sport type (dummy coded using CrossFit athletes as the reference group and coded as 0), training duration, and training frequency predicted body image outcomes (non-athletes were not included in these analyses). To do so, we conducted a series of multiple linear regressions with body appreciation, body dissatisfaction, muscle dysmorphia (using total MDDI scores in men), and muscularity concerns (using total FMS scores in women) as criterion variables, respectively. Neither the regression with body appreciation nor body dissatisfaction were significant (Fs< 2.22, Adj. $R^2 \leq 0.02$). In women, the regression with total FMS scores as the criterion variable was also non-significant, $F_{(3, 169)} = 1.55$, $p = 0.205$, Adj. $R^2 = 0.03$. In men, the regression was significant, $F_{(3, 196)} = 4.22$, $p = 0.006$, Adj. $R^2 = 0.06$. Weight-trainers were more likely to display symptoms of muscle dysmorphia than CrossFit athletes (B= 0.27, SE= 0.09, β= 0.23, t= 3.16, p= 0.002) and greater weekly frequency of training was associated with greater symptoms of muscle dysmorphia (B= 0.15, SE= 0.07, β= 0.16, t= 2.21, p= 0.028). Duration of training was not significantly associated with symptoms of muscle dysmorphia (B= -0.01, SE= 0.01, β= -0.08, t= -1.14, p= 0.256.

DISCUSSION

The present study examined body image outcomes in a sample of CrossFit athletes, weight-trainers, and non-athletes from Brazil. We hypothesised that CrossFit athletes would have significantly greater body appreciation and lower body dissatisfaction and muscularity concerns/muscle dysmorphia than weight-trainers and non-athletes. Our results support these hypotheses: CrossFit athletes had lower body dissatisfaction than weight-trainers and non-athletes, but

there was no significant difference between CrossFit athletes and weight-trainers in terms of body appreciation (though both groups had significantly higher body appreciation than non-athletes). Among men, there was some evidence that CrossFit athletes differed from weight-trainers in terms of drive for size, although both groups had significantly greater functional impairment than non-athletes. Among women, there were no significant differences in muscularity concerns between all three groups.

In broad outline, our results are consistent with the results of meta-analyses and scoping reviews indicating that athletes have fewer body image concerns than non-athletes (Varnes et al., 2013) and that sports participation is associated with lower body image concerns (Campbell & Hausenblas, 2009; Bassett-Gunter et al., 2017) and more positive body image (Sabiston et al., 2019). It seems likely that sport and physical activity bring real changes to the physical self, such as changes in weight, body shape, and appearance, that contribute to improvements in body image (Martin Ginis & Bassett, 2012). In addition, it is also possible that sports participation helps to build feelings of self-efficacy, mastery of new skills, and development of confidence that either directly or indirectly result in improvements in body image (Swami, 2019). In this sense, it is reasonable to suppose that sports such as CrossFit and weight-training may also provide individuals with opportunities to form close and appreciative relationships with their bodies (e.g., by developing improved awareness of what their bodies are capable of achieving physically and by mastering new skills); that is, both CrossFit and weight-training may be viewed as embodying activities (Piran, 2017) that contribute to a closer and more connected relationship with one's body.

Beyond the focus on athletes versus non-athletes, however, the results of the present study were more equivocal. On the one hand, there was no significant difference in body appreciation between CrossFit athletes and weight-trainers. On the other hand, CrossFit athletes had significantly lower body dissatisfaction compared with weight-trainers (although the effect size of this difference was small-to-moderate). Although CrossFit has been touted as a useful mechanism for promoting healthier body image outcomes due to its focus on both health- and skill-related fitness over body aesthetics (Swami, 2019; Coyne & Woodruff, 2020), our results suggest that CrossFit may not be overly superior in achieving healthier body image compared to weight-training alone. Indeed, our results are particularly important given that previous studies examining the impact of CrossFit on body image have not included appropriate comparison groups. One possible explanation for the present findings is that weight-training, like CrossFit, produces substantive changes to muscular strength and mass. These changes likely mean that these athletes not only close the gap between current and idealised appearance ideals but also receive immediate feedback on their functional capabilities, which in turn de-emphasises a focus on body aesthetics (SantaBarbara et al., 2017).

A more critical reading of our results would suggest that CrossFit may not contribute much more to developing a healthier body image than weight-training alone. Of course, this does not suggest that CrossFit does not convey other benefits beyond weight-training that contribute to body image outcomes, such as skills-related improvements. However, based on the present results alone, it seems likely that any benefit to body image conveyed by participation in CrossFit is not substantially greater than that conveyed by weight training alone. Importantly, our results also indicated a lack of gendered effects in this regard. That is, although men had significantly higher body appreciation and significantly lower body dissatisfaction than women, which is consistent with previous work (He, Sun, Zickgraf, Lin, & Fan, 2020), our results indicated no significant sport type by gender interaction. Put differently, both CrossFit and weight-training appear to be associated with real benefits in terms of body image outcomes, irrespective of an athlete's gender, compared to non-athleticism.

Our findings on muscularity concerns in women and muscle dysmorphia were also noteworthy. In terms of women, we found no significant differences in either muscularity-related behaviours or attitudes across all three groups. That is, although both CrossFit and weight-training can be expected to promote the development of body musculature, our results suggest that involvement in these sports is not necessarily associated with unhealthy muscularity-related attitudes and behaviours in female athletes compared to non-athletes. This may be a particularly important finding for female athletes, particularly given discussions about the way that female musculature can help women to resist heteronormative appearance ideals actively, subvert traditional feminine expectations of feminine appearance, and promote greater body confidence (Knapp, 2015b; Podmore & Paff Ogle, 2018). It may be that immersion in supportive weight-training or CrossFit communities helps to disrupt normative expectations around appearance while helping female athletes to manage their muscularity concerns (Podmore & Paff Ogle, 2018).

However, our results about muscle dysmorphic symptomatology among men were less clear-cut. First, we found no significant between-group differences in appearance intolerance (i.e., the extent of avoidance behaviours related to displaying one's body) across the three groups. Second, we found

that weight-trainers had a significantly greater drive for size (i.e., a perception of not being sufficient muscular or looking small and a desire to increase body size) than CrossFit athletes, who were not significantly different from non-athletes. Finally, our results indicated that both weight-trainers and CrossFit athletes had significantly greater functional impairment (i.e., the extent to which individuals maintain a routine of excessive exercise, discomfort as a result of altering this behaviour, and the avoidance of social situations) than non-athletes. Overall, these results may be interpreted as showing that, while participation in both weight-training and CrossFit may be associated with a compulsion to exercise, CrossFit is not necessarily associated with the greater drive for greater size or muscularity compared with non-athletes.

These results are notable for two reasons. First, the finding that weight-trainers experience a deficit in appearance (i.e., a lack of perceived muscularity) has been noted previously (Hildebrandt, Schlundt, Langenbucher, & Chung, 2006), and our work is consistent in showing that weight-trainers experience relatively high levels of driving for size. Interestingly, the finding that CrossFit athletes did not differ significantly from non-athletes in terms of drive for size may be seen as evidence supporting the claim that the CrossFit programme de-emphasises a focus on appearance. Conversely, both CrossFit athletes and weight-trainers had significantly higher levels of functional impairment compared with non-athletes, which suggests that these groups experience a compulsion to exercise or maintain routines of physical activity that may interfere with other aspects of their lives. Indeed, the finding of higher scores among athletes on functional impairment is particularly notable given that scores on this subscale of the MDDI fit with criteria in the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* concerning the negative impact of muscular dysmorphic disorder (American Psychiatric Association, 2013). These findings were also consistent with our exploratory analyses with male athletes, which indicated that weekly training frequency was significantly associated with greater muscle dysmorphia symptomatology.

Compared to previous work (Köteles et al., 2016; Swami, 2019; Coyne & Woodruff, 2020), a strength of the present study is the recruitment of a relatively large sample of CrossFit athletes, as well as the inclusion of two comparative groups that differed in their degree of physical activity. Nevertheless, several limitations of the present study should also be acknowledged. First, the cross-sectional design of our study limits the causational conclusions that can be drawn. For instance, while we have interpreted our findings in line with theorising and earlier results (Swami, 2019) showing that participation in CrossFit is associated with longitudinal improvements in body image, alternative explanations are also possible. Thus, it could be that individuals with higher levels of body appreciation and/or lower body dissatisfaction are more likely to gravitate toward physical activity programmes, such as weight training and CrossFit. Participation in these programmes may reflect a repertoire of behaviours associated with healthier body image (Tylka, 2018).

A second limitation was that our samples were not ideally matched; there were significant differences in the distribution of educational qualifications and mean age across the three groups, as well as differences in training duration and weekly frequency across the CrossFit and weight-training groups. Although these variables were included as covariates in our analyses, and although we see no evidence that these factors impacted our findings, we cannot entirely rule out the possibility that some of our results are accounted for by sociodemographic or training differences across groups. Similarly, we note that our recruitment strategy was impacted by the social distancing measures implemented to manage the transmission of COVID-19. It is difficult to know how this may have affected our results, although we acknowledge that the stress and anxiety caused by the pandemic may have had adverse effects on body image outcomes (Swami, Horne, & Furnham, 2021).

A second limitation of our study design is that we did not assess our participants' athleticism levels. Although we do not have any reason to believe that our sample included a disproportionately high number of elite athletes (i.e., most, if not all, CrossFit athletes and weight-trainers were recreational athletes), we acknowledge that the level of participation may have been important. For instance, compared to recreational athletes and non-athletes, elite or professional athletes likely experience unique pressures that have a detrimental effect on their body image, including heightened pressure to maintain a lean and muscular physique for optimum physical performance. In future work, it will be important to assess body image outcomes as a function of both sport type and sport level. Likewise, it may also be useful to examine constructs associated with body image outcomes, such as body acceptance by others and perceived pressure to internalise appearance ideals, as well as sport-related factors, such as sport-confidence and subjective appraisals of performance.

CONCLUSION

The present results suggest that CrossFit athletes and weight-trainers may be more similar than different in terms of body appreciation and body dissatisfaction. In

contrast, differences in muscle dysmorphia/muscularity concerns are more equivocal and gendered. However, our findings are consistent with a large body of existing literature showing that sports participation is associated with lower body image concerns (Campbell & Hausenblas, 2009; Bassett-Gunter et al., 2017) and more positive body image (Sabiston et al., 2019). Findings such as ours are particularly important given the high levels of physical inactivity worldwide and the relationship between physical inactivity and premature mortality (Lee et al., 2012). As such, encouraging physically inactive individuals to participate in weight-training or CrossFit programmes — carefully managed to emphasise health- and functional-related fitness, rather than body aesthetics (e.g., through improved coach awareness of these body image issues) — may bring benefits not just in terms of physical health, but also in terms of body image outcomes.

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ARTIGO ORIGINAL

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Tendências do Fitness em Portugal para 2022

Tendências do Fitness em Portugal para 2022

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RESUMO

O *American College of Sports Medicine* (ACSM) publica anualmente um estudo com as tendências mundiais do fitness. Em 2021 foi publicado o primeiro estudo com as tendências do fitness em Portugal. Neste estudo foi reproduzida a metodologia do ACSM e caracterizadas as tendências do fitness em Portugal para 2022 bem como comparadas as tendências 2021 e 2022, entre géneros, exercer ou não funções enquanto profissional e possuir o título de Técnico de Exercício Físico (TEF), Diretor Técnico (DT) ou não possuir título. Responderam a um questionário online 758 profissionais/estudantes de fitness (PF). As principais tendências do fitness para 2022 em Portugal são "Licenças (títulos) para PF", "Empregar PF certificados", "Personal trainer", "Exercício para perda de peso" e Estilo de vida saudável e mudança comportamental", respetivamente. Este *top* 5 de tendências é o mesmo obtido no estudo do ano anterior em Portugal. Na comparação das tendências 2021 e 2022 verificou-se existirem diferenças significativas em 17 das 42 tendências. Na comparação de género existiram diferenças significativas em 25 das 42 tendências, entre os profissionais que exerciam funções e os que não exerciam funções enquanto PF existiram diferenças significativas em 14 das 42 tendências e entre TEF, DT ou Sem Título existiram diferenças significativas em 16 das 42 tendências.

PALAVRAS-CHAVE: Portugal; tendências; fitness; ACSM.

ABSTRACT

The American College of Sports Medicine (ACSM) annually publishes a study of global fitness trends. In 2021, the first study on fitness trends in Portugal was published. The present study reproduced the methodology of the ACSM trends study and characterized the fitness trends in Portugal for 2022. The trends between 2021 and 2022, between genders, between whether to do exercise functions as a professional and between holding the title of Exercise Technician Physical (TEF), Technical Director (DT) or without title, were compared. 758 fitness professionals (FP) responded to an online survey. The main fitness trends for 2022 in Portugal are "Licenses (titles) for FP", "Employ certified FP", "Personal trainer", "Exercise for weight loss" and Healthy lifestyle and behaviour change". These top 5 trends are the same as those obtained in the study on trends for 2021 in Portugal. When comparing the results of fitness trends 2021 versus 2022, there were significant differences in 17 of the 42 trends. Regarding gender comparison, there were significant differences in 25 of the 42 trends. In the comparison between professionals who exercised functions and those who did not exercise functions as FP there were significant differences in 14 of the 42 trends. In the comparison between professionals with a TEF, DT or untitled title, there were differences in 16 of the 42 trends.

KEYWORDS: Portugal; Trends; Fitness; ACSM.

INTRODUÇÃO

Segundo a Internacional Health, Racquet & Sportsclub Association (IHRSA, 2020) nas últimas quatro décadas e antes da pandemia provocada pela doença COVID-19, embora tenha passado por tempos económicos difíceis, a indústria do fitness cresceu e desenvolveu-se exponencialmente, com os meios de comunicação, governos e a comunidade médica e científica a apoiar e encorajar os cidadãos à prática de exercício físico. O facto da atividade física e do exercício físico ser associada a benefícios em termos de saúde (Siddiqui, Nessa,

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& Hossain, 2010; Warburton & Bredin, 2017) e diminuição da mortalidade (Ekelund et al., 2016) bem como as próprias recomendações da Organização Mundial da Saúde (2018) para a sua realização também contribuíram, certamente, para esta grande expansão do mercado do fitness mundial e a sensibilização da população para um estilo de vida mais ativo e saudável. A pandemia provocada pela doença COVID-19 veio abalar fortemente a tendência de expansão e crescimento do setor do fitness que se tinha verificado. Segundo a EuropeActive (2021), o número de praticantes de atividades de fitness na Europa diminuiu cerca de 15,4% durante o ano de 2020, passando de 64,8 milhões para 54,8 milhões, as receitas caíram 32,9% e o número total de ginásios/*health clubs* diminuiu 1,4%.

Portugal não é exceção e o setor do fitness foi afetado abruptamente através dos indicadores que tendencialmente apresentavam crescimento ao longo dos últimos anos. Segundo o barómetro 2021, realizado pela Associação de Ginásios e Academias de Portugal — Portugal Activo (AGAP, 2021), o número de ginásios/*health clubs* em Portugal diminuiu 27%, passando de cerca de 1100 unidades para 800 (bastante acima do valor de 1,4% apresentado pela EuropeActive, 2021), o número de praticantes de atividades de fitness desceu 29% (quase o dobro da média europeia), o volume da faturação 42% e o número de trabalhadores 15%.

O *American College of Sports Medicine* (ACSM) é uma das instituições mais relevantes internacionalmente no âmbito do exercício e saúde e um dos seus objetivos é a promoção da investigação científica, educação e aplicação prática da medicina desportiva e do exercício orientado para a saúde. Desde 2007 que o ACSM publica, anualmente, um estudo acerca das tendências do fitness mundiais (Thompson, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2021), contribuindo para que o setor do fitness possa ajustar e atualizar, regularmente, a sua oferta. Considerando que as tendências podem ter as suas singularidades, dada a sua especificidade em termos geográficos e culturais (ClubIntel, 2018; Kercher, Feíto, & Yates, 2019), para além das tendências mundiais para 2020, no ano de 2019 o ACSM também publicou um artigo acerca das tendências para determinadas regiões, como a América do Norte, Ásia, Europa e América do Sul, bem como realizou a comparação entre estas (Kercher et al., 2019). No ano de 2017 Espanha começou a publicar anualmente as tendências do fitness no seu país (Veiga, Valcarce-Torrente, & King, 2017). Em 2020 foram acrescentados e comparados os resultados de estudos realizados em outros países, nomeadamente das tendências obtidas na Austrália, Brasil, China, Europa, México, Espanha e Estados Unidos da América (Kercher et al., 2021), para além do estudo habitual acerca das tendências do ACSM (Thompson, 2021). Todos os estudos anteriores foram realizados com base em uma amostra constituída por profissionais de fitness, profissionais de saúde relacionados com o exercício, gestores e estudantes do setor. No ano de 2021 foi publicado, em Portugal, o primeiro estudo acerca das tendências do fitness para 2021 (Franco et al., 2021) tendo por base o mesmo tipo de amostra de profissionais dos estudos mundiais, mas também acrescentando a perspetiva dos praticantes, ainda que com uma amostra mais reduzida. Os resultados foram confrontados com os obtidos a nível europeu e mundial, tendo sido realizadas comparações, nomeadamente entre profissionais e praticantes, e nos profissionais entre género, exercer ou não funções e entre o título profissional de técnico de exercício físico (TEF), diretor técnico (DT) ou não possuir título (como no caso dos estudantes e profissionais de saúde relacionados com o exercício). Das 42, as principais tendências do fitness em Portugal para 2021 foram, por ordem decrescente, licenças (títulos) para profissionais de fitness, empregar profissionais de fitness certificados, exercício para perda de peso, estilo de vida saudável e mudança comportamental, atividades outdoor e treino com o peso corporal. Portugal, nas tendências para 2021, foi mais ao encontro das tendências europeias do que das mundiais. O mesmo estudo evidenciou que estas tendências apresentaram algumas diferenças em função da amostra ser de profissionais ou praticantes (4 diferenças significativas), dos profissionais serem de diferentes géneros (20 diferenças), exercerem ou não funções (7 diferenças) e terem título de TEF, DT ou sem título (9 diferenças).

O conhecimento acerca das tendências na área do fitness pretende contribuir para que esta indústria tome decisões no sentido do seu crescimento e desenvolvimento futuro, de modo a serem tomadas decisões com base na ciência e não em estratégias comerciais ou publicidade dos *media* (Thompson, 2021), levando a que a dinâmica destas tendências possa criar impacto social a longo prazo, nomeadamente nas atitudes, valores e comportamentos da sociedade (ClubIntel, 2018).

O presente estudo pretende, deste modo, identificar as tendências do fitness para 2022 em Portugal, na mesma perspetiva que o ACSM, ou seja, recolhendo a opinião do mesmo tipo de amostra (profissionais/estudantes). Pretende-se também caracterizar e comparar as tendências do fitness para 2022 com os resultados obtidos no estudo das tendências do fitness para 2021 em Portugal, dos mesmos autores (Franco et al., 2021). Objetiva-se ainda caracterizar e comparar as tendências em função entre géneros, exercer ou não funções e título profissional de TEF, DT ou Sem Título, tal como recomendado no estudo de Franco et al. (2021).

MÉTODO

Para a concretização dos objetivos foi realizado um estudo transversal com a utilização de um questionário online para a recolha de dados, com base no do ACSM.

Amostra

Participaram neste estudo 758 profissionais de fitness e profissionais da saúde relacionados com o exercício bem como estudantes do setor do fitness/educação física/desporto (Tabela 1) com características semelhantes à amostra utilizada nos estudos do ACSM (Thompson, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2021). A média e o desvio padrão da idade dos respondentes foi de 35,2± 9,6 anos, com um equilíbrio entre o género feminino (48,5%) e o masculino (48,9%). A maioria (60,2%) exerce funções enquanto profissional de fitness e é TEF (43%). Os elementos da amostra foram informados do anonimato e confidencialidade dos dados obtidos, tendo o estudo a aprovação do comitê de ética da Escola Superior de Desporto de Rio Maior, Instituto Politécnico de Santarém.

Instrumentos

Relativamente ao instrumento primeiramente foi verificado se existiam algumas alterações nas tendências identificadas pelo questionário do ACSM relativamente às do ano anterior, facto que não se verificou. Seguidamente foi verificado se para além destas fazia sentido incluir outras tendências no questionário, tal como realizado em Espanha (Veiga et al., 2021) e no estudo de Portugal para 2021 (Franco et al., 2021). Para tal foram consultados 6 especialistas na área do fitness em Portugal, com domínio da língua inglesa e portuguesa, os quais, à semelhança do ano anterior, concordaram em introduzir a tendência *Crosstraining* (treino funcional das capacidades físicas, constantemente variado/alta intensidade, incluindo exercícios gímnicos, levantamento de pesos e arremessos, sendo o programa mais conhecido o *Crossfit*®).

Tabela 1. Caracterização dos profissionais e estudantes do setor (*n*= 758).

Variáveis	
Género	(%)
Feminino	48.5
Masculino	48.9
Outro	0.1
Não respondeu	2.4
Exerce funções enquanto PF	(%)
Sim	60.2
Não	23.7
Não se aplica	12.4
Não respondeu	3.7
Título enquanto profissional	(%)
TEF	43.0
DT	23.4
Sem título	31.3
Não respondeu	2.3
Idade	(Anos)
Média± Desvio Padrão	35.2± 9.6

Procedimentos

O questionário foi colocado na plataforma online *SurveyMonkey*, ao qual os respondentes tinham acesso através de um link, sendo que os dados foram recolhidos entre abril e junho de 2021. Para além das tendências o questionário possuía também questões relacionadas com a caracterização sociodemográfica dos sujeitos, bem como relativas à sua intervenção no setor do fitness. Para a divulgação do questionário dos profissionais foram contactadas universidades/politécnicos em Portugal com formação na área das ciências do desporto, exercício e saúde, condição física e saúde e similares, escolas de formação do ensino técnico do fitness em Portugal (que possuíssem cursos de especialização tecnológica (CET) de TEF), bem como associações do setor do fitness em Portugal, nomeadamente a Associação de Ginásios e Academias de Portugal (AGAP/Portugal Ativo), a Associação Portuguesa dos Fisiologistas do Exercício (APFE), a Associação Portuguesa de Técnicos de Exercício Físico (APTEF) e a União Portuguesa dos Diretores e Técnicos de Exercício Físico (UPDTEF), bem como foi realizada a divulgação do estudo nas redes sociais.

Análise estatística

Para caracterizar as tendências do fitness em Portugal para 2022 foi realizada a estatística descritiva de todas as tendências, nomeadamente a média (M) e o desvio padrão (DP). Nas comparações com dois grupos (género masculino e feminino; exercer ou não funções enquanto profissional de fitness; tendências 2021 e tendências 2022) foi utilizado o teste t, e nas comparações com três grupos de profissionais/estudantes (TEF, DT e sem título) foi utilizada a técnica estatística ANOVA complementada com um teste *post hoc* de Tukey (se as variâncias fossem homogéneas de acordo com o teste de Levene) ou um teste *post hoc* Games-Howell (se as variâncias não assumissem homogeneidade) (Ho, 2014; Pestana & Gageiro, 2014). Foram reportados também os tamanhos dos efeitos (*Effect Sizes*) através do *d* de Cohen para todas as diferenças significativas, como sugerido por Espírito-Santo e Daniel (2018). Os valores de

corte assumidos para a análise dos tamanhos do efeito foram: ≥ 0,20 e < 0,5 pequeno; ≥ 0,50 e < 0,8 médio; ≥ 0,80 e < 1,2 grande; ≥ 1,20 muito grande (Ellis, 2010).

RESULTADOS

Os principais resultados estão representados na Figura 1, relativamente às 20 principais tendências do fitness para 2022 em Portugal. As primeiras 5 tendências identificadas são, por ordem decrescente, "Licenças (títulos) para PF", "Empregar PF certificados", "PT", "Exercício para perda de peso" e Estilo de vida saudável e mudança comportamental".

Seguidamente verificou-se se as 20 principais tendências do fitness para Portugal em 2022 eram semelhantes, de acordo com a ordem, em relação às identificadas em 2021 (Tabela 2). As primeiras 5 tendências ocupam exatamente a mesma posição nos 2 anos expostos. Da 6.ª à 10.ª posição as tendências são as mesmas, existindo apenas ligeiras diferenças no lugar que ocupam. Da 11.ª à 20.ª as tendências identificadas nos 2 anos são similares, identificando-se alteração de lugar nas seguintes: a tendência "Treino Online" identificada na 15.ª posição em 2021 não está nas 20 primeiras de 2022 e as tendências "Tecnologia *Wearable*", que ocupa a 11.ª posição em 2022 e "Movimento Corpo & Mente", que ocupa a 20.ª posição em 2022, não fizeram parte das 20 maiores tendências de 2021. Após caracterizadas, foram comparadas as tendências 2022 e 2021, sendo que existem diferenças significativas em 17 das 42 tendências. No entanto, quando analisados os tamanhos do efeito das tendências onde existiram diferenças significativas pode verificar-se que apenas 3 são pequenos e dois médios, nomeadamente "Exercício para a perda de peso", com média superior em 2022, e "Medição de Resultados", com média superior em 2021.

Figura 1. Tendências do fitness para 2022 em Portugal segundo os profissionais/estudantes do setor.

Em relação às respostas do género masculino e feminino (Tabela 3) verifica-se que existem diferenças significativas na maioria das tendências, nomeadamente em 25 das 42 tendências, apesar de 17 dos tamanhos do efeito serem pequenos, com a exceção da tendência "Pilates", com média superior no género feminino, em que o efeito é médio.

Efetuada a caracterização, quando se comparou quem estava a exercer funções enquanto PF (TEFs e DTs a exercer funções) e quem não estava a exercer funções enquanto PF (TEFs e DTs que naquele momento não estavam a exercer funções, estudantes, profissionais de saúde relacionados com o exercício, gestores e coordenadores que não estivessem a exercer funções), verificou-se que existem diferenças significativas em 14 das 42 tendências (Tabela 4). No entanto, quando classificados os tamanhos do efeito, nas tendências onde existem diferenças significativas, pode verificar-se que existem em 8, mas são classificados como pequenos.

A Tabela 5 diz respeito à caracterização e comparação dos PF que possuíam o título de DT, TEF e Sem Título (estudantes, gestores/coordenadores sem título, profissionais de saúde ligados ao exercício), na qual se verifica que existem diferenças significativas em 16 das 42 tendências, sendo que quando analisados os tamanhos do efeito, nas tendências onde existiram diferenças significativas, pode verificar-se que existem 14 pequenos.

DISCUSSÃO

Este estudo pretende contribuir para que exista mais conhecimento acerca do setor do fitness em Portugal, nomeadamente através da identificação das tendências para esta indústria no próximo ano de 2022, de modo que a indústria tome decisões no sentido do seu crescimento e desenvolvimento futuro, (Thompson, 2021), levando a que a dinâmica destas tendências possa criar impacto social a longo prazo, nomeadamente nas atitudes, valores e comportamentos da sociedade (ClubIntel, 2018).

As duas principais tendências para 2022 são, exatamente como no ano anterior (Franco et al., 2021), "Licenças (títulos)

Tabela 2. Tendências do fitness para 2022 e 2021, em Portugal, dos profissionais/estudantes do setor do fitness e saúde.

Lugar	Tendências do Fitness em Portugal 2022 (Presente Estudo)	Tendências do Fitness em Portugal 2021 (Franco et al., 2021)
1	Licenças (títulos) para PF	Licenças (títulos) para PF
2	Empregar PF certificados	Empregar PF certificados
3	PT	PT
4	Exercício para perda de peso	Exercício para perda de peso
5	Estilo de vida saudável e mudança comportamental	Estilo de vida saudável e mudança comportamental
6	Treino de saúde/bem-estar	Atividades *outdoor*
7	Atividades *outdoor*	Treino com o peso corporal
8	Treino funcional	Treino de saúde/bem-estar
9	Treino com o peso corporal	Treino funcional
10	PT para pequenos grupos	Tecnologia *wearable*
11	Tecnologia *wearable*	PT para pequenos grupos
12	HIIT	HIIT
13	Exercício para idosos	Treino de força com pesos livres
14	Treino de força com pesos livres	Exercício como medicina
15	Exercício como medicina	Treino *online*
16	Medição de resultados	Exercício para idosos
17	Treino em circuito	Medição de resultados
18	Treino do Core	Treino em circuito
19	Integração clínica com medicina desportiva/fitness	Integração clínica com medicina desportiva/fitness
20	Movimento Corpo&Mente	Treino do *core*

PF: Profissionais de fitness; PT: Treino personalizado; HIIT: Treino intervalado de alta intensidade.

para profissionais de fitness" e "Empregar profissionais certificados" (Tabela 2). A prestação de um serviço por profissionais qualificados e a sua contratação assume-se, desta forma, novamente preponderante para os inquiridos. Também no estudo mundial do ACSM estas são tendências relevantes em todos os anos em que foi realizado o estudo, sendo que de 2008 a 2013 foram a tendência que ocupava o 1.º lugar, de 2014 a 2018 fizeram parte do top 10 e desde então fazem parte das primeiras 20 tendências, ocupando o 6.º lugar a tendência "Empregar Profissionais de Fitness certificados" e o 18.º lugar a tendência "Licenças (títulos) para PF" (Thompson, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2021), ainda que tenham vindo a descer no ranking nos últimos anos. Vários estudos referem também que a formação é essencial para a prestação de um bom serviço ao cliente, o que também pode justificar a importância que lhe é atribuída (Antunes, 2003; Lloyd, 2008; Stacey, Hopkins, Adamo, Shorr, & Prud'homme, 2010; Ramos, Oliveira, Carvalhinho, & Franco, 2015). Por outro lado, também a legislação portuguesa (Lei n.º 39/2012, de 28 de agosto — Portugal, 2012), que obriga à existência de título para intervir como profissional de fitness, pode levar a uma valorização destas duas tendências no top.

O "Treino personalizado" (PT) surge como a 3.ª tendência identificada para 2022, sendo que num estudo de caracterização dos profissionais de fitness em Portugal (Ramos et al., 2021) esta foi a 2.ª função mais realizada pelos TEFs e DTs no âmbito da sua atuação enquanto profissional de fitness, o que pode justificar ser considerada uma tendência importante para o setor. Também o Barómetro do Fitness em Portugal (AGAP, 2021) referiu que, a seguir às mensalidades, o PT representou a 2.ª fonte de receitas dos ginásios/*health clubs*, sendo que para além dos ginásios e *health clubs* (79%) que geralmente têm o serviço de PT, em termos de tipologia de ginásio 8% são estúdios específicos de PT, aspetos que reforçam ainda mais a sua importância para o mercado. A 10.ª tendência identificada, nomeadamente "PT para pequenos grupos", assume também um lugar de destaque e pensa-se que pelas mesmas razões já referidas. As tendências "Exercício para a perda de peso", "Estilo de vida saudável e mudança comportamental" e "Treino de saúde e bem-estar" ocuparam o 4.º, 5.º e 6.º lugares, respetivamente. Considerando que Portugal possuía, no ano de 2019, mais de metade da população adulta com obesidade (INE, 2019), e sendo uma preocupação mundial, reconhecida pela Organização Mundial de Saúde (Organização Mundial

Tabela 3. Tendências do fitness para 2022 e 2021, em Portugal, dos profissionais/estudantes do setor do fitness e saúde: caracterização e comparação.

	Tendências Profissionais/ Estudantes 2021 (n= 300) M± DP	Tendências Profissionais/ Estudantes 2022 (n= 758) M± DP	*Test T*	*Effect Sizes*
Acompanhamento de treino *online*	7.56± 2.03	7.00± 2.18	.000*	.26
Aparelhos de mobilidade/miofasciais	6.53± 2.28	6.79± 2.21	.079	
Aplicações de exercício para *smartphones*	7.22± 2.35	6.85± 2.28	.016*	.16
Atividades *outdoor*	8.10± 1.84	8.20± 1.68	.411	
Aulas de treino militar (*boot camp*)	6.08± 2.32	6.02± 2.28	.704	
Aulas de grupo	7.27± 2.27	7.29± 2.11	.887	
Aulas pós-reabilitação	6.83± 2.31	7.26± 2.18	.005*	.19
Boxe, *kickboxing*, ou atividades relacionadas c/ artes marciais	5.83± 2.34	6.09± 2.22	.092	
Clubes de caminhadas/corrida/ciclismo	6.64± 2.24	7.06± 2.12	.004*	.19
Crosstraining	7.11± 2.04	7.25± 1.97	.292	
Desenvolvimento da juventude a longo prazo (desenvolvimento atlético)	7.01± 2.20	7.24± 2.11	.122	
Empregar profissionais de fitness certificados	8.59± 2.05	8.74± 1.82	.290	
Estilo de vida saudável e mudança comportamental	8.14± 1.82	8.39± 1.68	.035*	.14
Exercícios baseados na dança	5.79± 2.39	5.94± 2.20	.362	
Exercício como medicina	7.65± 2.14	7.76± 2.08	.457	
Exercício para crianças	7.15± 2.25	7.35± 2.10	.171	
Exercício para perda de peso	7.45± 2.11	8.44± 1.54	.034*	.54
Fitness pré e pós-parto	8.18± 1.82	7.41± 2.06	.001*	.40
Ginásios tipo *boutique*	6.95± 2.10	6.62± 2.47	.001*	.14
Ginásios/*health clubs low cost* (baixo custo)	6.04± 2.47	6.94± 2.28	.086	
Hidroginástica	6.67± 2.40	6.31± 2.42	.002*	.15
Integração clínica com medicina desportiva/fitness	5.80± 2.52	7.55± 2.09	.116	
Licenças (títulos) para profissionais de fitness	7.33± 2.07	8.76± 1.81	.748	
Medição de resultados	8.72± 1.84	7.74± 1.91	.024*	.52
Movimento corpo e mente (*body&mind*)	7.42± 2.13	7.54± 2.02	.003*	.06
Pilates	7.12± 2.20	7.42± 2.04	.043*	.14
Programas de exercício para idosos	7.14± 2.21	7.85± 1.91	.003*	.34
Programas de incentivo ao trabalhador	6.71± 2.25	6.88± 2.40	.298	
Promoção da Saúde no Local de Trabalho	6.88± 2.21	7.00± 2.44	.442	
Tecnologia *wearable*	7.85± 1.99	7.93± 1.98	.526	
Treino com electroestimulação	5.15± 2.39	5.41± 2.42	.119	
Treino com o peso corporal	8.08± 1.84	8.06± 1.78	.900	
Treino de força com pesos livres	7.72± 1.91	7.79± 1.79	.576	
Treino de saúde/bem-estar	7.99± 1.87	8.30± 1.66	.008*	.18
Treino do *core*	7.27± 2.07	7.59± 1.91	.016*	.16
Treino em circuito	7.37± 1.98	7.67± 1.81	.018*	.16
Treino funcional	7.90± 1.92	8.10± 1.72	.101	
Treino intervalado de alta intensidade (HIIT)	7.74± 2.02	7.88± 1.78	.310	
Treino personalizado (PT)	8.58± 1.54	8.47± 1.67	.329	
Treino personalizado para pequenos grupos (*small group* PT)	7.79± 1.91	7.95± 1.89	.207	
Treino Virtual	6.83± 2.49	6.68± 2.27	.362	
Yoga	6.48± 2.47	6.82± 2.23	.027*	.14

*p≤ 0.05; M: média; DP: desvio padrão.

Tabela 4. Tendências do fitness para 2022, em Portugal, no género feminino e masculino: caracterização e comparação.

	Género Feminino (n= 368) M± DP	Género Masculino (n= 371) M± DP	*Teste-T*	*Effect-Sizes*
Acompanhamento de treino *online*	7.41± 1.95	6.61± 2.33	.000*	.37
Aparelhos de mobilidade/miofasciais	7.08± 2.18	6.51± 2.25	.000*	.26
Aplicações de exercício para *smartphones*	7.02± 2.23	6.69± 2.31	.049*	.15
Atividades *outdoor*	8.35± 1.68	8.03± 1.69	.010*	.19
Aulas de treino militar (*boot camp*)	5.98± 2.30	6.08± 2.32	.525	
Aulas de grupo	7.44± 2.15	7.15± 2.07	.063	
Aulas pós-reabilitação	7.40± 2.15	7.16± 2.20	.134	
Boxe, *kickboxing*, ou atividades relacionadas com artes marciais	6.14± 2.29	6.04± 2.19	.551	
Clubes de caminhadas/corrida/ciclismo	7.13± 2.24	6.99± 1.99	.395	
Crosstraining	7.24± 2.09	7.24± 1.87	.989	
Desenvolvimento da juventude a longo prazo (desenvolvimento atlético)	7.19± 2.05	7.22± 2.09	.087	
Empregar profissionais de fitness certificados	8.83± 1.85	8.66± 1.77	.207	
Estilo de vida saudável e mudança comportamental	8.57± 1.60	8.22± 1.73	.004*	.21
Exercícios baseados na dança	6.31± 2.27	5.55± 2.08	.000*	.35
Exercício como medicina	7.85± 2.11	7.66± 2.07	.229	
Exercício para crianças	7.60± 2.07	7.14± 2.10	.003*	.22
Exercício para idosos	8.08± 1.85	7.61± 1.93	.001*	.25
Exercício para perda de peso	8.46± 1.61	8.44± 1.46	.861	
Fitness pré e pós-parto	7.80± 1.95	7.04± 2.10	.000*	.38
Ginásios tipo *boutique*	6.77± 2.45	6.47± 2.48	.095	
Ginásios/*health clubs low cost* (baixo custo)	7.13± 2.27	6.76± 2.32	.028	
Hidroginástica	6.62± 2.50	6.00± 2.33	.001*	.26
Integração clínica com medicina desportiva/fitness	7.73± 2.03	7.37± 2.13	.020*	.17
Licenças (títulos) para profissionais de fitness	8.89± 1.69	8.63± 1.93	.054	
Medição de resultados	7.91± 1.94	7.55± 1.89	.011*	.19
Movimento corpo e mente (*body&mind*)	8.01± 1.92	7.08± 2.01	.000*	.47
Pilates	7.93± 1.90	6.88± 2.04	.000*	.53
Programas de incentivo ao trabalhador	7.13± 2.43	6.63± 2.36	.005*	.21
Programas de saúde e bem-estar no local de trabalho	7.27± 2.47	6.74± 2.39	.003*	.22
Tecnologia *wearable*	8.15± 1.94	7.74± 1.99	.005*	.21
Treino com electroestimulação	5.84± 2.33	4.95± 2.42	.000*	.37
Treino com o peso corporal	8.17± 1.86	7.96± 1.72	.118	
Treino de força com pesos livres	7.80± 1.89	7.81± 1.69	.941	
Treino de saúde/bem-estar	8.50± 1.66	8.13± 1.64	.002*	.22
Treino do *core*	7.79± 1.88	7.37± 1.94	.003*	.22
Treino em circuito	7.80± 1.82	7.54± 1.80	.047*	.14
Treino funcional	8.26± 1.72	7.95± 1.72	.015*	.18
Treino intervalado de alta intensidade (HIIT)	7.91± 1.83	7.84± 1.75	.598	
Treino personalizado (PT)	8.56± 1.68	8.40± 1.65	.196	
Treino personalizado para pequenos grupos (*small group* PT)	8.16± 1.84	7.80± 1.87	.009*	.19
Treino virtual (*virtual training*)	7.05± 2.16	6.31± 2.33	.000*	.33
Yoga	7.31± 2.18	6.31± 2.20	.000*	.46

*p≤ 0.05; M: média; DP: desvio padrão.

Tabela 5. Tendências do fitness para 2022, em Portugal, de quem estava e de quem não estava a exercer funções enquanto PF: caracterização e comparação.

	Exerce funções enquanto PF (n= 456) M± DP	Não exerce funções enquanto PF (n= 274) M± DP	Teste-T	Effect Sizes
Acompanhamento de treino *online*	7.00± 2.16	7.04± 2.22	.827	
Aparelhos de mobilidade/miofasciais	6.61± 2.17	7.14± 2.27	.002*	.24
Aplicações de exercício para *smartphones*	6.77± 2.30	6.99± 2.27	.211	
Atividades *outdoor*	8.04± 1.72	8.48± 1.55	.001*	.27
Aulas de treino militar (*boot camp*)	5.85± 2.12	6.33± 2.54	.009*	.21
Aulas de grupo	7.26± 2.06	7.39± 2.15	.431	
Aulas pós-reabilitação	7.27± 2.09	7.29± 2.34	.924	
Boxe, *kickboxing*, ou atividades relacionadas c/ artes marciais	5.95± 2.09	6.30± 2.43	.046*	.15
Clubes de caminhadas/corrida/ciclismo	7.01± 2.03	7.15± 2.26	.425	
Crosstraining	7.20± 1.78	7.35± 2.26	.350	
Desenvolvimento da juventude a longo prazo (desen. atlético)	7.14± 2.05	7.42± 2.24	.092	
Empregar profissionais de fitness certificados	8.82± 1.79	8.65± 1.83	.201	
Estilo de vida saudável e mudança comportamental	8.39± 1.63	8.41± 1.75	.890	
Exercícios baseados na dança	5.77± 2.03	6.21± 2.42	.009*	0,20
Exercício como medicina	7.79± 2.07	7.74± 2.12	.743	
Exercício para crianças	7.22± 2.06	7.62± 2.14	.012*	0,19
Exercício para idosos	7.79± 1.84	7.95± 2.00	.263	
Exercício para perda de peso	8.38± 1.54	8.58± 1.52	.086	
Fitness pré e pós-parto	7.44± 1.95	7.45± 2.21	.956	
Ginásios tipo *boutique*	6.89± 2.37	6.17± 2.56	.000*	.29
Ginásios/*health clubs low cost* (baixo custo)	6.77± 2.25	7.24± 2.33	.007*	.21
Hidroginástica	6.17± 2.39	6.56± 2.46	.035*	.16
Integração clínica com medicina desportiva/fitness	7.58± 2.08	7.54± 2.06	.789	
Licenças (títulos) para profissionais de fitness	8.84± 1.68	8.66± 1.99	.222	
Medição de resultados	7.66± 1.94	7.91± 1.85	.083	
Movimento corpo e mente (*body&mind*)	7.49± 1.94	7.69± 2.05	.191	
Pilates	7.47± 1.93	7.34± 2.17	.387	
Programas de incentivo ao trabalhador	6.70± 2.32	7.23± 2.48	.004*	.22
Programas de saúde e bem-estar no local de trabalho	6.87± 2.40	7.28± 2.49	.028*	.17
Tecnologia *wearable*	7.96± 1.88	7.95± 2.09	.981	
Treino com electroestimulação	5.22± 2.38	5.67± 2.44	.016*	.19
Treino com o peso corporal	8.07± 1.84	8.10± 1.85	.822	
Treino de força com pesos livres	7.74± 1.66	7.94± 1.96	.152	
Treino de saúde/bem-estar	8.38± 1.53	8.24± 1.80	.286	
Treino do *core*	7.54± 1.87	7.66± 1.97	.392	
Treino em circuito	7.57± 1.72	7.86± 1.93	.040*	.16
Treino funcional	8.09± 1.64	8.18± 1.80	.477	
Treino intervalado de alta intensidade (HIIT)	7.85± 1.67	7.95± 1.94	.467	
Treino personalizado (PT)	8.66± 1.46	8.21± 1.89	.001*	.27
Treino personalizado para pequenos grupos (*small group* PT)	8.07± 1.77	7.85± 1.99	.129	
Treino virtual (*virtual training*)	6.58± 2.21	6.85± 2.34	.114	
Yoga	6.70± 2.14	7.01± 2.36	.075	

*p≤ 0.05; M: média; DP: desvio padrão.

da Saúde, 2018), a alteração comportamental para um estilo de vida mais ativo, parece natural que os profissionais de fitness considerem estas como tendências fortes para o próximo ano. As "Atividades outdoor" surgem como a 7.ª tendência identificada pelos profissionais, as quais passaram a aparecer no top 10 das tendências mundiais para o fitness a partir de 2021 (Thompson, 2021). Estas atividades tenderam a crescer devido à pandemia provocada pela doença COVID-19, em 2020 e 2021, uma vez que era mais seguro treinar no exterior, o que pode ser confirmado no barómetro da AGAP, onde é referido que 63% dos clubes possuem aulas Outdoor (AGAP, 2021). O "Treino funcional" surge como 8.ª tendência e também no barómetro da AGAP esta ocupa um lugar de destaque já que 92% dos ginásios/*health cbubs* afirma que oferece este tipo de serviço. A 9.ª tendência, designadamente "Treino com o peso corporal", tem também estado no top 10 a nível mundial desde 2013 (Thompson, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2021). O facto de o treino com o peso do corpo não ter material associado, facilitando o uso nos treinos em casa, outdoor ou online, e de não haver necessidade de desinfeção, pode ter potenciado ainda mais o seu crescimento.

Quando confrontadas as tendências do fitness para Portugal em 2022 com as de Espanha em 2021 (Veiga, Valcarce-Torrente, & Cámara, 2021), Europa em 2021 (Kercher et al., 2021) e com as últimas tendências mundiais publicadas pelo ACSM (Thompson, 2021), verifica-se que, do top10, 6 das tendências para Portugal são semelhantes às de Espanha, 8 são semelhantes às europeias, mas apenas 3 são semelhantes às mundiais. Parece que Portugal tende a assemelhar-se mais ao nosso país vizinho Espanha ou à Europa em geral, comparativamente à diversidade mundial. Esta diferenciação encontrada entre as tendências para o fitness em Portugal e a nível mundial vem reforçar este recente movimento dos países fazerem o levantamento das suas tendências nacionais (Kercher et al., 2021; Veiga, Romero-Caballero, Valcarce-Torrente, Kercher, & Thompson, 2022).

Verificou-se e explicou-se anteriormente que o lugar atribuído às tendências do fitness para 2021 e 2022 era semelhante, mas tal facto não quer dizer que não haja diferenças entre os valores médios das tendências em 2021 e em 2022. Desta forma procedeu-se à comparação das tendências destes dois anos (Tabela 3) sendo que existiram diferenças significativas em 17 das 42 tendências. Apesar de existirem diferenças significativas em bastantes tendências quando analisados os tamanhos do efeito (*effect sizes*), das mesmas pode verificar-se que só existem três pequenos (≥ 0,2 e < 0,5), e dois médios, nomeadamente "Exercício para a perda de peso", que subiu de uma média de 7,45 em 2021 para 8,44 em 2022 e "Medição de Resultados", que decresceu de 8,72 em 2021 para 7,74 em 2022. O aumento do valor atribuído à tendência "Exercício para a perda de peso" pode estar atribuído a alguns efeitos que a pandemia provocou, sendo que alguns estudos relatam que existiu aumento de peso neste período (Pellegrini et al., 2020; Cazal et al., 2021). Não obstante algumas diferenças encontradas entre as tendências para o fitness em Portugal entre 2021 e 2022, considerando os tamanhos dos efeitos nas diferenças encontradas, poder-se-á afirmar que parece existir alguma consistência nas tendências entre os dois anos.

O género pode ser importante para a escolha da atividade/exercício a ser praticado (TNS Opinion & Social, 2018), pelo que se procedeu à caracterização e comparação das tendências para 2022 segundo esta variável. Verificou-se que existiam diferenças significativas em 25 das 42 tendências, apesar de em 17 os tamanhos do efeito (serem todos pequenos, e apenas na tendência "Pilates" o efeito ser médio, atividades em que as mulheres apresentam um valor médio muito mais elevado do que os homens. Esta diferença pode estar relacionada com o facto de que existem muito mais mulheres a praticar aulas de grupo em geral, onde a modalidade de Pilates se incluí (Shiraishi, 2013; Freitas, Separowic, Maltese, Passarelli, & Lopes, 2019). Realça-se que em todos os valores com diferenças significativas as mulheres atribuíram sempre valores mais elevados do que os homens.

Como da amostra deste estudo fazem parte, à semelhança do que faz o ACSM, profissionais de fitness (independentemente de estarem ou não no ativo, desde que possuíssem título de TEF ou de DT), estudantes da área, coordenadores, gestores e profissionais de saúde relacionados com o exercício, pretendeu-se caracterizar e comparar quem de facto exercia naquele momento funções enquanto profissional de fitness/gestor/coordenador e quem não exercia (Tabela 5). Comparados estes grupos surgem diferenças em 16 das 42 tendências, apesar de apenas em oito se identificar um efeito maior do que 0,2 e este ser sempre pequeno. No estudo acerca das tendências do fitness para 2021 em Portugal (Franco et al., 2021) quando se comparou estes dois grupos existiram diferenças significativas apenas em 7. Realça-se que os valores médios atribuídos pelos profissionais de fitness que não exercem funções foram, à semelhança do estudo do ano anterior (Franco et al., 2021) e em todas as tendências com diferenças significativas, com exceção do "Treino Personalizado", superiores aos valores atribuídos pelos profissionais de fitness que exerciam funções, o que revela perceções diferentes de quem está ou não está no ativo profissionalmente.

Por último, efetuou-se a caracterização e comparação dos profissionais que possuíam o título de TEF, DT ou Sem Título (estudantes/profissionais de saúde relacionados com o exercício/gestores sem título). Existiram diferenças significativas em 16 das 42 tendências (Tabela 6), sendo que quando

Tabela 6. Tendências do fitness para 2022, para Portugal, nos vários títulos profissionais (TEF, DT e sem título): caracterização e comparação.

	DT M± DP	TEF M± DP	Sem Título M± DP	*ANOVA*	*Effect Sizes*
Acompanhamento de treino *online*	7.01± 2.09	7.00± 2.17	7.02± 2.27	.991	
Aparelhos de mobilidade/miofasciais	6.27± 2.08	6.83± 2.18	7.17± 2.31	.000*[1,3]	0,41
Aplicações de exercício para *smartphones*	6.73± 2.34	6.78± 2.20	7.00± 2.31	.406	
Atividades *outdoor*	8.06± 1.62	8.20± 1.68	8.30± 1.70	.368	
Aulas de treino militar (*boot camp*)	5.85± 2.01	6.04± 2.18	6.12± 2.62	.496	
Aulas de grupo	6.95± 1.92	7.32± 2.06	7.54± 2.23	.017*[3]	0,28
Aulas pós-reabilitação	7.15± 1.98	7.32± 2.09	7.29± 2.44	.696	
Boxe, *kickboxing*, ou atividades relac. c/ artes marciais	5.66± 2.06	6.13± 2.08	6.30± 2.48	.013*[2,3]	0,08
Clubes de caminhadas/corrida/ciclismo	6.91± 2.07	7.06± 1.97	7.14± 2.34	.544	
Crosstraining	7.10± 1.79	7.28± 1.75	7.31± 2.35	.523	
Desenvolvimento da juventude a longo prazo (atlético)	6.93± 2.11	7.21± 2.02	7.49± 2.24	.03*[3]	0,27
Empregar profissionais de fitness certificados	8.76± 1.83	8.78± 1.76	8.72± 1.86	.931	
Estilo de vida saudável e mudança comportamental	8.32± 1.82	8.42± 1.51	8.43± 1.77	.774	
Exercícios baseados na dança	5.46± 1.86	5.99± 2.09	6.21± 2.50	.002*[1,3]	0,34
Exercício como medicina	7.71± 2.00	7.86± 2.02	7.66± 2.23	.489	
Exercício para crianças	7.23± 2.03	7.33± 2.08	7.52± 2.18	.343	
Exercício para idosos	7.71± 1.85	7.90± 1.82	7.86± 2.05	.549	
Exercício para perda de peso	8.36± 1.50	8.39± 1.54	8.57± 1.55	.299	
Fitness pré e pós-parto	7.20± 2.04	7.53± 1.93	7.49± 2.19	.200	
Ginásios tipo *boutique*	6.93± 2.39	6.74± 2.42	6.19± 2.53	.005*[2,3]	0,30
Ginásios/*health clubs low cost* (baixo custo)	6.69± 2.32	6.75± 2.23	7.39± 2.28	.001*[2,3]	0,31
Hidroginástica	5.98± 2.34	6.37± 2.36	6.48± 2.56	.096	
Integração clínica com medicina desportiva/fitness	7.60± 2.05	7.61± 2.05	7.43± 2.12	.559	
Licenças (títulos) para profissionais de fitness	9.07± 1.38	8.73± 1.81	8.62± 2.04	.037*[3]	0,19
Medição de resultados	7.57± 1.84	7.64± 1.91	8.03± 1.92	.021*[2,3]	0,24
Movimento corpo e mente (*body&mind*)	7.31± 2.03	7.62± 1.88	7.65± 2.08	.167	
Pilates	7.18± 1.99	7.64± 1.88	7.29± 2.21	.026[1]	0,23
Programas de incentivo ao trabalhador	6.58± 2.35	6.86± 2.34	7.12± 2.47	.073	
Programas de saúde e bem-estar no local de trabalho	6.55± 2.48	7.04± 2.37	7.31± 2.45	.008*[3]	0,31
Tecnologia *wearable*	7.93± 1.82	7.93± 1.93	7.97± 2.12	.965	
Treino com electroestimulação	5.15± 2.14	5.29± 2.49	5.66± 2.46	.069	
Treino com o peso corporal	7.88± 1.84	8.14± 1.65	8.15± 1.88	.216	
Treino de força com pesos livres	7.51± 1.64	7.89± 1.67	7.91± 1.98	.042[1]	0,23
Treino de saúde/bem-estar	8.23± 1.58	8.43± 1.55	8.25± 1.80	.299	
Treino do *core*	7.15± 1.94	7.69± 1.85	7.73± 1.91	.003*[1,3]	0,31
Treino em circuito	7.41± 1.73	7.69± 1.74	7.87± 1.93	.036*[3]	0,23
Treino funcional	7.85± 1.77	8.15± 1.61	8.27± 1.77	.045*[3]	0,25
Treino intervalado de alta intensidade (HIIT)	7.88± 1.65	7.77± 1.73	8.03± 1.92	.248	
Treino personalizado (PT)	8.54± 1.50	8.60± 1.49	8.29± 1.92	.083	
Treino personalizado para pequenos grupos	8.10± 1.63	8.04± 1.77	7.82± 2.22	.243	
Treino virtual (*virtual training*)	6.54± 2.07	6.65± 2.30	6.83± 2.36	.408	
Yoga	6.39± 2.09	6.89± 2.13	7.02± 2.43	.012*[1,3]	0,28

*p≤ 0.05; M: média; DP: desvio padrão; [1]Diferenças entre DT e TEF; [2]Diferenças entre TEF e sem título; [3]Diferenças entre DT e sem título.

analisados os tamanhos do efeito das tendências onde existiram diferenças significativas pode verificar-se que existem 14 com um efeito pequeno. A maioria das diferenças significativas aconteceu entre os portadores do título de DT e os respondentes Sem Título, bem como entre os portadores do título de TEF e os respondentes Sem Título. No estudo de Franco et al. (2021), acerca das tendências do fitness para 2021 em Portugal, quando se comparou estes mesmos grupos existiram diferenças em 9 tendências, um valor mais baixo do que o obtido no presente estudo. Apesar disso a maioria das diferenças também era, como nos resultados que obtivemos no presente estudo, em relação aos portadores de título (TEF ou DT) com os profissionais que não possuíam título.

As limitações deste estudo prendem-se com o facto de a amostra ser aleatória e não representativa da população de profissionais/estudantes do setor. Com o presente estudo pretendeu aumentar-se o conhecimento acerca das tendências do fitness para 2022 em Portugal, sendo que esta informação poderá ser proveitosa para que as organizações e os profissionais de fitness possam ajustar a sua oferta. Num período de recuperação da pandemia causada pela doença COVID-19 as contribuições para o setor assumem ainda mais importância, sendo que se pretende realizar este estudo anualmente, tal como acontece com o estudo do ACSM nas tendências mundiais e em outros países nas tendências nacionais (Kercher et al., 2021; Veiga et al., 2022). Será também interessante continuar a confrontar os resultados obtidos das tendências do fitness em Portugal com as tendências mundiais, com as europeias e de alguns países em particular, como o caso de Espanha.

CONCLUSÕES

O presente estudo pretendeu caracterizar as tendências do fitness em Portugal para 2022, reproduzindo a metodologia do estudo das tendências do ACSM. Conclui-se que as principais tendências do fitness para 2022 em Portugal são, por ordem decrescente, "Licenças (títulos) para PF", "Empregar PF certificados", "PT", "Exercício para perda de peso" e Estilo de vida saudável e mudança comportamental". Este *top* 5 de tendências é exatamente o mesmo obtido no estudo acerca das tendências para 2021 em Portugal (Franco et al., 2021), o que revela consistência nos resultados obtidos. Quando comparadas as tendências do fitness entre 2021 e 2022 verificou-se que estas tendem a manter-se. Identificaram-se algumas diferenças significativas em termos de opinião dos PF acerca das tendências do fitness para Portugal em 2022 entre géneros, entre os profissionais que exerciam ou não funções e entre profissionais com título de TEF, DT ou sem título. Portugal tem as suas especificidades relativamente às tendências para o fitness, sendo que estas tendências se assemelham mais às da Europa do que às Mundiais, realçando a importância de se conhecer as tendências nacionais.

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ARTIGO DE REVISÃO

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Recomendações para a avaliação e prescrição de treino da força em indivíduos com dificuldade intelectual e desenvolvimental: revisão narrativa

Recommendations for the evaluation and prescription of strength training in individuals with intellectual difficulty and development: narrative review

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RESUMO

Existem diversos benefícios através da realização de programas de exercício físico (EF) em indivíduos com Dificuldade Intelectual e Desenvolvimental (DID), no entanto a literatura apresenta uma escassez na implementação e um reduzido número de estudos com metodologias e tipos de treino muito diversos. Intervenções de curto prazo, número reduzido de estudos longitudinais, lacunas metodológicas e métodos de treino inapropriados, dificultam conclusões mais explícitas e consensuais ao nível da prescrição e dos seus resultados. Contudo, os programas de EF, em particular, o treino da força (TF) que tem sido associado à diminuição do risco de aparecimento de doenças cardiovasculares e metabólicas, pode ser uma mais-valia para o indivíduo com DID, atendendo à prevalência de diversas comorbilidades, nomeadamente hipertensão, colesterol e diabetes tipo II. O presente estudo tem por objetivo identificar os aspetos fundamentais e estruturantes para a prescrição de TF, nomeadamente os métodos de avaliação, intensidade, duração, frequência, exercícios adequados e a sua relação com os resultados, através da metodologia com recurso à revisão narrativa, partindo da caracterização de vários programas de TF implementados em indivíduos com DID. Os resultados são apresentados sob a forma de recomendações para a avaliação e prescrição de programas de TF, na população com DID.
PALAVRAS-CHAVE: avaliação da força; dificuldade intelectual e desenvolvimental; programa de exercício físico; treino da força; saúde.

ABSTRACT

There are several benefits through the realization of physical exercise programs (EP) in individuals with Intellectual and Developmental Difficulties (DID), however, the literature presents a shortage in the implementation and a small number of studies with very different methodologies and types of training. Short-term interventions, a reduced number of longitudinal studies, methodological gaps and inappropriate training methods, hinder more explicit and consensual conclusions regarding the prescription and its results. However, EP programs, in particular strength training (ST), which has been associated with a reduced risk of cardiovascular and metabolic diseases, can be an asset for the individual with DID, given the prevalence of several comorbidities, namely hypertension, cholesterol and type II diabetes. The present study aims to identify the fundamental and structuring aspects for the prescription of ST, namely the assessment methods, intensity, duration, frequency, appropriate exercises and their relationship with the results, through the methodology using the narrative review, starting from the characterization of various ST programs implemented in individuals with DID. The results are presented in the form of recommendations for the evaluation and prescription of ST programs, in the population with DID.
KEYWORDS: strength assessment; intellectual and developmental difficulty; physical exercise program; strength training; health.

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INTRODUÇÃO

O treino da força (TF) objetiva provocar adaptações na musculatura esquelética através de sobrecargas, proporcionando um aumento na produção de força muscular e da atividade das enzimas glicolíticas, bem como da produção de adenosina trifosfato/fosfocreatina e adaptações no sistema nervoso, de forma a incrementar o recrutamento de unidades motoras (Nogueira et al., 2007; Pereira et al., 2012).

Todo este processo resulta em micro-lesões celulares principalmente na fase de ação excêntrica, ativando os sistemas de defesa como neutrófilos, macrófagos, citocinas e ainda, o que irá gerar espécies reativas de oxigénio e nitrogénio (Bloomer & Goldfarb, 2004). Estas micro-lesões são importantes para o processo de reparação e regeneração muscular, devido à fusão das células-satélite, com a célula principal, e à indução do metabolismo de síntese proteica e recuperação do tecido muscular (Hawke & Garry, 2001).

Na população aparentemente saudável têm sido reportados como benefícios do TF: a) aumento da força e hipertrofia muscular; b) aumento da densidade mineral e do conteúdo mineral ósseo; c) aumento da taxa de metabolismo basal; d) redução da gordura corporal visceral e apendicular; e) melhoria no metabolismo da glicose, prevenindo doenças como a diabetes tipo II e doenças cardiovasculares; f) melhoria do desempenho motor; g) menor risco de lesão músculo-esquelético; h) melhoria da capacidade de realização das atividades de vida diária (AVD); i) aumento dos níveis de autoestima (Savage et al., 2011; ACSM, 2017; Ruivo, 2018).

A dificuldade intelectual e desenvolvimental (DID) é caracterizada por um défice de funcionamento intelectual e adaptativo no domínio conceptual, social e prático. É identificada com os graus leve, moderado, grave e profundo, desenvolvendo-se antes dos 18 anos de idade (American Psychiatric Association, 2013). Indivíduos com DID obtêm os mesmos benefícios que a população em geral com a prática de EF, mantendo ou melhorando um ou mais aspetos das capacidades físicas (Janicas, 2014), como a ansiedade (Carraro & Gobbi, 2012), o sono (Janicas, 2014), o humor (Vogt, Schneider, Abeln, Anneken, & Strüder, 2012), a diminuição de comportamentos agressivos (Ogg-Groenendaal, Hermans, & Claessens, 2014) e, por conseguinte, os gastos com a saúde (Lante et al., 2014), promovendo a qualidade de vida (Lante et al., 2014; Pérez-Cruzado & Cuesta-Vargas, 2016) e a saúde no geral (Waterman et al., 2018).

Tendo em conta que a saúde é definida como um completo estado de bem-estar físico, mental e social e não somente a ausência de doença (World Health Organization, 1946), bem como um estado de harmonia entre o sujeito e a sua própria realidade (Segre & Ferraz, 1997), no que se refere especificamente aos indivíduos com DID, estes são maioritariamente sedentários e, por sua vez, os riscos para a sua saúde aumentam quando, comparados com a população em geral, nomeadamente na maior prevalência de hipertensão, da obesidade e síndrome metabólica (Brooker, van Dooren, McPherson, Lennox, & Ware, 2015; Foley, Lloyd, Turner, & Temple, 2017). Sabendo que a qualidade de vida é a perceção que um indivíduo tem sobre a sua posição 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 (WHOQOL Group, 1995), esta pode estar afetada com as comorbilidades associadas à DID descritas anteriormente.

O sedentarismo é um dos principais motivos para uma fraca aptidão física, nomeadamente para os níveis de força muscular serem bastante reduzidos quando comparados com população em geral (Golubović, Maksimović, Golubović, & Glumbić, 2012; Borji, Zghal, Zarrouk, Sahli, & Rebai, 2014; Borji et al., 2019), sendo o seu padrão de fadiga e recuperação neuromuscular díspar, pressupondo que menos força, menos fadiga e menos tempo para a recuperação muscular (Zafeiridis et al., 2010). Estes baixos níveis de força muscular poderão estar associados a uma falha do sistema nervoso central na ativação de unidades motoras e a algumas propriedades musculares intrínsecas anormais, nomeadamente atrofias (Borji et al., 2014). Contudo, podemos associar o sedentarismo à escassez de publicações na área, visando pontos como a caracterização da DID, desporto, desporto adaptado e atividade física.

Diretamente relacionada com o aumento da idade, a redução de massa muscular denominada como sarcopenia (Carmeli, Imam, & Merrick, 2012) está associada ao comprometimento da capacidade funcional e mobilidade (Bastiaanse, Hilgenkamp, Echteld, & Evenhuis, 2012), afetando de forma negativa o Índice de Massa Corporal (IMC), a taxa de metabolismo basal (Zafeiridis et al., 2010; Carmeli et al., 2012) e a capacidade de produção de força, que por sua vez está ligada à dependência física, quedas, hospitalizações, menor qualidade de vida e mesmo a morte (Willgoss, Yohannes, & Mitchell, 2010; Duchowny, Clarke, & Peterson, 2018). Para estes indivíduos, a força muscular tem sido considerada importante na análise da aptidão física, na sarcopenia e na osteopenia.

No contexto da avaliação da força muscular, o *American College of Sports Medicine* (2017) apresenta um conjunto de recomendações para os indivíduos com DID, que se descrevem na Tabela 1.

O nível de condição física e técnica do indivíduo vai influenciar a duração da sessão, frequência semanal, a intensidade a prescrever, bem como as adaptações provocadas pelas variáveis do TF. Considerando todas as variáveis referidas anteriormente, de seguida, na Tabela 2, são apresentadas algumas recomendações para o TF em pessoas com DID (ACSM, 2017).

Tabela 1. Tipos de avaliações da força muscular na DID.

Testes Recomendados	Teste a evitar
Teste de 1RM usando máquinas de musculação; Teste isocinético; Contração isométrica voluntária máxima.	Teste de 1RM usando pesos livres; Flexões de braços; Elevações.

RM: Repetição Máxima.
Fonte: ACSM (2017).

Tabela 2. Recomendações para o TF em adultos com DID.

Variáveis	TF
Intensidade	Iniciar com 12 - 20 RM (60% - 70% de 1RM) durante 1 - 2 semanas Progredir para 8 - 12RM (75% - 80% de 1RM)
Duração	2 - 3 séries com intervalos de 1 - 2 min entre séries
Frequência	2 - 3 dias/semana
Tipo	Usar máquinas destinadas aos 6 - 8 exercício dos principais grupos musculares Supervisionar o programa sempre que possível com especial ênfase nos primeiros 3 meses

TF: treino de força; RM: repetição máxima; MIN: minutos.
Fonte: ACSM (2017).

Tendo em conta a escassa literatura científica, no que diz respeito a programas de EF de TF, este documento servirá de orientação aos profissionais para o desenvolvimento de tais atividades, aprimorando os serviços prestados, contribuindo de forma significativa para ampliação de novos conhecimentos, promovendo a aptidão física, qualidade de vida e saúde de um indivíduo com DID. Assim, o objetivo do presente estudo é identificar aspetos e diretrizes cruciais para a prescrição de TF, nomeadamente os métodos de avaliação e prescrição de programas de exercício adequados, bem como os principais resultados, através de uma revisão narrativa.

METODOLOGIA

Estratégia de pesquisa

A procura dos artigos foi realizada a partir de setembro de 2018 a abril de 2020, através de pesquisas eletrónicas em várias bases de dados, B-on, PubMed, SciELO e ScienceDirect, considerando o período de recuo até 2010. Foram utilizados os descritores: "Dificuldade Intelectual e Desenvolvimental"; "Aptidão Física"; "Programa de Exercício"; "Treino da Força", em português, espanhol e inglês, de forma isolada ou em combinação com os operadores boleanos "e" ou "ou". Adicionalmente foram pesquisadas as listas de referência dos estudos e outros artigos a partir dos primeiros encontrados. Após a análise dos *abstracts* foram selecionados os artigos, de acordo com os critérios de inclusão e exclusão previamente definidos e, da leitura do texto integral dos artigos, constituiu-se a amostra do estudo com 19 artigos, onde são abordadas questões no contexto do TF, na população com DID.

Processo de extração de dados

Objetivou-se procurar artigos em que a intervenção consistisse num programa de EF de TF, independentemente do seu propósito. Foram consideradas informações das publicações como a autoria, o ano de publicação, o país, objetivos, participantes, tipo de estudo, instrumentos de avaliação, duração/frequência, exercícios e intensidades e principais resultados.

Critérios de inclusão

- Estudos de intervenção e estudos piloto;
- Estudos que apresentavam claramente os resultados;
- Estudos de intervenção com qualquer duração;
- População com DID, nos diversos graus, incluindo com Síndrome de *Down* (SD);
- Sem restrições quanto à faixa etária ou género;
- Estudos com indivíduos de qualquer raça ou etnia;
- Estudos com qualquer número de participantes;

Critérios de exclusão

- Artigos publicados antes de 2010;
- Artigos que não foram publicados na língua inglesa, espanhola ou portuguesa;
- Estudos que não descrevem o protocolo de intervenção do TF;
- Estudos em que a intervenção é só focada numa modalidade desportiva;

- Estudos com participantes com outro tipo de deficiência, sem conter DID.

Avaliação da qualidade dos estudos

A Escala Downs e Black (Black & Downs, 1998), foi utilizada para a avaliação da qualidade e o risco de viés de cada estudo, desenvolvida para colmatar a necessidade de avaliar estudos que não RCTs (Randomized Controled Trials). Constituída por 27 itens, pontuado com "um valor", caso o autor se identifique e "zero na sua ausência", caracterizando as várias partes de um artigo. Esta avaliação do risco de viés foi efetuada de forma independente por dois investigadores, sendo que os resultados obtidos por ambos foram comparados e discutidos, de forma a existir um consenso e, caso não existisse, as discrepâncias foram resolvidas por um avaliador externo. Os intervalos de pontuação da escala receberam níveis de qualidade correspondentes: excelente (26-28); bom (20-25); justo (15-19); e pobre (≤ 14). No entanto, como seis questões (questão 11, 12, 13, 16, 22 e 25) não eram aplicáveis a todos os estudos analisados, elas foram removidas. A escala, depois de modificada teve no máximo 21 pontos em relação à original. O valor de Cohen, ou seja, a concordância entre avaliadores foi classificada como boa (k= 0,757).

RESULTADOS

Na Tabela 3 apresentam-se os 19 artigos selecionados para a análise do presente estudo.

Qualidade dos estudos

A qualidade metodológica dos estudos foi avaliada como pobre (7 estudos), justo (6 estudos) e bom (6 estudos). Não foi excluído qualquer estudo devido à pontuação de baixa qualidade. O estudo com qualidade mais alta foi Shields & Taylor (2010). Os estudos com a avaliação de qualidade mais baixa foram desenvolvidos por Borssatti, Anjos e Lima (2013), Son & Jeon (2017b), Dijkhuizen et al., (2019) e Zenebe, Legesse, Mandal, Mahmud, & Aragaw (2020). A classificação de qualidade é apresentada na Tabela 3.

DISCUSSÃO

O objetivo do presente estudo foi identificar os métodos de avaliação, a duração, frequência e prescrição de programas de exercício adequados, bem como os principais resultados.

Dos dezanove estudos selecionados, um é oriundo do continente africano (Zenebe et al., 2020), dois estudos da Oceânia (Shields & Taylor, 2010; Shields et al., 2013), quatro do continente asiático (Ghaeeni, Bahari, & Khazaei, 2015; Eid, Aly, Huneif, & Ismail, 2017; Son & Jeon, 2017a, 2017b), cinco do continente europeu (Cowley et al., 2011; González-Agüero et al., 2011; Rosety-Rodriguez et al., 2013; Bossink, van der Putten, Waninge, & Vlaskamp, 2017; Dijkhuizen et al., 2019) e sete do continente americano (Florentino Neto, Pontes, & Fernandes Filho, 2010; Tamse et al., 2010; Borssatti et al., 2013; Raulino, Brito, & Barros, 2014; Seron, Silva, & Greguol, 2014; Modesto, Almeida, Carani, & Greguol, 2015; Seron, Modesto, Stanganelli, Carvalho, & Greguol, 2017), sendo o Brasil o país com maior número de publicações.

Dezasseis (Florentino Neto et al., 2010; Tamse et al., 2010; Cowley et al., 2011; González-Agüero et al., 2011; Shields, Synnot, & Barr, 2011; Rosety-Rodriguez et al., 2013; Shields et al., 2013; Borji et al., 2014; Raulino et al., 2014; Ghaeeni et al., 2015; Modesto et al., 2015; Bossink et al., 2017; Eid et al., 2017; Dijkhuizen et al., 2019; Seron et al., 2014, 2017) estudos analisados têm como objetivo avaliar as alterações físicas a partir de um programa de exercício físico, contudo, é de salientar que há um único estudo que pretendeu avaliar as alterações ao nível cognitivo e o TF foi um meio para o conseguir (Zenebe et al., 2020). Especificamente, dois estudos (Son & Jeon, 2017a, 2017b) apresentam diretrizes e boas práticas na implementação de programas da capacidade abordada no documento.

Nos estudos selecionados encontrou-se um somatório de 504 participantes com DID, dos quais 399 (79%) tinham SD. A maioria dos estudos recrutou uma amostra na faixa etária de adolescentes e jovens adultos, contudo, no estudo de Ghaeeni et al. (2015), os participantes tinham idade compreendidas entre os oito e os treze anos.

Quanto aos instrumentos de avaliação, a maioria dos estudos avalia a capacidade funcional (Shields & Taylor, 2010; Cowley et al., 2011; Rosety-Rodriguez et al., 2013; Shields et al., 2013; Raulino et al., 2014; Son & Jeon, 2017a, 2017b), utilizando alguns testes da bateria de *Fullerton* (Rikli & Jones, 1999), nomeadamente o teste de caminhada, teste de agilidade, teste sentar e alcançar, ou outros, como o teste dos abdominias ou teste de subir/descer escadas, bem como uma avaliação antropométrica (peso, altura, perímetro da cintura e IMC), evidente em seis artigos (Florentino Neto et al., 2010; González-Agüero et al., 2011; Rosety-Rodriguez et al., 2013; Seron et al., 2014; Modesto et al., 2015; Bossink et al., 2017). Diversos estudos avaliam igualmente a massa livre de gordura e da massa gorda com recurso a absormetria de raio-x de dupla energia DEXA, bio impedância ou pregas cutâneas (Florentino Neto et al., 2010; González-Agüero et al., 2011; Seron et al., 2014; Son & Jeon, 2017b). De ressaltar que a avaliação da força é efetuada maioritariamente através do teste de 1RM (Shields & Taylor, 2010;

Tabela 3. Efeitos do TF em adultos com DID.

Autor, ano, País	Objetivo	Participantes	Instrumentos de avaliação	Duração/ frequência	Exercícios e intensidade	Resultados	Qualidade
Borssatti et al. (2013), Brasil	Efeitos do TF na marcha.	*N*= 8 (♂= 5; ♀= 3); MI: 19,33± 2,44A; SD.	Avaliação do passo, passada e velocidade.	12 semanas; 2 x semana; Duração da sessão: ND	Exer funcionais solicitando o glúteo médio (saltos), isquiotibiais (tocar com o calcanhar no glúteo), flexores do quadril (sentar/levantar) e o tibial anterior (caminhar sobre o calcanhar); 2 a 3 séries; 12 reps.	Sem alterações das variáveis da marcha.	Pobre.
Bossink et al. (2017), Holanda	Efeitos do TF.	*N*= 37; MI: 32,10± 14,60A; DID profunda e deficiência motora; Grupos randomizados: treino (*N*= 19) e controlo (*N*= 18).	Escala de Avaliação Comportamental (Van Het Gedrags Taxatie Instrument); IMC; Escala de Ashworth (avaliação da espasticidade; Oxímetro (sat O2 e FC); QOL-PMD (Petry Maes & Valslamp, 2009).	20 semanas; 3 x semana; 30 min sessão.	Exer em aparelhos: abdominais (não é identificada a variante), leg extension, cadeira abdutora e adutora dos m.inf. e elevações laterais dos ombros.	Aumento da saturação O2 e do bem-estar social; Diminuição do bem-estar físico.	Bom.
Cowley et al. (2011), Reino Unido	Efeitos do TF na força dos m.inf., capacidade aeróbia e aptidão física.	*N*= 30; MI: 28± 8A; SD e DID leve; Grupos aleatórios: treino (♂= 9; ♀= 10) e controlo (♂= 8; ♀= 3).	Dinamómetro (60°/s, extensão e flexão m.inf.); Protocolo máximo de esforço; Teste de 3 AVD.	10 semanas; 2 x semana; Duração da sessão: ND.	Exer em aparelhos: leg extension and flexion, leg press, shoulder press, chest press, bicep curl e extensão do tricípite; 3 séries de 12RM.	Aumento do pico de torque isocinético do extensor e flexor dos m.inf. e da capacidade cardiorrespiratória.	Justo.
Dijkhuizen et al., (2019), Holanda	Efeitos do TF na força dos m.inf.	*N*= 8; MI: 29,60± 5,90A; DID, deficiência visual e auditiva;	Teste 1RM (extensão dos m.inf.).	10 semanas; 2 a 3 x semana; 45 min/sessão; Tempo entre sessões: 48h.	Exer em aparelhos: 50%-80% 1RM – leg extension.	Aumento da força dos quadricípites.	Pobre.
Eid et al. (2017), Arábia Saudita	Efeitos do TF na força e equilibro postural.	*N*= 31; 9- 12A; SD; Grupos aleatórios: treino (♂= 8; ♀= 7) e controlo (♂= 9; ♀= 7).	Dinamómetro (120°/s, exer extensão e flexão m.inf.).	12 semanas; 3 x semana; 15 min/sessão.	Exer em aparelhos: leg extension e leg curl; 3 séries, 10RM 3 min entre séries.	Melhoria da força muscular e equilíbrio postural.	Bom.
Ghaeeni et al. (2015), Irão	Efeitos do TF na estabilidade postural.	*N*= 16; 8- 13A; SD; Grupos aleatórios: treino (*N*= 8) e controlo (*N*= 8).	Teste da cegonha (Equilíbrio estático).	8 semanas; 3 x semana; 45 a 60 min/ sessão.	Treino de abdominais, 21 exer diferentes. 3- 4 exer por sessão; 3- 6 séries; 10- 20 reps.	Melhoria do equilíbrio estático.	Bom.
González-Agüero et al. (2011), Espanha	Efeitos do TF na composição corporal.	*N*= 26; I= 10- 19A; SD; Grupos aleatórios: treino (*N*= 13) e controlo (*N*= 13).	DXA (massa magra e massa gorda); Estadiómetro.	21 semanas; 2 x semana; 20 a 25 min/ sessão.	Exer em circuito, saltos (4 variantes), flexões na parede, exer. com elásticos (elevação e abertura lateral do ombro e bicípite curl) e lançamento com bolas medicinais; 1 a 2 séries de 10 a 20 reps.	Aumento da massa magra.	Justo.

Continua...

Tabela 3. Continuação.

Autor, ano, País	Objetivo	Participantes	Instrumentos de avaliação	Duração/ frequência	Exercícios e intensidade	Resultados	Qualidade
Modesto et al. (2015), Brasil	Efeitos do TF na força muscular.	*N*= 41; 12- 20A; MI: 15,40± 2,90A; SD; Grupos aleatórios: TF (*N*= 15), treino aeróbio (*N*= 16) e controlo (*N*= 10).	Peso; Altura; IMC; Perímetro abdominal; Teste 1RM (remada alta e cadeia extensora); Dinamómetro manual (JAMAR).	12 semanas; 2 x semana; 50 min/sessão.	Exer em aparelhos: chest press, leg extension, leg curl (caneleira com peso), puxador vertical, elevação lateral do ombro, extensão do tricípite, bicípite curl, elevação do calcanhar (caneleira com peso) e abdominal crush 1 série de 12RM; Descanso de 45s entre séries.	Aumento da força dos m.inf. e m.sup.	Pobre.
Florentino Neto et al. (2010), Brasil	Efeitos do TF na composição corporal.	*N*= 15; MI: 22,10± 7,50A; 15- 35A; SD; Grupos aleatórios: treino (♂= 6; ♀= 2) e controlo (♂= 5; ♀= 2).	Peso; Altura; Pregas cutâneas; Composição corporal, através de fórmulas de cálculo.	12 semanas; 3 x semana; 60 min/sessão.	Exer em aparelhos: remada unilateral, elevação do calcanhar, bicípite curl, tricípite francês e abdominal crunch 3 séries, 8 a 12 reps (carga estimada de modo a realizar as reps no intervalo definido); Intervalo 30 a 60s.	Aumento da massa magra e redução da % de gordura.	Bom.
Raulino et al. (2014), Brasil	Efeitos do TF na força muscular e desempenho nas AVD.	*N*= 40; MI: 21,60± 4,80A; Grupos aleatórios: treino (*N*= 20) e controlo (*N*= 20).	Teste de 1RM (nos exercícios prescritos no programa de EF); Dinamómetro isocinético (60°/s, flexão e extensão m.inf); Avaliação do desempenho nas AVD (Protocolo Andreotti e Okuma, 1999).	12 semanas; 3 x semana; Duração da sessão: ND	Exer em aparelhos: leg press; leg extension; flexão do tríceps crural; elevação do calcanhar; supino plano; puxada vertical; flexão do bíceps braquial em supinação; extensão do tríceps braquial em pronação; 2 a 3 séries, 60% a 90% 1RM.	Aumento da força muscular e melhor desempenho nas AVD.	Justo.
Rosety-Rodriguez et al. (2013), Espanha	Efeitos do TF na resistência da inflamação sistémica de baixo grau.	*N*= 40 ♂; MI: 23,70 ± 3,10A; SD; Grupos aleatórios: treino (*N*= 24) e controlo (*N*= 16).	Amostras de sangue - níveis plasmáticos de leptina, adiponectina, interleucina-6 e TNF-α (kits ELISA); Proteína C reativa - nefelometria; Massa magra – bio impedância; Perímetro da cintura; Teste de agilidade.	12 semanas; 3 x semana; Duração da sessão: ND	Exer em aparelhos: bicípite curl, leg extension, remada baixa, leg curl, extensão do tricípite e leg press; 40 a 65% de 8RM; 2 séries; 6 a 10 reps.	Os níveis plasmáticos de leptina, TNF-α e IL-6 e o perímetro da cintura diminuíram; Aumento da massa livre de gordura; Melhoria da resposta à inflamação sistémica.	Justo.
Seron et al. (2017), Brasil	Efeitos do TF na capacidade cardiorrespiratória.	*N*= 41; MI: 15,51± 2,70A; SD; Grupos aleatórios: TF (*N*= 15), treino aeróbio (*N*= 16) e controlo (*N*= 10).	Protocolo de esforço máximo e submáximo.	12 semanas; 2 x semana; 30 min/ semana.	Exer em aparelhos: prensa de peito, leg extension, push up, bicípite curl, extensão do tricípite, elevação do calcanhar (caneleira com pesos), elevação frontal do ombro (halters) e abdominal (não é identificada qual a variante); 3 séries, 12RM; 1 min descanso entre séries, 3 min entre exer.	Melhoria da eficiência cardíaca e aumento da ventilação máxima.	Justo.

Continua...

Tabela 3. Continuação.

Autor, ano, País	Objetivo	Participantes	Instrumentos de avaliação	Duração/ frequência	Exercícios e intensidade	Resultados	Qualidade
Seron, Silva, & Greguol (2014), Brasil	Efeitos do TF na composição corporal.	*N*= 41; Grupo de TF (*N*= 15, MI: 16± 2,80A), grupo de treino aeróbio (*N*= 16, MI: 15,70± 2,70A) e grupo de controlo (*N*= 10, MI: 14,40± 2,50A).	Peso; Altura; Pletismografia Bod Pod (% gordura); Perímetro da cintura.	12 semanas; 2 x semana; 50 min/sessão.	Exer em aparelhos: prensa de peito, leg extension, puxador vertical, flexão do quadril (caneleira com pesos), extensão do tricípite, elevação do calcanhar (caneleira com pesos), elevação frontal do ombro e abdominal (não é identificada qual a variante). 3 séries de 12RM; 3 min descanso entre exer.	Manutenção dos níveis de gordura, IMC e perímetro da cintura.	Pobre.
Shields & Taylor (2010), Austrália	Efeitos do TF na capacidade de produção de força muscular e na aptidão física.	*N*= 23; MI: 15,60± 1,60A; SD; Grupos aleatórios: treino (*N*= 9) e controlo (*N*= 11).	Teste 1RM (prensa de peito e de pernas); Teste Timed Up and Go; Teste Down Stairs; Teste do supermercado.	10 semanas; 2 x semana; Duração da sessão: ND	Exer em aparelhos: puxador vertical, prensa de peito e de m.inf., remada baixa, leg extension e elevação do calcanhar; 3 séries de 12 reps; 2 min de descanso entre exer.	Melhoria na força muscular dos m.inf.	Bom.
Shields et al. (2013), Austrália	Avaliar os efeitos do treino.	*N*= 68; MI: 17,90± 2,60A; DID leve a moderada; Grupos aleatórios: treino (*N*= 34) e controlo (*N*= 34).	Teste de empilhamento de caixas; Teste de transporte de um balde; Teste de 1RM (prensa de peito e pernas).	10 semanas; 2 x semana; 60 min/sessão.	Exer em aparelhos: puxador vertical, prensa de peito e m.inf, remada baixa, leg extension e elevação do calcanhar; 3 séries de 12 reps 60% a 80% RM; 2 min descanso entre exer.	Aumento da força dos m.inf. e m.sup.	Bom.
Son & Jeon (2017b), Coreia do Sul	Promover a saúde e fornecer diretrizes para a promoção de programas de treino.	*N*=10; DID leve; Divisão não aleatória: treino de extrema importância (♂= 3; ♀= 2, MI: 22,20A) e treino de neutra importância (♂= 3; ♀= 2, MI: 24A).	Avaliação do desempenho ocupacional; Testes dos abdominais; Teste sentar e alcançar.	12 semanas; 2 x semana; Duração da sessão: ND	Exer com elásticos que incidiam nos principais grupos musculares: grande peitoral, ombros, dorsal, bicípite e tricípite, m.inf. e abdómen; 3 séries de 12 reps;	Aumento da força e da flexibilidade.	Justo.
Son & Jeon (2017a), Coreia do Sul	Fornecer diretrizes para o treino de abdominais.	*N*= 10; MI: 22,90A; DID leve;	InBody 230; Teste sentar e alcançar; Teste dos abdominais.	12 semanas; 2 x semana; Duração da sessão: ND	Abdominal crunch, sit-up e elevação dos m.inf.; 3 séries de 12 reps.	Diminuição do peso; Aumento da força muscular e da flexibilidade.	Pobre.
Tamse et al. (2010), EUA	Avaliar os efeitos do treino.	*N*= 32; 19- 24A; 15 DID e 17 população em geral; Divididos em grupo de atletas (*N*= 15, MI: 21,30A) e grupo de não atletas (*N*= 17, MI: 20,80A).	1RM para cada exer prescrito.	10 a 12 sessões; 50 min/sessão.	Exer em aparelhos: remada baixa, leg extension, leg curl, prensa de peito, abdominal crunch; 1 séries De 8 a 12RM.	Ambos os grupos tiveram ganhos semelhantes ao nível da força.	Pobre.
Zenebe et al. (2020), Etiópia	Efeitos do TF na capacidade cognitiva.	*N*= 18; MI: 14,25± 1,14A; DID.	Avaliação das variáveis cognitivas.	16 semanas; 3 x semana; 50 min/sessão.	Ponte de glúteos, agachamento isométrico, overhead, elevação do calcanhar, bicípite curl, extensão do tricípite, prensa de pernas e ombros, extensão do tronco, flexão, adução e abdução dos m.inf., anteversão e retroversão pélvica, prancha lateral isométrica; 3 a 16 reps.	Alterações positivas da memória de trabalho, da memória a curto prazo, conhecimento do vocabulário e capacidade de raciocínio.	Pobre.

A: Anos; AVD: Atividades de Vida Diária; DID:–Dificuldade Intelectual e Desenvolvimental; Exer: Exercício/s; FC: Frequência Cardíaca; IMC: Índice de Massa Corporal; MI: Média de Idade; min: Minutos; m.inf.: Membros Inferiores; m.sup.: Membros Superiores; N: Participantes; ND: Não definida; O2: Oxigénio; Reps: Repetições; RM: Repetição Máxima; s: Segundos; Síndrome de Down: SD; TF: Treino de força.

Tamse et al., 2010; Shields et al., 2013; Raulino et al., 2014; Modesto et al., 2015; Dijkhuizen et al., 2019), utilizando os exercícios prescritos nos programas de EF. Os instrumentos dinamómetro manual (Modesto et al., 2015) ou isocinético (Cowley et al., 2011; Raulino et al., 2014; Eid et al., 2017), para os exercícios flexão e extensão dos membros inferiores, também são frequentemente utilizados pelos autores. É também visível a avaliação da força pelos testes funcionais, nomeadamente o teste "*Down Stair*" (Shields & Taylor, 2010), "Supermercado" (Shields & Taylor, 2010), "Transporte de um Balde" (Shields et al., 2013), "Empilhamento de Caixas" (Shields et al., 2013) ou o teste dos "Abdominais" (Son & Jeon, 2017a, 2017b). Apesar de serem programas de TF, os autores avaliam outras variáveis, nomeadamente físicas (Ghaeeni et al., 2015), fisiológicas (Rosety-Rodriguez et al., 2013; Bossink et al., 2017), cognitivas (Zenebe et al., 2020) ou em termos da qualidade de vida (Bossink et al., 2017), de modo a perceber o impacto que o treino da capacidade neuromuscular provoca.

A duração total dos programas varia entre 10 a 21 semanas, sendo mais frequente o período compreendido entre as 10 e 12 semanas, presente em quatorze estudos (Florentino Neto et al., 2010; Shields & Taylor, 2010; Cowley et al., 2011; Rosety-Rodriguez et al., 2013; Shields et al., 2013; Borji et al., 2014; Raulino et al., 2014; Seron et al., 2014; Modesto et al., 2015; Eid et al., 2017; Seron et al., 2017; Son & Jeon, 2017a, 2017b; Dijkhuizen et al., 2019), ou seja, programas de curta duração. Constrangimentos ao nível logístico ou organizacional podem estar na base da reduzida duração dos programas de EF, bem como a taxa de desistência dos indivíduos a programas com maior longevidade temporal. São necessários mais estudos longitudinais, com métodos diferenciados e com exercícios variados, indo ao encontro das preferências individuais, de forma a promover a adesão aos programas de TF.

A frequência semanal varia entre 2 a 3 vezes, sendo que se encontram mais programas com uma assiduidade de 2 vezes por semana (dez estudos: Shields & Taylor, 2010; Cowley et al., 2011; González-Agüero et al., 2011; Shields et al., 2013; Borji et al., 2014; Modesto et al., 2015; Seron et al., 2014, 2017; Son & Jeon, 2017a, 2017b), indo ao encontro das recomendações (ACSM, 2017).

A duração das sessões de treino varia entre 10 a 60 minutos, sendo os valores diferentes entre os programas de EF. Atendendo a que a duração de alguns programas de treino é desconhecida (Shields & Taylor, 2010; Cowley et al., 2011; Rosety-Rodriguez et al., 2013; Borji et al., 2014; Raulino et al., 2014; Son & Jeon, 2017a, 2017b), parece-nos que a maioria prescreve com uma duração de 45 a 60 minutos (Florentino Neto et al., 2010; Tamse et al., 2010; Shields et al., 2013; Seron et al., 2014; Ghaeeni et al., 2015; Modesto et al., 2015; Dijkhuizen et al., 2019; Zenebe et al., 2020), estando em acordo com as recomendações (ACSM, 2017) e tendo sempre em consideração uma fase de aquecimento, parte fundamental e retorno à calma. A duração da sessão de treino é importante, não deverá ultrapassar o tempo recomendado, a fim de manter o foco e interesse ao longo da mesma.

A maioria dos programas de EF realiza TF, solicitando os principais grupos musculares em cada sessão. O número de séries utilizado varia entre 1 a 3 séries por exercício, sendo o mais frequente a prescrição de 3 séries (nove estudos: Florentino Neto et al., 2010; Shields & Taylor, 2010; Cowley et al., 2011; Shields et al., 2013; Eid et al., 2017; Seron et al., 2014, 2017; Son & Jeon, 2017a, 2017b). O número de repetições por série varia entre 10 a 20, contudo, com nove estudos (Shields & Taylor, 2010; Cowley et al., 2011; Shields et al., 2013; Borji et al., 2014; Modesto et al., 2015; Seron et al., 2014, 2017; Son & Jeon, 2017a, 2017b) a prescrevem 12 repetições, sejam estas máximas ou por exercício. Todavia, as diretrizes do TF para a população em estudo recomendam a realização de 12 repetições com intensidade entre 60 a 70% da 1RM durante 1-2 semanas com uma progressão para 75-80 da 1RM, 2 a 3 séries por exercício, preferindo a utilização por máquinas de musculação (ACSM, 2017).

Em termos da progressão da carga/resistência do exercício, verifica-se um aumento ao longo do programa, independentemente do tipo de material utilizado, quer seja em aparelhos de musculação, bolas medicinais, caneleiras de tornozelo, elásticos entre outros materiais. É realizada de forma gradual em função das semanas de treino ou da performance individual, seja pelo acréscimo de percentagem de carga de treino, pela mudança de elástico para uma resistência maior, um aumento do peso nas caneleiras de tornozelo e das bolas medicinais ou simplesmente pelo acréscimo de séries e/ou repetições a executar na sessão de treino.

Sendo os exercícios de força realizados em máquinas de musculação, com recurso a elásticos de resistência e/ou caneleiras com pesos para os tornozelos, ou bolas medicinais existe um modelo no movimento e, por sua vez, um padrão no principal músculo solicitado, sendo os mais comuns a flexão e extensão das pernas (isquiotibiais e quadricípites), exercícios de abdominais pelas suas diferentes variantes (músculos do abdómen), a prensa de peito (grande peitoral), a remada baixa ou a puxada vertical (grande dorsal), a flexão do antebraço (bicípite), a extensão do antebraço (tricípite) e elevação, abdução ou prensa de ombro (deltoides). Os exercícios prescritos tendem a ser de simples e fácil execução, evitando tarefas/movimentos complexos. O profissional de EF que fará

o acompanhamento e supervisão da sessão terá que adotar uma postura de atenção permanente, um especial cuidado no reforço/feedback, bem como na instrução, demonstração e familiarização com o equipamento, promovendo o sucesso na realização do movimento e evitando eventual ocorrência de lesão (ACSM, 2017).

Os resultados identificados referem que a prescrição e implementação de programas de treino com exercícios de força leva a um aumento significativo dessa variável, quer nos membros inferiores, quer nos membros superiores, aumentando assim a massa livre de gordura e reduzindo a massa gorda. Dependendo dos objetivos do estudo e dos seus métodos de avaliação, podemos encontrar também referência à diminuição do peso corporal, do perímetro da cintura, do IMC, aumento do equilíbrio e melhoria da postura, bem como um aumento da capacidade cardiorrespiratória. Observamos igualmente adaptações positivas ao nível das AVD, nos diversos tópicos das escalas, sendo um aspeto fundamental para a autonomia das pessoas em foco.

De igual forma, verificam-se alterações cognitivas positivas, no âmbito da memória de trabalho, da memória a curto prazo, conhecimento do vocabulário e capacidade de raciocínio. De salientar que é observável a diminuição do bem-estar físico dos participantes num estudo, no entanto, essa variável foi avaliada por indivíduos que prestavam cuidados diretos (Bossink et al., 2017), a partir da sua perceção relacionada com o esforço realizado e, por isso, a interpretação deste resultado deve ser cuidadosa sendo necessários mais estudos para confirma-la.

Analisando os diversos estudos, destacam-se as principais limitações identificadas pelos autores: a) reduzido número de participantes (Eid et al., 2017; Seron et al., 2017; Son & Jeon, 2017b; Dijkhuizen et al., 2019); b) programas de curto prazo (Shields & Taylor, 2010; Rosety-Rodriguez et al., 2013; Modesto et al., 2015; Eid et al., 2017; Seron et al., 2014, 2017; Son & Jeon, 2017b); c) complicações da própria deficiência (Florentino Neto et al., 2010); d) programa de EF supervisionado por um número reduzido de profissionais (Florentino Neto et al., 2010); e) TF não foi realizado com base nas percentagens de repetição máxima (González-Agüero et al., 2011); f) a não avaliação de outras variáveis importantes, como por exemplo a dieta alimentar (Seron et al., 2014; Modesto et al., 2015; Son & Jeon, 2017a); g) utilização de instrumentos de avaliação com alguma margem de erro (Rosety-Rodriguez et al., 2013); h) falta de acompanhamento pós programa (Shields & Taylor, 2010; Rosety-Rodriguez et al., 2013; Eid et al., 2017); i) análise das adaptações provocadas pelo treino em poucas variáveis (Shields et al., 2013); j) falta de um grupo de controlo (Cowley et al., 2011; Dijkhuizen et al., 2019); k) não abrangência dos diversos graus de DID (Cowley et al., 2011; Bossink et al., 2017); l) amostra heterogenea (Bossink et al., 2017); m) divisão de grupos não aleatória (Seron et al., 2017); n) utilização de amostras de conveniência (Seron et al., 2014). Estes aspetos devem ser analisados pelos profissionais do exercício físico na hora de prescrever um programa de treino, aumentando o sucesso do mesmo e diminuindo o viés dos resultados.

Apesar das limitações identificadas em alguns estudos, a maioria reporta benefícios do TF, através do aumento desta capacidade física ou do aumento da massa livre de gorda (Florentino Neto et al., 2010; Shields & Taylor, 2010; Tamse et al., 2010; Cowley et al., 2011; González-Agüero et al., 2011; Shields et al., 2013; Raulino et al., 2014; Modesto et al., 2015; Eid et al., 2017; Son & Jeon, 2017a, 2017b; Dijkhuizen et al., 2019), melhorando assim, a aptidão física, reduzindo o risco de aparecimento de doenças, aumentando a autonomia na realização de AVD e melhorando a autoeficácia e autoestima.

Recomenda-se a continuidade da implementação de programas de EF de TF na população em foco, alargando o conhecimento ao nível dos métodos, estrutura e duração utilizados, para que os profissionais consigam prescrever de forma adaptada e eficaz.

Sugere-se ainda uma avaliação com recurso às variáveis da composição corporal, tais como a avaliação do ângulo de fase, de modo a compreendermos se existem adaptações com o TF nesta variável que tem forte correlação com a integridade e saúde celular, sendo um excelente indicador da capacidade da membrana celular em reter líquidos, fluídos e nutrientes na população com DID.

CONCLUSÕES

Através da metodologia com recurso à revisão narrativa, o presente estudo tem como objetivo determinar métodos e estratégias para a participação de indivíduos com DID em programas de TF. Prossupõe a identificação de aspetos e recomendações para a prescrição de exercícios, como a duração, frequência, métodos de avaliação e exercícios adequados e análise dos diversos programas de TF desenvolvidos e implementados. Independentemente dos objetivos dos programas de TF, os métodos de avaliação física mais comuns são:

- Avaliação antropométrica (peso, altura, perímetro da cintura e IMC);
- Avaliação da composição corporal, nomeadamente a massa livre de gordura e da massa gorda (bio impedância, multi-frequência e multi-polar);

- Avaliação funcional, pelos seus mais variados testes: "Down Stair", "Supermercado", "Transporte de um Balde", "Empilhamento de Caixas", teste dos "Abdominais" ou com recurso à bateria de teste de Fullerton (Rikli & Jones, 1999);
- Avaliação da capacidade neuromuscular por dinamómetro isocinético, na velocidade angular 60º/s ou 120º/s ou testes 1RM, utilizando para avaliação os exercícios prescritos no programa de EF;

As duas últimas alíneas referidas anteriormente, são associadas à avaliação da capacidade física força. São as formas mais comuns dos autores a avaliarem, sendo também as recomendadas.

Estão descritas as características e os princípios mais utilizados na implementação de programas de EF de força, na população com DID, nomeadamente o processo de avaliação e prescrição, fundamental para o alcance dos objetivos propostos. Atendendo aos programas de TF, foram identificados um conjunto de aspetos basilares para a prescrição de exercícios nos programas de EF, os quais se descrevem de seguida:

- Duração de 10 a 12 semanas, sendo que o ideal é que os programas de EF sejam implementados de forma contínua;
- A maioria é aplicado, no mínimo, 2 vezes por semana;
- Duração de 45 a 60 minutos por sessão;
- 6-7 exercícios recrutando os principais grupos musculares, evitando pesos livres, como por exemplo: prensa de peito (grande peitoral), remada baixa ou a puxada vertical (grande dorsal), elevação, abdução ou prensa de ombro (deltoides), exercícios de abdominais pelas suas diferentes variantes (solicitação dos músculos do abdómen), flexão do antebraço (bicípite), a extensão do antebraço (tricípite), a flexão e extensão das pernas (isquiotibiais e quadricípites, respetivamente);
- Para cada exercício: 3 séries com uma média de 12RM, sendo a progressão essencial para o processo de sobrecarga, podendo ser efetuada dos modos referidos anteriormente.

Este documento é uma ferramenta útil para consulta dos profissionais da área, pois nele constam as características e recomendações que os técnicos devem reger-se ao implementarem um programa de EF, nomeadamente TF, essencial para promover benefícios e resultados para este grupo em foco, nomeadamente a manutenção/aumento da aptidão física, qualidade de vida e saúde, de uma população onde prevalece o estilo de vida sedentário, diminuindo, assim, o risco de aparecimento de doenças crónicas.

É fundamental a implementação deste tipo de programas de EF, incorporados na rotina diária desta população que, quando tem associado um estilo de vida apropriado, provoca um conjunto de adaptações e benefícios e, em última análise, pode promover uma diminuição dos gastos em despesas clínicas, um envelhecimento saudável e uma saúde mais plena.

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ARTIGO DE REVISÃO

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Habilidades motoras de crianças saudáveis de seis a 12 anos: revisão sistemática

Motor skills of healthy children aged six to 12 years: systematic review

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RESUMO

O objetivo do presente trabalho foi analisar as habilidades motoras de crianças saudáveis de seis a 12 anos, identificar potenciais fatores associados aos déficits no desempenho motor e sintetizar os instrumentos usados para avaliação. Os descritores utilizados foram: criança saudável; crianças saudáveis; habilidade motora; desempenho psicomotor e desempenho motor, nos idiomas inglês, português e espanhol. Nas bases de dados Scielo, Lilacs e Pubmed. Dois revisores realizaram a seleção dos estudos, extração de dados e análise da qualidade. A busca foi restrita a artigos transversais publicados entre 1997 e 2018. A qualidade dos estudos foi avaliada pelo *Checklist for Analytical Cross Sectional Studies* do *Joanna Briggs Institute* (JBI). Na busca inicial encontrou-se 4.746 referências, foram lidos 165 artigos, resultando em 11 artigos para a revisão final. As meninas demonstraram pior desempenho. Os instrumentos encontrados foram: *Test for Gross Motor Development Second Edition-TGMD2*; *Koperkoordination test fur Kinder-KTK*; *Movement Assessment Battery for Children*-MABC e *Movement Assessment Battery for Children Second Edition-MABC-2*. Os testes MABC e MABC-2 avaliam além de motricidade grossa também motricidade fina. As habilidades motoras de crianças de seis a 12 anos foram consideradas satisfatórias em cinco estudos e em seis as crianças apresentaram atraso motor. O *TGMD2* foi o instrumento o mais frequente.

PALAVRAS-CHAVE: habilidades motoras; criança; escolares; sexo.

ABSTRACT

The present research aimed to analyze the motor skills of healthy children aged six to 12 years, identify potential factors associated with deficits in motor performance and synthesize the instruments used for assessment. The descriptors used were: healthy child; healthy children; motor skills; psychomotor performance and motor performance in English, Portuguese and Spanish in Scielo, Lilacs and Pubmed databases. Two independent reviewers performed the study selection, data extraction and methodological quality analysis. The search was restricted to original articles from observational studies published between 1997 and 2018. The methodological quality of the studies was assessed using the Joanna Briggs Institute (JBI) instruments. Results: In the initial search, 4746 references were found, and 165 full articles were read, resulting in 11 articles for fine review after using the exclusion criteria. The girls showed worse performance. The instruments used were: Test for Gross Motor Development Second Edition (TGMD-2); Koperkoordination test fur Kinder (KTK); Movement Assessment Battery for Children Second Edition (MABC-2); and Movement Assessment Battery for Children Second Edition (MABC). TGMD-2 and KTK assess gross motor skills, whereas the MABC and MABC-2 tests also assess fine motor skills. This literature review showed that the motor skills of healthy children aged 6 to 12 years were considered satisfactory in five studies and that six children had a motor delay. The most frequent was the Test of Gross Motor Development Second Edition (TGMD-2).

KEYWORDS: motor skills; child; schoolchildren; sex.

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INTRODUÇÃO

Os termos "habilidades motoras" e "desempenho motor" são utilizados como sinônimos para se referir ao desempenho das crianças em tarefas motoras não relacionadas à aptidão física e é influenciado por fatores biológicos e sociodemográficos (Wuang, Su, & Su, 2012; van der Cammen-van Zijp et al., 2014; Barnett et al., 2016; Cheng et al., 2016; Toussaint et al., 2016; Aertssen, Bonney, Ferguson, & Smits-Engelsman, 2018; Greenfield, 2018; Nobre, Valentini & Nobre, 2018). Entre os fatores que influenciam negativamente as habilidades motoras encontram-se: exposição pré-natal ao álcool (Lucas et al., 2016); obesidade pré-natal materna grave (Mina et al., 2017); prematuridade (Broström, Vollmer, Bolk, Eklöf, & Ådén, 2018); baixo peso ao nascer (Manacero & Nunes, 2021); excesso de peso da criança (Lopes, Santos, Moreira, Pereira & Lopes, 2015); e sexo feminino (Duncan, Jones, O'Brien, Barnett & Eyre, 2018).

Nos primeiros anos de vida o desenvolvimento motor sofre maior influência da maturação biológica e nos anos seguintes da oportunidade e prática de habilidades motoras (Barnett et al., 2016). O desempenho motor da criança repercute nas suas aptidões físicas, comportamento escolar e letramento (Cameron, Cottone, Murrah, & Grissmer, 2016). A motricidade auxilia na evolução das funções do pensamento e cognição, consequentemente crianças com atraso motor apresentam problemas na aprendizagem (Gorla, Duarte & Montagner, 2008), níveis mais elevados de depressão e estão mais expostas a *bullying* na escola e ao isolamento social (Campbell, Missiuna, & Vaillancourt, 2012).

Há interesse em se estudar comprometimento motor de crianças de seis a 12 anos com e sem atraso no desenvolvimento psicomotor, pois este pode influenciar o desenvolvimento intelectual e adaptativo da criança (Alesi, Battaglia, Pepi, Bianco & Palma, 2018). Crianças consideradas típicas podem revelar dificuldade de aprendizagem ou na coordenação motora, como é o caso de indivíduos com Transtorno do Desenvolvimento da Coordenação (TDC) (OMS, 2004; APA, 2014; Suhaili et al., 2019). No TDC há declínio motor, fraqueza, imprecisão de movimentos, caligrafia insuficiente, alteração na motricidade não explicados por condições de saúde congênitas ou adquiridas (OMS, 2004; APA, 2014).

Alterações na motricidade, no desenvolvimento e na coordenação nos primeiros anos escolares podem repercutir na qualidade de vida, desempenho físico e escolha durante a infância, adolescência e vida adulta (Engel-Yeger, 2020; Katagiri et al., 2021). As crianças em idade escolar merecem atenção especial quanto ao avaliação das habilidades motoras, pois a identificação de comprometimento seguida de intervenção adequada traz resultados favoráveis com melhora nas habilidades motoras (Ma et al., 2018).

Se faz notória a necessidade de empregar um teste válido e confiável (Malerba, 2019) para realizar a identificação de desvios motores, independente da região do mundo, pois estudos revelam que crianças típicas de várias nacionalidades podem apresentar desempenho insatisfatório (Suyama et al., 2020; Jaikaew & Satiansukpong, 2021; Licari et al., 2021). A partir do conhecimento a respeito dos instrumentos disponíveis, professores de educação física e profissionais da saúde podem decidir qual ferramenta que melhor se adequa à sua realidade, detectar crianças com comprometimentos e encaminhá-las a profissionais especializados.

Há na literatura revisões sistemáticas com o intuito de avaliar as propriedades psicométricas, qualidade e aplicação clínica de instrumentos de avaliação motora (Griffiths, Toovey, Morgan & Spittle, 2018; Scheuer, Herrmann & Bund, 2019). Contudo, esses trabalhos possuem foco nos instrumentos sem apresentar o desempenho das crianças e os fatores de risco associados ao atraso no desenvolvimento motor. Além disso, apresentaram métodos diferentes da presente revisão. Um dos artigos realizou a revisão com um revisor, a pesquisa incluiu artigos de revisão e validação, o que segundo os autores trouxe grande heterogeneidade e dificuldade em trabalhar os resultados de forma específica. Os idiomas pesquisados foram inglês e alemão, o que pode ter limitado a inclusão de estudos em outros idiomas. Os autores incluíram ainda estudos com crianças com comprometimentos, o que dificulta a ampliação para contextos educacionais gerais, como relata o próprio artigo (Scheuer et al., 2019).

Outro estudo semelhante envolveu a seleção e leitura dos resumos por um revisor e a leitura dos artigos completos por dois revisores. A busca excluiu instrumentos de triagem, com menos de dois itens motores grossos e com manuais não disponíveis em inglês (Griffiths et al., 2018).

A partir disso é possível observar a necessidade de se desenvolver uma revisão com a participação dois revisores em todo o processo (Brasil, 2014), que visa reduzir risco de erros e de viés de seleção (Lefebvre et al., 2019). Além disso, é importante que a revisão: inclua maior quantidade de idiomas; seja focado em crianças sem comprometimentos; que inclua artigos com um tipo de delineamento, o diminui a heterogeneidade dos dados e possibilidade compreensão mais clara dos resultados; e que envolva também o desempenho motor e os fatores de risco associados ao pior desempenho. Esse último se torna relevante quando pensamos em ampliar a análise dos resultados para a prática clínica e acompanhamento em ambiente escolar.

A presente revisão de diferencia das demais por: incluir estudos que utilizaram as diferentes versões dos instrumentos, o que amplia a análise de resultados; ser direcionada a estudos com foco em analisar as habilidades motoras, isso garante menor heterogeneidade de dados e permite descobertas mais específicas; incluir estudos com crianças sem comprometimentos, que possibilita a utilização de seus resultados em contextos educacionais gerais; a seleção dos estudos foi conduzida por dois revisores independentes desde o processo de seleção dos estudos por título e resumo, isso confere maior fidedignidade dos resultados.

Com esta revisão será possível pensar em estratégias de prevenção e promoção da saúde infantil, visto que crianças saudáveis que apresentem algum desvio no desempenho motor devem ser acompanhadas para evitar repercussões negativas tanto emocionais quanto relacionadas ao desempenho escolar e interação social.

Diante disso, os objetivos desta revisão sistemática foram analisar as habilidades motoras de crianças saudáveis de seis a 12 anos, identificar potenciais fatores associados aos déficits no desempenho motor e sintetizar os instrumentos usados para avaliação.

MÉTODOS

Protocolo e registro

Esta revisão sistemática foi realizada com a seleção de artigos segundo as diretrizes do PRISMA (Fokkens et al., 2012), (Arquivo Adicional 1), com protocolo registrado no PROSPERO (PROSPERO, n.d.) (CRD42017067634).

Fontes de informação

Dois revisores independentes realizaram a busca nas bases de dados *Medical Literature Analysis and Retrievel System Online* (PubMed — MEDLINE), *Scientific Electronic Library Online* (SciELO) e Literatura Latino-americana e do Caribe em Ciências da Saúde (LILACS). Um terceiro revisor participou quando houve divergência entre os revisores.

Estratégia de busca

A busca foi realizada com a combinação da seguinte forma (em inglês, português e espanhol): (healthy child) OR (healthy children) AND (motor skills) OR (psychomotor performance) OR (motor performance); (criança saudável) OR (crianças saudáveis) AND (habilidade motora) OR (desempenho psicomotor) OR (desempenho motor); e (niño sano) OR (niños sanos) AND (destreza motora) OR (desempeño psicomotor) OR (desempeño motor). Foram utilizadas as palavras incluídas no *Medical Subject Headings (Mesh)* ou Descritores em Ciências da Saúde (DeCS) e não cadastradas, mas encontradas em artigos publicados (Quadro 1).

Critério de elegibilidade

Os estudos foram selecionados de acordo com os seguintes critérios:

- Participantes (Population): crianças saudáveis de qualquer sexo e qualquer região geográfica;
- Exposição (Exposure): que estejam matriculadas em ambiente escolar;
- Grupo Controle (Control Group): sem grupo controle;
- Resultados (Outcomes): habilidades motoras;
- Desenho do Estudo (Study Design): estudos transversais, nos quais foram utilizados instrumentos de habilidades motoras gerais ou específicos.

Os critérios de inclusão foram: artigos originais transversais; artigos publicados entre 01 de janeiro de 1997 e 18 de dezembro de 2018; estudos que avaliaram as habilidades motoras de crianças saudáveis de seis a 12 anos de idade; estudos que utilizaram instrumentos de avaliação gerais e específicos para habilidades motoras; estudos que utilizaram instrumento validado; artigos publicados em Português, Inglês ou Espanhol.

Quanto aos critérios de exclusão temos: estudos que utilizaram instrumentos para avaliação das habilidades motoras por meio de entrevista com os responsáveis; estudos que avaliaram crianças prematuras, com distúrbios ou com excesso de peso; estudos que não concluíram sobre as habilidades motoras em geral; e estudos que realizaram comparações entre crianças praticantes e não praticantes de esporte fora das aulas de educação física/projetos sociais e esportivos; uso parcial de instrumentos; e uso de instrumentos não validados.

Seleção dos estudos

Após a busca os dois revisores realizaram a leitura de títulos e resumos, com base nos critérios selecionaram os artigos elegíveis. Na sequência, os artigos foram lidos na íntegra de forma independente também. Nos casos em que houve divergência um terceiro revisor auxiliou na tomada de decisão. Foram incluídos apenas os artigos que atenderam aos requisitos e critérios desta revisão sistemática. Foi realizada busca manual com o objetivo de esgotar a literatura e ampliar o alcance desta revisão sistemática. Esse recurso viabilizou a identificação de artigos elegíveis que podem não ter sido recuperados pela estratégia de busca e pode ser realizada pela verificação de listas de referências bibliográficas

Quadro 1. Descrição da estratégia de busca utilizada.

Base de dados	Descritores	Filtros	Idiomas	Período
Lilacs	(tw:(criança saudável)) OR (tw:(crianças saudáveis)) AND (tw:(habilidade motora)) OR (tw:(desempenho psicomotor)) OR (tw:(desempenho motor)) (tw:(niño sano)) OR (tw:(niños sanos)) AND (tw:(destreza motora)) OR (tw:(desempeño psicomotor)) OR (tw:(desempeño motor)) (tw:(healthy child)) OR (tw:(healthy children)) AND (tw:(motor skills)) OR (tw:(psychomotor performance)) OR (tw:(motor performance))	"child" "article"	Inglês Espanhol Português	01/01/1997 A 18/12/2018
Pubmed	((crianca[All Fields] AND saudavel[All Fields]) OR (crianca[All Fields] AND saudaveis[All Fields]) AND (habilidades[All Fields] AND motora[All Fields]) OR (desempenho[All Fields] AND psychomotor[All Fields]) OR (desempenho[All Fields] AND motor[All Fields])) ((nino[All Fields] AND sano[All Fields]) OR (ninos[All Fields] AND sanos[All Fields])) AND (destrezas[All Fields] AND motora[All Fields])) OR (desempeno[All Fields] AND psychomotor[All Fields])) OR (desempeno[All Fields] AND motor[All Fields]) (("Healthy Child"[All Fields] OR "Healthy Children"[All Fields]) AND ("Motor Skills"[Mesh] OR "Psychomotor Performance"[Mesh] OR "Motor Performance"[All Fields]))	"child"		
Scielo	(criança saudável) OR (crianças saudáveis) AND (habilidade motora) OR (desempenho psicomotor) OR (desempenho motor) (niño sano) OR (niños sanos) AND (destreza motora) OR (desempeño psicomotor) OR (desempeño motor) (healthy child) OR (healthy children) AND (motor skills) OR (psychomotor performance) OR (motor performance)	"research article"		

ou pela busca diretamente em revistas científicas (Galvão, Sawada, & Trevizan, 2004; Brasil, 2012).

Extração de dados

Os estudos relevantes para inclusão foram identificados por revisores independentes, que leram os títulos e resumos e os avaliaram de acordo com os critérios de inclusão. Os textos completos de qualquer um identificado como sendo potencialmente relevante foram avaliados e uma decisão final foi tomada se eles atendem aos critérios de inclusão. Em caso de desacordo, os revisores discutiram o assunto para chegar a um acordo, ou um terceiro revisor foi consultado para auxiliar na tomada de uma decisão.

Os dois revisores extraíram os dados dos artigos utilizando um formulário em que preencheram informações como citação, ano, país do estudo, idioma, delineamento do estudo, amostra (exemplo: idade, sexo), instrumentos de avaliação motora utilizados, principais resultados motores (média e desvio padrão do desempenho nos testes) e conclusões sobre as habilidades motoras. Para gerenciamento de dados foram utilizadas planilhas do *Microsoft Excel*®. O mesmo formulário de extração de dados foi utilizado pelos dois revisores.

Qualidade metodológica

A qualidade dos estudos incluídos foi avaliada por meio do *Checklist for Analytical Cross Sectional Studies* do *Joanna Briggs Institute* (JBI) (Arquivo Adicional 2) (Moola et al., 2017). Dois autores avaliaram a qualidade metodológica e as divergências foram sanadas por meio de discussão e consenso. Os estudos que atenderam aos requisitos do JBI (≥ 7 pontos) foram considerados de "alta" qualidade e baixo risco de viés. Aqueles que apresentaram falhas que não comprometessem a qualidade da pesquisa foram classificados como "média" qualidade e risco de viés moderado (JBI de 5 a 6 pontos). Os artigos considerados com "baixa" qualidade foram aqueles com graves falhas e alto risco de viés (JBI 4≤ pontos) (Higginbottom et al., 2015; Catalá-López et al., 2019). Os estudos não foram excluídos com base na análise da qualidade metodológica, essa avaliação foi utilizada para descrever o perfil de qualidade dos estudos incluídos.

Análise estatística

Para análise de concordância entre os revisores independentes após leitura dos resumos e após leitura dos artigos foi utilizado o Coeficiente Kappa, no *Statistical Package for Social Science* versão 23.0. O critério de significância adotado foi de $\alpha = 0,05$, $p < 0,05$. Os resultados dos Kappa foram assim interpretados: valores ≤ 0, ausência de concordância; 0,01-0,20 como nenhuma a pouca concordância; 0,21-0,40 como razoável; 0,41-0,60 como moderada; 0,61-0,80 como substancial; 0,81-1,00 como concordância quase perfeita (McHugh, 2012; Soneson et al., 2019).

RESULTADOS

Na busca inicial foram encontrados 4.746 estudos, dos quais 77 foram oriundos de busca manual. Após exclusão dos duplicados (n= 1.547), 3.199 resumos foram lidos, selecionando-se 165 artigos para leitura na íntegra. Aplicando os critérios de elegibilidade 154 foram excluídos, o que resultou em 11 artigos para serem analisados (Figura 1).

A análise de concordância entre os revisores revelou "concordância substancial" na etapa de leitura dos resumos (Kappa= 0,72, $p < 0,001$) e "concordância moderada" na etapa

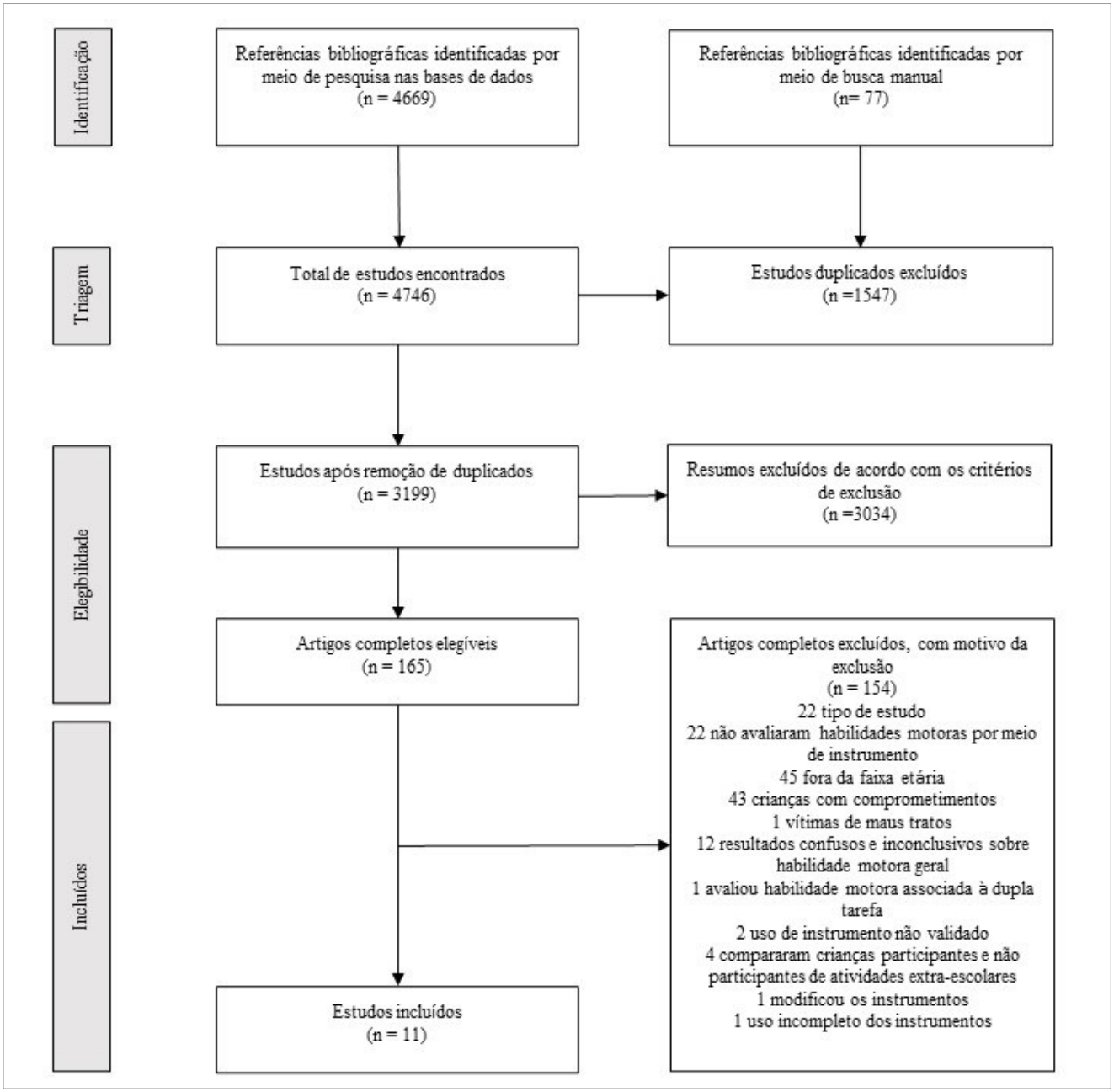

Figura 1. Fluxograma PRISMA dos estudos selecionados.

de leitura dos artigos na íntegra (Kappa= 0,60, p< 0,001). A maioria dos estudos incluídos foi desenvolvida no Brasil (n= 8). A classificação da análise de qualidade metodológica foi a seguinte: 05 baixa e 06 média (Quadro 2).

As habilidades motoras foram consideradas adequadas (ou seja, esperadas para idade), em cinco artigos (Gorla et al., 2008; Krebs, Duarte, Nobre, Nazario & Santos, 2011; Santos & Vieira, 2013; Silva & Beltrame, 2013; Capistrano et al., 2016) e insatisfatórias em seis (Villwock & Valentini, 2007; Lopes, Lopes, Santos, & Pereira, 2012a; Romanholo, Baia, Coelho, & Carvalhal, 2013; Nobre, Coutinho, & Valentini, 2014; Lopes et al., 2015; Mukherjee, Ting Jamie, & Fong, 2017; De Meester et al., 2018).

Seis pesquisas fizeram comparação entre sexos (Villwock & Valentini, 2007; Gorla et al., 2008; Silva & Beltrame, 2013; Nobre et al., 2014; Lopes et al., 2015; Capistrano et al., 2016; Mukherjee et al., 2017), quatro das quais concluíram que os meninos obtiveram melhor desempenho, e enquanto um concluiu que meninos e meninas conquistaram melhores desempenhos em diferentes subtestes (meninos obtiveram melhor habilidade em Lançar e Receber e as meninas em Equilíbrio e Destreza Manual).

Uma pesquisa investigou interação entre o estresse, a imagem corporal e a coordenação motora grossa em escolares. Nesse estudo os participantes com baixo desempenho na coordenação motora apresentaram também níveis de estresse médios a elevados e distorção de sua imagem corporal (Romanholo et al., 2013).

Um dos estudos incluídos além da avaliação quantitativa das habilidades motoras realizou uma análise de elementos do macrossistema em que as crianças estavam inseridas (riscos, estruturas de oportunidades, recursos, opções de vida, estilo de vida, intercâmbio social e sistema de crianças). Esse aspecto do artigo trouxe reflexões com maior amplitude ao se pensar no meio em que a criança está inserida. Os resultados encontrados revelaram que houve: estrutura física inexistente para práticas motoras orientadas na maioria das escolas; violência como fator inibidor ou limitador das práticas motoras; falta de recursos materiais e de propostas didático-pedagógicas visando o desenvolvimento motor; déficit nas oportunidades para a prática; baixa capacitação docente (Nobre et al., 2014).

Quanto à escolha dos testes de avaliação, quatro instrumentos foram empregados para avaliação das habilidades motoras das crianças: *Test for Gross Motor Development Second Edition* – TGMD-2, o mais utilizado (n= 7); *Koperkoordination test fur Kinder* (KTK) (n= 2); *Movement Assessment Battery for Children* Second Edition – MABC-2 (n=2); e *Movement Assessment Battery for Children – MABC* (n= 1). (Tabela 1). Em um estudo foram utilizados dois instrumentos, TGMD-2 e KTK.

Ao analisar os domínios em cada um dos instrumentos, observou-se que os mais frequentes foram equilíbrio (estático e dinâmico) e controle do objeto. As habilidades motoras finas e grossas estão presentes em dois instrumentos (Tabela 1). O desempenho nesses domínios revelou que em seis artigos as crianças estão abaixo do esperado e em cinco artigos as crianças tiveram desempenho satisfatório. Quanto ao desempenho por domínios nas habilidades motoras, foi possível observar em dois estudos que escore mais elevados foi em locomoção (corrida, passada e galope). As habilidades em que houve maior dificuldade motora foram controle do objeto, habilidades manuais e com bola.

DISCUSSÃO

Esta revisão sistemática incluiu 11 estudos com dados coletados no Brasil, Portugal, Estados Unidos e Singapura perfazendo um total de 2.951 crianças avaliadas. Em sete artigos crianças hígidas apresentaram atraso, totalizando 1.533 crianças. Foram encontrados quatro instrumentos para avaliação das habilidades motoras, sendo o TGMD-2 o mais frequente. Distorção da percepção corporal, estresse (Romanholo et al., 2013), violência no ambiente e sistema de crenças dos pais, ausência de estrutura física e oportunidades para práticas motoras (Nobre et al., 2014) contribuíram para pior desempenho motor de crianças. Contudo, o fator mais frequentemente associado a desempenho inferior foi sexo feminino.

As crianças dos estudos que constataram desempenho motor satisfatório possivelmente encontravam-se no estágio maduro do movimento fundamental e início da fase especializada das habilidades motoras (Krebs et al., 2011). Ao contrário, as crianças com habilidades motoras insatisfatórias podem ter sofrido influência de fatores externos que comprometeram o desenvolvimento adequado de suas potencialidades (Romanholo et al., 2013).

A partir disso, pode-se afirmar que é primordial que é primordial que sejam colocadas em práticas políticas públicas de incentivo à promoção, prevenção e estimulação do desenvolvimento infantil, visto que crianças típicas de diferentes nacionalidades apresentam comprometimento motor (Suyama et al., 2020; Jaikaew & Satiansukpong, 2021; Licari et al., 2021).

Os fatores associados às habilidades motoras nos estudos incluídos foram: sexo; percepção da imagem corporal e estresse. Os meninos apresentaram melhor habilidade motora quando comparados às meninas em três estudos (Villwock & Valentini, 2007; Gorla et al., 2008; Nobre et al., 2014) e em uma pesquisa meninos e meninas apresentaram desempenho

Quadro 2. Característica das habilidades motoras das crianças nas pesquisas (*n*= 11).

Lista de Artigos - Avaliação das habilidades motoras de crianças de 6 a 12 anos: revisão sistemática.					
Referência - País (Idioma)	Objetivo e Delineamento	Amostra e Instrumento de avaliação motora	Resultados principais (habilidades motoras)	Conclusões (habilidades motoras)	Qualidade JBI
Gorla et al. (2008) - Brasil (Português)	Avaliar a coordenação corporal de crianças da área urbana do Município de Umuarama-PR Estudo transversal	283 crianças (6 a 8 anos) Köperkoordinationtest für Kinder (KTK)	Trave Equilíbrio 6 anos: 49.90± 12.16 [Meninas: 50.19± 12.72; Meninos: 46.66± 11.28] 7 anos: 49.37± 11.1 [Meninas: 50.53± 11.30; Meninos: 48.11± 10.8] 8 anos: 31.5± 12.27 [Meninas: 53.38± 10.88; Meninos: 50.84± 13.47] Salto Monopedal 6 anos: 34.24± 10.65 [Meninas: 36.66± 10.67; Meninos: 30.0± 9.58] 7 anos: 38.34± 11.1[Meninas: 40.16± 9.56; Meninos: 36.65± 8.88; "t" cal= 2.622 (significativo), meninos com melhor desempenho] 8 anos: 42.13± 11.65 [Meninas: 41.81± 8.82; Meninos: 42.43± 13.91] Salto Lateral 6 anos: 36.27± 8.87 [Meninas: 38.38± 8.12; Meninos: 32.58± 9.26] 7 anos: 41.88± 9.96 [Meninas: 42.25± 10.09; Meninos: 41.48± 9.86] 8 anos: 43.5± 10.04 [Meninas: 45.11± 9.84; Meninos: 41.95± 10.09] Transferência sobre plataforma 6 anos: 28.0± 5.60 [Meninas: 31.0± 4.42; Meninos: 28.25± 6.38] 7 anos: 31.0± 6.2 [Meninas: 31.85± 6.65; Meninos: 30.07± 5.55] 8 anos: 31.47± 7.35 [Meninas: 31.67± 6.94; Meninos: 31.28± 7.78]	Superioridade na maioria dos testes em favor da população Brasileira nas idades de 6 e 7 anos. Quanto ao sexo, houve diferença significativa no Salto monopedal aos 7 anos em favor dos meninos.	Baixa
Lopes et al. (2012a) Portugal (Português)	Verificar a relação entre a atividade física habitual, habilidades motoras fundamentais e a coordenação motora de crianças Estudo transversal	21 crianças (6 a 7 anos) 1)Test of Gross Motor Development, Second Edition (TGMD-2) 2) Körperkoordination Test für Kinder (KTK)	TGMD-2 Locomoção Média= 41.43 ± 3.91 Controle de Objeto Média= 32.86 ± 6.81 TGMD-2 Total Média= 19.48 ± 3.44 TGMD-2 Percentis (%) Locomoção < P50=23.80; ≥ P50 e < P75= 42.9; > P75= 33.3 Controle do objeto < P50= 71.4; ≥ P50 e < P75= 23.8; > P75= 4.8 Total < P50= 61.9; ≥ P50 e < P75= 23.8; > P75= 14.3 KTK - Quociente motor Média=84.86± 12.44; 52.4% insuficiência da coordenação	Resultados sugestivos de insuficiências da coordenação e pobre desenvolvimento das habilidades motoras fundamentais.	Baixa
Silva et al. (2013) - Brasil (Português)	Caracterizar as crianças quanto à presença do indicativo de Transtorno do Desenvolvimento da Coordenação - TDC. Estudo transversal	406 crianças (7 a 10 anos) Movement Assessment Battery for Children (MABC)	Percentual de indicativo de TDC:11.1% [Meninos=1 6 (9.1%); Meninas= 29 (12.6%)] Risco de TDC: 16.7% [Meninos= 32 (18.3%); Meninas= 33 (14.3%)] Sem dificuldades motoras: 72.2% [Meninos= 127 (72.6%); Meninas= 169 (73.2%)] 7 e 8 anos [TDC: 9 (5.5%); Risco de TDC: 17 (10.3%); Sem TDC: 139 (84.2%)] 9 e 10 anos [DCD: 36 (14.9%); Risco de TDC: 51 (21.2%); Sem TDC: 154 (63.9%), *p*= 0.0001, *V*= 0.224]	A maioria não apresentou dificuldades. Alta prevalência do indicativo de TDC foi de 11,1%. Maior prevalência de TDC entre as crianças mais velhas (9 e 10 anos). Não houve associação significante entre sexo.	Média

Continua...

Quadro 2. Continuação.

Lista de Artigos - Avaliação das habilidades motoras de crianças de 6 a 12 anos: revisão sistemática.					
Referência - País (Idioma)	Objetivo e Delineamento	Amostra e Instrumento de avaliação motora	Resultados principais (habilidades motoras)	Conclusões (habilidades motoras)	Qualidade JBI
Capistrano et al. (2016) – Brasil (Português)	Analisar a relação entre o desempenho motor e a aptidão física de escolares Estudo transversal	98 crianças (7 a 10 anos) Movement Assessment Battery for Children Second Edition (MABC-2)	Escore Equilíbrio Meninos Média= 30.05± 7.02; Meninas Média= 32.25± 5.52 Escore Destreza Manual Meninos Média= 21.66± 6.59; Meninas Média= 23.51± 5.46 Escore Lançar e Receber Meninos Média= 21.34± 4.88; Meninas Média= 18.98± 4.22 Pontuação total MABC-2 Meninos Média= 73.05± 13.,84; Meninas Média= 74.74± 10.84 Dificuldade motora: 5.9% Risco para dificuldade: 13.9% Sem dificuldade: 80.2%	A maioria não apresentou dificuldades motoras. Meninos obtiveram melhor desempenho em Lançar e Receber. Meninas apresentaram melhor desempenho em Equilíbrio, Destreza Manual e Pontuação Total na MABC-2 .	Média
Santos et al. (2013) - Brasil (Português)	(1) investigar a prevalência de potencial TDC (2) investigar em que tarefas motoras as crianças com provável TDC e risco de TDC apresentam maior dificuldade motora. Estudo transversal	581 crianças (7 a 10 anos) Movement Assessment Battery for Children (MABC)	Desenvolvimento típico: 454 (78.1%) [7 anos: 119(74.8%); 8 anos: 124(81.1%); 9 anos: 134 (77.4%); 10 anos: 77 (80.2%)] Risco de TDC: 61 (10.5%) [7 anos: 14(8.8%); 8 anos: 21(13.7%); 9 anos: 20(11.6%); 10 anos: 6(6.3%)] Provável TDC: 66 (11.4%) [7 anos: 26 (16.4%); 8 anos: 8(5.2%); 9 anos: 19(11.0%); 10 anos: 13(13.5%)	A maioria classificada como desenvolvimento típico. Houve maior prevalência de possível TDC aos 7 e 10 anos e risco de TDC aos 8 e 9 anos, com maior dificuldade em habilidades com bola e manual.	Média
Krebs et al. (2011) - Brasil (Português)	Investigar a relação entre os escores de desempenho motor e aptidão física de crianças eutróficas Estudo transversal	50 crianças (7 e 8 anos) Test for Gross Motor Development Second Edition (TGMD-2)	TGMD-2 % abaixo da mediana Corrida lateral (48%); Rebater (46%); Arremesso por cima (34%) % mediana Correr (98%); Galopar (44%); Passada (98%); Salto Horizontal (52%); Chutar (88%); Arremesso por cima (34%); Arremesso por baixo (46%). % acima da mediana Salta com 1 pé (44%); Quicar (48%)	A maioria das crianças encontra-se na mediana ou acima da mediana, demonstrando padrões de movimento esperados para idade.	Média
Nobre et al. (2014) - Brasil (Português)	Descrever e explicar os processos proximais para o desenvolvimento de habilidade motoras fundamentais em escolares Estudo transversal	104 crianças (7 a 10 anos) Test for Gross Motor Development Second Edition (TGMD-2)	TGMD-2 Locomoção - esperado: 42 pontos (Meninos: 24.0± 5.5; Meninas: 23.2± 5.1) Controle do Objeto - esperado: 42 para meninos e 38 para meninas (Meninos: 26.7± 6.0; Meninas: 22.2± 6.0, $p< 0.001$) Locomoção (crianças abaixo do percentil 5: 95.1%, atraso motor) Controle do Objeto (crianças abaixo do percentil 5: 81.7%, atraso motor)	Meninas apresentaram desempenho inferior em Controle do Objeto. Toda amostra apresentou atraso motor.	Baixa

Continua...

Quadro 2. Continuação.

Lista de Artigos - Avaliação das habilidades motoras de crianças de 6 a 12 anos: revisão sistemática.					
Referência - País (Idioma)	Objetivo e Delineamento	Amostra e Instrumento de avaliação motora	Resultados principais (habilidades motoras)	Conclusões (habilidades motoras)	Qualidade JBI
Romanholo et al. (2013) - Brasil (Português)	Analisar a interação entre a imagem corporal, o estresse e a coordenação motora grossa em escolares. Estudo transversal	192 meninos (7 a 10 anos) Test for Gross Motor Development Second Edition (TGMD-2)	TGMD-2 Locomoção: 3.0± 1.45 Controle: 2.5± 0.42 Total: 6.0± 2.34	Amostra abaixo da média do ponto de corte.	Média
Villwock e Valentini (2007) - Brasil (Português)	Investigar a percepção de competência, a orientação motivacional e a competência motora em crianças. Estudo transversal	298 crianças (8 a 10 anos) Test for Gross Motor Development Second Edition (TGMD-2)	Coeficiente de Motricidade Ampla: 62.83± 8.94 Meninos: 5.27± 0.67; Meninas: 4.38± 0.69; $p< 0.001$	Desempenho geral classificado como muito pobre. Meninos apresentaram competência motora superior	Baixa
De Meester et al. (2018) – Estados Unidos (Inglês)	(1) se há evidências de um limiar da Competência Motora real, abaixo do qual uma criança tem menor probabilidade de atingir 60 min de atividade física moderada a vigorosa (AFMV) por dia e (2) se a Competência Motora percebida media a relação entre a Competência Motora real e a porcentagem de crianças que atendem às diretrizes da AFMV. Estudo transversal	326 crianças (6 a 11 anos) Test for Gross Motor Development Second Edition (TGMD-2)	Percentil médio= 19.15± 22.3. Componente Motor Baixo= 8.30(7.92) Componente Motor Médio= 42.55(7.84) Componente Motor Alto= 74.59(8.60) Componente Motor Baixo =248 (76.07%) [Meninas= 124; Meninos= 124] Componente Motor Médio= 51 (15.64%) [Meninas= 28; Meninos= 23] Componente Motor Alto= 27 (8.28%) [Meninas= 16; Meninos= 11]	A maioria das crianças apresentou componente motor baixo.	Baixa
Mukherjee et al. (2017) - Singapura (Inglês)	(1) medir, descrever e relatar habilidades motoras fundamentais (2) comparar as habilidades motoras fundamentais de crianças de Singapura e dos EUA e (3) testar a hipótese de que a proficiência nas habilidades motoras fundamentais melhora com a exposição ao currículo e ao ambiente de Educação Física escolar. Estudo transversal	244 crianças (6 a 10 anos) Test for Gross Motor Development Second Edition (TGMD-2)	6 anos - 6 anos e 5meses Meninos (Quociente Motor Grosso= 85.75± 10.24); Meninas (Quociente Motor Grosso= 80.15± 7.60) 6-6 a 6-11 Meninos (Quociente Motor Grosso= 82.71± 10.40); Meninas (Quociente Motor Grosso= 85.28± 9.71) 7 anos Meninos (Quociente Motor Grosso= 75.70± 6.70); Meninas (Quociente Motor Grosso= 78.00± 7.23) 8 anos Meninos (Quociente Motor Grosso= 77.00± 9.36); Meninas (Quociente Motor Grosso= 80.29± 9.68) 9 anos Meninos (Quociente Motor Grosso= 79.18± 8.15); Meninas (Quociente Motor Grosso= 78.76± 10.31)	As crianças de Singapura apresentaram atrasos em comparação ao TGMD2 (USA). Não houve diferença significativa entre sexos.	Média

±: desvio padrão; n: frequência; TGMD-2: Test of Gross Motor Develoment Second Edition; KTK: Körperkoordinationstest Für Kinder; MABC-2: Movement Assessment Battery for Children Second Edition; MABC: Movement Assessment Battery for Children; TDC: Transtorno do Desenvolvimento da Coordenação.

Tabela 1. Domínios das habilidades motoras avaliados pelos instrumentos/avaliações encontrados nos estudos incluídos.

Domínio	Número de instrumentos	Instrumentos em que o domínio está presente
Habilidades motoras finas (destreza manual)	2	Movement Assessment Battery for Children (MABC) Movement Assessment Battery for Children 2nd (MABC-2)
Equilíbrio (estático; dinâmico)	3	Movement Assessment Battery for Children (MABC) Movement Assessment Battery for Children 2nd (MABC-2) Koperkoordinationtest fur Kinder (KTK)
Habilidades motoras grossas (habilidade de locomoção; saltos monopedais; saltos laterais; transferência lateral sobre plataformas)	2	Test for Gross Motor Development 2nd Edition (TGMD-2nd) Koperkoordinationtest fur Kinder (KTK)
Habilidade de controle de objeto (Alvo & Precisão; habilidade com bola)	3	Movement Assessment Battery for Children (MABC) Movement Assessment Battery for Children 2nd (MABC-2) Test for Gross Motor Development Second Edition (TGMD-2)

TGMD-2: Test of Gross Motor Develoment Second Edition; KTK: Körperkoordinationstest Für Kinder; MABC-2: Movement Assessment Battery for Children Second Edition; MABC: Movement Assessment Battery for Children.

superior em tarefas diferentes, em que meninos obtiveram melhor habilidade em Lançar e Receber e as meninas em Equilíbrio e Destreza Manual (Capistrano et al., 2016). O desempenho superior dos meninos pode ser devido a maior resistência de força (Gorla et al., 2008) e ao maior incentivo destinados a eles para realizar atividades motoras desde a primeira infância (Villwock & Valentini, 2007). O envolvimento das meninas em atividades que estimulem sua capacidade motora necessita ser encorajado para que elas se sintam desafiadas e motivadas a desenvolver suas habilidades motoras (Villwock & Valentini, 2007). A atuação de professores, profissionais de saúde e pais nesse momento é decisiva. O apoio dos pais é considerado um componente de engajamento em atividades motoras (De Meester et al., 2018).

Uma das pesquisas incluídas revelou relação entre estresse e desempenho insatisfatório na coordenação motora. Sabe-se que crianças com dificuldades motoras estão associadas a problemas com controle das emoções, isolamento social, reatividade emocional e maior resposta somática (Li, Kwan, King-Dowling, Rodríguez, & Cairney, 2021). Com base nisso, se torna pertinente compreender o contexto em que criança está inserida, incluindo a escola, local onde ela pode estar exposta a tarefas em excesso, irritabilidade do professor, impaciência, falta de comunicação, entre outros (Romanholo et al., 2013).

A exposição a um contexto marcado pela violência tem potencial para afetar o desempenho da criança, seja em ambiente escolar (por meio do bullying) (Martins, Silva, Coelho, Becker, & Oliveira, 2018) ou na sociedade (bairros considerados violentos) (Nobre et al., 2014). Esses dois aspectos podem reduzir a motivação da criança para explorar seus potenciais, seja na prática motora na escola ou na comunidade.

Outro fator decisivo para o desenvolvimento motor adequado se refere às oportunidades, uma vez que poucas oportunidades de prática motora refletem em estagnação da evolução das competências motoras infantis (Villwock & Valentini, 2007).

A criança com dificuldade de coordenação possui tendência a desmotivação diante de atividades físicas e isso repercute em composição corporal inadequada (Melo & Lopes, 2013). Assim, a estimulação da coordenação na infância é determinante na promoção e prevenção do excesso de peso a longo prazo (Lopes et al., 2012b).

Dentre os seis estudos que identificaram crianças com atraso motor, cinco utilizaram o TGMD-2 e um o KTK (que foi utilizado juntamente ao TGMD-2 em um dos artigos). O TGMD-2 visa identificar criança com atraso no desempenho motor amplo. Esse instrumento avalia aspectos motores de forma qualitativa, sendo eles: controle do objeto e locomoção. Tanto o KTK quanto o TGMD-2 avaliam habilidades motoras amplas. O KTK analisa a coordenação e controle do corpo, principalmente equilíbrio dinâmico. O KTK avalia crianças típicas e crianças com dificuldade de aprendizagem, comprometimento neurológico e problemas comportamentais (Cools, Martelaer, Samaey & Andries, 2009).

Um estudo (Gorla et al., 2008) afirma que as diferenças encontradas entre o desempenho das crianças e os dados normativos do teste KTK são justificadas por diferenças culturais, climáticas e hábitos alimentares entre os países Brasil (amostra da pesquisa) e Alemanha (país de origem do instrumento KTK, em que se tem os dados normativos). Tal reflexão ressalta a relevância de se utilizar instrumentos com dados normativos referentes à população alvo. Pesquisas recentes têm sido realizadas visando ampliar o conhecimento sobre as propriedades psicométricas desse teste (Moreira et al., 2019; Santos et al., 2020). O profissional da saúde ou professor de educação física deve ter cautela ao utilizar o teste, visto que

não o KTK não possui dados normativos para população brasileira. Além disso, o profissional deve se manter atualizado e atento à novas descobertas a respeito do teste KTK.

A MABC-2 é indicada para identificar deficiências na função motora de crianças. Além de fornecer dados quantitativos a MABC-2 possibilita uma análise complementar qualitativa das atividades motoras (Henderson, Sugden & Barnett, 2007).

O domínio "equilíbrio" está presente em três instrumentos, portanto, fica evidente a importância desse item na avaliação de habilidades motoras, visto que o equilíbrio compõe o controle postural e proporciona estabilidade em atividades estáticas, durante a locomoção e em movimentos voluntários (Cordeiro et al., 2020). Isso ressalta que é recomendado que o pesquisador ou professor faça a escolha de instrumentos que contenham esse domínio, visto que ele é a base para as diversas habilidades desenvolvidas ao longo da infância. Habilidades motoras finas e habilidades motoras grossas estão presentes em dois testes. O que indica que o examinador tem a opção de utilizar instrumentos que avaliem as habilidades motoras de forma mais ampla.

Em relação à qualidade metodológica dos artigos incluídos, a maioria foi classificada como média ou baixa qualidade. Esse fator ressalta a necessidade de desenvolver pesquisas com maior rigor metodológico, com a identificação de fatores de confusão e formas de lidar com esses fatores; descrição dos critérios de inclusão, descrição da amostra e da exposição de forma detalhada. Esses são alguns aspectos que possibilitam avaliar as habilidades motoras para proporcionar resultados com ausência de risco de viés e que sejam base para intervenções realizadas por profissionais da saúde.

Esta revisão apresenta algumas limitações. A busca foi realizada no período de 20 anos e pode haver publicações anteriores à data de início da coleta que não foram incluídas nesta revisão. Outro fator limitante possui relação com a qualidade metodológica dos estudos. Isso pode fragilizar a análise dos resultados obtidos, visto que pesquisas com média qualidade fornecem resultados com risco de viés metodológico. Contudo, a nossa revisão descreveu os estudos encontrados e identificou a qualidade metodológica cuja análise é de grande utilidade para os pesquisadores da área.

CONCLUSÕES

Em cinco estudos as crianças hígidas de 6 a 12 anos apresentaram habilidades motoras esperadas para idade e em seis estudos as crianças apresentaram atraso. Os estudos incluídos utilizaram quatro instrumentos de avaliação das habilidades motoras e o mais utilizado foi o *Test of Gross Motor Development Second Edition* (TGMD-2). O fator mais comumente associado a pior desempenho foi sexo feminino, além de distorção da percepção corporal e estresse. O estudo que abordou análise qualitativa relata, ainda, a influência negativa da violência no ambiente, ausência de estrutura física e oportunidades para prática. A partir da presente revisão torna-se perceptível que triar as habilidades motoras, seja na escola ou nos centros de saúde da família, proporciona a identificação de desvios do desenvolvimento e possibilita intervenções adequadas visando melhor desempenho motor. Professores e profissionais da saúde que atuam na atenção primária devem estar atentos ao correto estímulo das habilidades motoras de meninas, crianças que apresentem distorção da imagem corporal e aquelas com níveis elevados de estresse. Além de fornecer oportunidades para práticas das habilidades motoras e ambiente seguro para desenvolvê-las. Esses profissionais são ferramentas fundamentais para o adequado acompanhamentos do desenvolvimento das habilidades motoras das crianças escolares.

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REVIEW ARTICLE

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The influence of the pilates method on the quality of life of its practitioners: a systematic review

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ABSTRACT

Created in Germany by Joseph Pilates in the 1920s, the Pilates Method (PM) uses exercises aiming to improve physical health and mental balance. The present work objective was to verify, through a systematic literature review without delineating languages and dates, the influence of PM on the quality of life (QoL) of its practitioners. Medline, Embase, Web of Science, Scopus, and Google Scholar databases were consulted. The articles were independently selected by two researchers, who also conducted the risk of bias assessment of the included articles. Were identified 2489 articles on the databases, of which 30 were included in the study synthesis. The practice of PM improves the QoL of its practitioners, providing enhanced functional capacity, pain relief, and improvement of emotional aspects in individuals of both sexes, different age groups, and different clinical contexts.

KEYWORDS: Pilates method; quality of life; functional capacity; pain; mental health.

INTRODUCTION

The term quality of life (QoL) has never been so popular in our country, precisely because of the current moment the world is going through. However, due to its complexity and use in different areas of study, its definitions are presented in varied ways, and several factors are taken as foundations for its definition, carrying with them a subjective, cultural, and historical essence, having as the primary source of information individuals themselves (Araújo & Bós, 2017).

The World Health Organization (WHO) conceptualized QoL as the individual's perception of their position in life, related to their goals, expectations, standards, and concerns (WHO, 1997).

Due to the conceptual dynamism of the term QoL, numerous factors influence its context. Health-related quality of life encompasses the impact of illnesses as well as the various forms of therapeutic interventions which, under the individual's perception, promote change in their health, whether physical, psychological, social, and/or spiritual (Aguiar et al., 2021).

Pilates Method (PM) appears as a therapeutic intervention model that can contribute to the QoL improvement of its practitioners. Created by the German Joseph Pilates, the method aims to benefit through integration between body and mind, enabling individuals to overcome their limitations and relieve pain and stress (Roh, 2019).

This method principle relies on the execution of integrative movements between body and mind through synchronism between fluidity, concentration, breathing, and muscle contraction (Melo et al., 2020).

Composed of a wide range of exercises that cater to audiences of different age groups and functional profiles, PM aims to stimulate the body to benefit the physical and

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emotional aspects that impact the quality of life of its practitioners (Vilella, León-Zarceño, & Serrano-Rosa, 2017).

Pilates Method is characterized as a complete activity for working the body as a whole, associating physical and mental conditioning, body awareness, postural correction, strength, and flexibility, which, collectively, contribute to the improvement of muscle imbalances, as well as structural and emotional stability of the individual, favouring a healthier life (Bezerra, Araújo, Elizabeth, & Araújo, 2020).

In recent years, research on PM has intensified alongside the dissemination of the method and the increase in practitioners. The method has been increasingly used as a therapeutic and preventive method, with favourable results for improving the QoL of its adherents (Pereira, Flach, & Haas, 2018).

The benefits for QoL with the practice of PM were related to improvement in levels of depression, anxiety, and pain in a study with patients with fibromyalgia (Cordeiro et al., 2020). However, Kim et al. (2019) observed in their study with patients diagnosed with fibromyalgia that flexibility activities — such as those performed in PM — had lower results in terms of QoL when compared to aerobic activities.

The results achieved through PM can motivate its practitioners and be used as an alternative approach to traditional exercises, such as walking. Vancini, Rayes, Lira, Sarro, and Andrade (2017) found that eight weeks (three sessions/week) of Pilates and aerobic training, with monitored and progressively adjusted intensity, had a positive impact on improving general health, self-esteem, emotional and psychological state, mood, and motivation of practitioners.

In sedentary patients, Leopoldino et al. (2013) found that an increase in QoL through the practice of PM was linked to the improvement of sleep quality of the volunteers. In women with postmenopausal osteoporosis, PM contributed to improving QoL by promoting improvement in functional capacity (Küçükçakır, Altan & Korkmaz, 2013).

A similar result was evidenced in research with individuals diagnosed with chronic low back pain, where the practice of PM increased the practitioners' QoL by improving their range of motion and pain (Natour, Cazotti, Ribeiro, Baptista, & Jones, 2015). The practice of PM has also contributed to reducing pain and enhancing the range of motion and functional capacity in patients with juvenile idiopathic arthritis, improving patients' QoL (Mendonça et al., 2013).

Therefore, the choice to carry out a literature systematic review on the influence of PM on the QoL of its practitioners is justified by providing scientific standards. Such standards minimize errors and favour reliable results to synthesize the information provided by different authors in different countries, thus elaborating an important instrument to base the method, health management, and clinical practice (Impellizzeri and Bizzini, 2012).

In this sense, despite varied evidence that indicates the effectiveness of PM for health, the novelty of this study lies in the compilation of information about aspects relating to the influence of PM on the QoL of its practitioners, therefore expanding and updating knowledge about the application of the method and allowing for an expansion of clinical indications.

METHODS

Protocol and registration

This review was developed following the PRISMA 2020 protocol — Preferred Reporting Items for Systematic Reviews and Meta-analyses and was registered in the International Prospective Register of Systematic Reviews (PROSPERO): number CRD42021273295.

Eligibility criteria

Observational and experimental studies may be included, as long as they investigate the relationship between the practice of the Pilates Method in people over 18 years of age and their QoL, without delimiting dates, in any language or location. Review studies, letters to the editors, qualitative analyses, case studies or book chapters, and studies that included people under 18 years of age will be excluded.

Information sources and research strategy

The search strategy was developed based on the Peer Review of Electronic Search Strategies (PRESS) list of recommendations (McGowan et al., 2016) and sent to two investigators for review.

The following databases were used (Appendix 1): MEDLINE, Embase, Web of Science, Scopus and Google Scholar. The search strategy used for MEDLINE was: ("Pilates Practitioners"[Title/Abstract]) OR ("Young People"[Title/Abstract]) OR ("Old People"[Title/Abstract]) OR (Aged[Title/ Abstract]) OR (Elderly[Title/Abstract]) OR (Young[Title/Abstract]) OR Adult [Title/Abstract] AND ("Pilates"[Title/Abstract] OR "Pilates Training"[Title/Abstract] OR " Pilates Based Exercises"[Title/Abstract] OR "Pilates based exercises"[Title/Abstract] OR "Pilates Based Exercises"[Title/Abstract] OR "training Pilates"[Title/Abstract] OR

"Pilates Method"[Title/Abstract]) OR "Motor activity"[Title/Abstract] OR "Pilates Exercise"[Title/Abstract] OR "Pilates Activity" [Title/Abstract] AND ("Quality of life"[Title/Abstract] OR "Lifestyle"[Title /Abstract] OR "Life Quality"[Title/Abstract] OR "health related quality of life"[Title/Abstract] OR "Health Related Quality"[Title/Abstract] OR "HRQOL"[Title/Abstract]) AND (Observational OR "Observational Study" OR Survey OR "Cross - Sectional" OR "Cross sectional" OR Cohort OR Association OR Relationship OR Correlation).

Searches were initiated and finished in May 2021.

Selection of studies and data extraction

The studies were selected in two phases by two researchers independently (FSAS e LCSA). The studies were selected by title and abstract in the first phase, always following the eligibility criteria. In the second phase, the selected articles were fully read, and a selection was made again to see if they would meet the inclusion criteria.

Afterwards, the two investigators (FSAS e LCSA) met to resolve any disagreement about the selection. A search was also carried out in the bibliographic references of the selected articles to verify any possible studies that could be incorporated into this review. The participation of a third researcher was not necessary, as all differences between the two main ones were resolved.

The characteristics of the selected articles were distributed in three tables, with the following information: Author and year; country of study; sample (n sample, sex, and age); evaluated population, study design, and objective; quality of life assessment instruments and respective scores by domains; method of evaluation of the Pilates practice and its respective results; types of statistical tests used, adjustment variables, main results, and one final question: "What is the influence of PM in improving the QoL of its practitioners?".

Risk of bias in individual studies

The instrument recommended by the Joanna Briggs Institute (Moola, Munn, & Tufanaru, 2017) for experimental studies was used to assess the risk of bias.

The instrument for experimental studies consists of thirteen questions: "Was true randomization used to assign participants to treatment groups"; "Was assignment to treatment groups hidden"; "Were treatment groups similar at baseline"; "Were participants blinded to treatment assignment"; "Were those delivering treatment blinded to treatment assignment"; "Were outcome assessors blinded to treatment assignment"; "Were treatment groups treated identically beyond the intervention of interest"; "Was it the full follow-up and, otherwise, were the differences between groups in terms of follow-up adequately described and analyzed"; "Were participants analyzed in the groups in which they were randomized"; "Were outcomes measured in the same way for the treatment groups"; "Were results reliably measured"; "Was appropriate statistical analysis used"; "Were the proper trial design, and any deviations from the standard RCT design (individual randomization, parallel groups), accounted for in the conduct and analysis of the trial."

Questions were answered as "yes", "no", "not clear" or "not applicable". If all answers are "yes" for all items, the risk of bias will be low, and if any item is rated "no," a high risk of bias is expected. This assessment was not used as an eligibility criterion for the inclusion of articles.

RESULTS

Selection of studies

Figure 1 shows the selection steps and the number of final articles included in the review. Appendix 2 shows the excluded articles and the reason for the exclusion (supplementary material).

Study characteristics

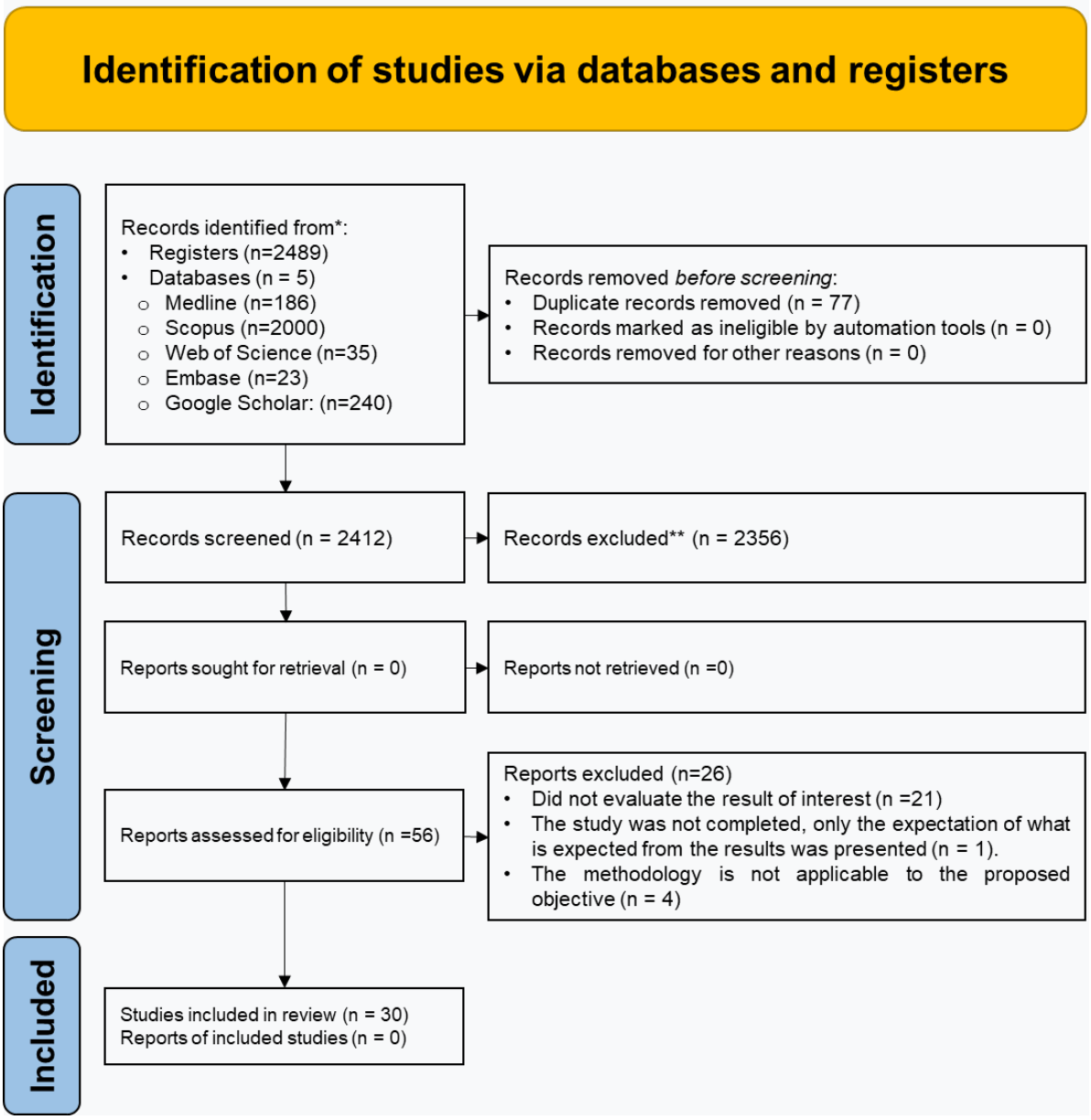
Table 1 presents the general objective of each study and other characteristics. After the selection steps, 30 articles were selected, which included a control group and a group with the intervention performing PM. The studies were published between 2009 and 2020. The studies were carried out in several countries, and the largest number were carried out in Brazil (*n*= 10; 33.33%) and Turkey (*n*= 10; 33.33%). The total sample consisted of 1,624 individuals.

Results of individual studies

Tables 2 and 3 show the results of the relationship between PM and aspects connected to the improvement of the QoL of its practitioners, showing the various instruments used to assess the variables of interest, statistical tests, adjustment variables, and the main outcomes.

Risk of bias in individual studies

Two leading investigators independently (FSAS e LCSA) performed the risk of bias assessment. There were no differences between the two evaluators. Of the 30 articles evaluated, 10.3% (*n*= 3) had a low risk of bias (Appendix 3), with only "yes" answers for all parameters evaluated (Figure 2).



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers); **If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.
Source: Page et al. (2021).

Figure 1. Flow diagram for new systematic reviews which included searches of databases and registers only. Adapted from PRISMA 2020.

DISCUSSION

The present study aimed to identify, through a systematic literature review, the influence of PM on the QoL of its practitioners. From the evaluation of the selected articles, it became evident that the practice of PM improved QoL in individuals of both sexes with different clinical conditions and established diagnoses.

Pilates Method is already recognized for its effectiveness in physical health. Thus, evaluating its importance in the QoL of its practitioners widens the horizon of application of the technique regarding clinical indications for which Pilates can be recommended. Among the selected studies, it was possible to verify scientific productions on the subject in different parts of the world, with a predominance of publications

Table 1. Description of included studies.

Author/Year	Country	Sample (n. sex. age)	Evaluated population	Study design	Aim of the study
Altan, Korkmaz, Bingol, and Gunay (2009)	Turkey	55. Both Sexes. 28 to 69 years. Mean age: 45.23± 10.73.	People with ankylosing spondylitis	Randomized, prospective, controlled, and single-blind trial.	To investigate the effects of Pilates on pain, functional status, and QoL in patients with ankylosing spondylitis.
Angın et al. (2015)	Turkey	41. Female. Age: 40 - 69 years	Women with postmenopausal osteoporosis	Randomized clinical trial.	To investigate the effects of Clinical Pilates Exercises on BMD, physical performance, and QoL in postmenopausal osteoporosis.
Borges et al. (2014)	Brazil	22. Both sexes. 18 to 65 years	Patients with HTLV-1.	Randomized crossover clinical trial	To assess the effect of Pilates exercises on chronic low back pain in these patients and its impact on QoL.
Campos de Oliveira, Gonçalves de Oliveira, Pires-Oliveira (2015)	Brazil	16. Both sexes. Mean age, 63.62± 1.02 years.	Older adults.	Randomized, controlled, clinical trial	To determine the effects of Pilates on lower leg strength, postural balance and the HRQoL of older adults.
Eyigor, Karapolat, Yesil, Uslu, & Durmaz (2010)	Turkey	52. Female. 18 to 75 years.	Female breast cancer patients.	Randomized controlled trial.	To investigate the impact of Pilates exercises on physical performance, flexibility, fatigue, depression, and QoL in women who had been treated for breast cancer.
Gandolfi, Corrente, De Vitta, Gollino, and Mazeto(2012)	Brazil	40. Female. 60 years and older.	Older Women	Longitudinal prospective study with intervention	To evaluate the effects of the Pilates method on QoL and bone remodelling markers in a group of older women.
García-Soidán et al. (2014)	Spain	99. Both Sexes. Mean age: 47.6± 0.8 years.	Middle-Aged People.	Prospective Experimental Study	To evaluate the effects of a 12-week Pilates exercise program in sedentary, middle-aged individuals
Karaman, Yuksel, Kinikli, & Caglar (2017)	Turkey	46. Both Sexes. 55 to 85 years.	Total knee arthroplasty	Prospective, randomized, controlled study with intervention	To investigate the effect of the addition of Pilates-based exercises to standard exercise programs performed after total knee arthroplasty on QoL and balance.
Kheirkhah, Mirsane, Ajorpaz, & Rezaei (2016)	Iran	60. Both sexes. 18 to 70 years. PG: mean age 40.1± 1.8 years.	Patients on Hemodialysis	Clinical trial	To define the effect of Pilates exercise on the QoL of patients on hemodialysis referred to selected hospitals in Kashan.
Kofotolis, Kellis, Vlachopoulos, Gouitas, & Theodorakis (2016)	Greece	101. Female. Age 25–65 years,	Patients with Chronic low back pain	Randomized clinical trial.	To compare the effects of a Pilates program and a trunk strengthening exercise program on functional disability and HRQoL in women with non-specific chronic low back pain.
Vécseyné Kovách, Kopkáné Plachy, Bognár, Olvasztóné Balogh, & Barthalos (2013)	Hungary	54. Both sexes. Mean age 66.4± 6.2 years.	Retired elderly.	Randomly assigned	To measure the effects of Pilates and aqua fitness training on functional fitness and QoL in older individuals.
Küçük, Kara, Poyraz, & İdiman (2016)	Turkey	20. Both Sexes.	Multiple sclerosis patients.	Controlled randomized study.	To determine the effects of clinical Pilates in multiple sclerosis patients.
Küçükçakır et al. (2013)	Turkey	70. Female. 45 to 65 years.	Women with postmenopausal osteoporosis	Randomized, prospective, controlled, and single-blind trial.	To evaluate the effects of the Pilates exercise program on pain, functional status, and QoL in women with postmenopausal osteoporosis.
Lim and Park (2019)	South Korea.	90. Both Sexes. 30 to 40 years.	Yoga Community and Korean Pilates Federation participants.	Randomized clinical trial.	To investigate the effect of Pilates and yoga participation on their functional movement and individual health level.
Liposcki, da Silva Nagata, Silvano, Zanella, & Schneider (2019)	Brazil	24. Female. Pilates Group: Mean age: 63.7± 3.3 years.	Sedentary elderly people	Blind, controlled clinical trial	To verify the effects of a Pilates exercise program on the QoL of sedentary elderly people.
Medeiros et al. (2020)	Brazil	42. Female. 18 to 60 years	Women with fibromyalgia.	Clinical, randomized, and blind trial.	To evaluate the effectiveness of the mat Pilates method for improving symptoms in women with fibromyalgia.

Continue...

Table 1. Continuation.

Author/Year	Country	Sample (n. sex. age)	Evaluated population	Study design	Aim of the study
Natour, Cazotti, Ribeiro, Baptista, and Jones (2015)	Brazil	60. Both Sexes. 18 to 50 years.	Chronic low back pain	Randomized controlled trial	To assess the effectiveness of the Pilates method on patients with chronic non-specific low back pain (LBP).
Odynets, Briskin, and Todorova (2019)	Ukraine	115. Female. 50 and 60 years.	Breast Cancer Surgery Rehabilitation	Randomized, prospective, controlled trial.	To evaluate the effects of different exercise interventions on QoL parameters in breast cancer patients during one year of outpatient rehabilitation.
Oliveira, Oliveira, and Pires-Oliveira (2018)	Brazil	51. Female. 40 to 70 years.	Postmenopausal women.	Randomized controlled clinical trial	To compare the effects of Pilates vs whole-body vibration (WBV) on isokinetic muscle strength and QoL in postmenopausal women.
Oliveira et al. (2019)	Brazil	51. Both Sexes. 18 years and older.	Patients with a confirmed diagnosis of Chikungunya fever.	Blind, controlled clinical trial	To evaluate the effects of the Pilates method on the reduction of pain, improvement of joint function, and QoL of patients with chronic Chikungunya fever.
Özyemişci Taşkiran et al. (2014)	Turkey	58. Both sexes. Mean age 78± 6.8 years.	Elderly living in a nursing home.	Randomized clinical trial.	To investigate whether Pilates and yoga affect QoL and physical performance of elderly subjects living in a nursing home.
Rahimimoghadam, Rahemi, Sadat, & Mirbagher Ajorpaz (2018)	Iran	50. Both sexes. 18 to 65 years.	Patients with chronic kidney diseases	Randomized controlled clinical trial.	To determine the effect of Pilates exercises on the QoL of CKD patients.
Rodrigues, Ali Cader, Bento Torres, Oliveira, & Martin Dantas (2010)	Brazil	52. Female. 60 to 78 years.	Elderly Female	Randomized controlled clinical trial.	To evaluate the effects of the Pilates method on personal autonomy, static balance, and QoL in healthy elderly females.
Saltan and Ankarali (2021)	Turkey	92. Both sexes. 18 to 25 years. PG: Mean age: 18.82± 1.071.	University students.	Randomized controlled trial	To investigate the effects of the Pilates exercise program on HRQoL pain, functional level, and depression status in university students.
Surbala Devi et al. (2013)	India	23. Both Sexes. Mean age: Pilates Group: 57± 5.2 Years; Control Group: 59± 5.5 years.	Sub-Acute Stroke Subjects.	Randomized Controlled	To evaluate the effects of Pilates training on functional balance and QoL in sub-acute Stroke subjects.
Surbala Devi, Ratan, Parth, Bhatt, & Vasveliya (2014)	India	51. Both sexes. PG: mean age: 70.7± 2.7 years.	Elderly.	Blinded prospective randomized controlled.	To compare the effectiveness of PI and CBT in improving functional balance and QoL in elderly individuals.
Vancini, Rayes, Lira, Sarro, & Andrade (2017)	Brazil	63. Both sexes. 18 to 66 years.	Overweight and obese individuals	Randomized blinded and controlled.	To compare the effects of Pilates and walking on QoL, depression, and anxiety levels
Yentür, Ataş, Öztürk, & Oskay (2021)	Turkey	30. Both Sexes. 18 to 65 years.	Rheumatoid arthritis	Randomized clinical trial	To compare the effects of Pilates exercises, aerobic exercises, and combined training, including Pilates with aerobic exercises, on fatigue, depression, aerobic capacity, pain, sleep quality, and QoL.
Yucel and Omer (2018)	Turkey	56. Female. Age: 18 - 65 years.	Women with type 2 diabetes	Randomized clinical trial	To investigate the effects of PBME on glycemic control, anxiety, depression, and QoL in women with type 2 diabetes.
Yun et al. (2017)	Korea	40. Both Sexes. Mean age 63.5± 3.5	Chronic stroke patients	Randomized clinical trial.	To observe the influence of Pilates training on the QoL in chronic stroke patients.

ATR: Angle of trunk rotation; BMD: bone mineral density; CBT: Conventional Balance Training; CKD: chronic kidney diseases; HAM/TSP: HTLV-1–associated myelopathy/tropical spastic paraparesis; HLTV-1: Human T-cell Lymphotropic Virus 1; HRQoL: Health-related quality of life; JIA: Juvenile idiopathic arthritis; MP: Mat Pilates; PBME: Pilates-based mat exercise; PG: Pilates Group; PI: Pilates intervention; pwMS: persons with multiple sclerosis; QoL: Quality of Life; RT: Resistance Training; TC: Tai Chi Chuan; USA: United States of America.

Table 2. Instruments used to assess the quality of life and the practice of Pilates and their respective results.

Author/Year	QoL Instrument	QOL Result-Score	Evaluation method of pilates practice	Pilates practice results
Altan et al. (2009)	ASQOL	**PG before training:** ASQoL: Week 1: 3.7± 4.6; **PG after training:** Week 12:4± 4.9; Week 24: 4± 4.8.	Three sessions/ week. For 1 hour. 12 weeks.	In the Pilates group, ASQoL BASFI, BASMI, BASDAI, and chest expansion scores improved.
Angın et al. (2015)	QUALEFFO-41	**PG before training:** Pain:77.09± 10.33; DA:89.28± 6.83; HW: 73.14± 11.72; Mobility:84.43± 8.20; SA: 62.01± 12.22; GH:52.05± 9.24; MF:60.20± 10.19. **PG after training:** Pain:63.18± 12.30; DA:81.60± 13.79; HW: 62.27± 15.47; Mobility: 73.12± 13.22; SA: 39.98± 14.81; GH: 35.07± 12.83; MF: 51.95± 10.09.	Three sessions/ week, for 1 hour. 24 weeks	Pilates Exercise effectively increases BMD, QoL, walking distance, and is also beneficial to relieve pain. Physiotherapists can use Pilates Exercises for the subjects with osteoporosis in the clinics.
Borges et al. (2014)	SF-36	**PG before training:** PI:7.18± 2.35; PF:23.18± 14.88; PRF: 18.18± 31.80; BP: 31.82± 14.75; GHP: 46.36± 24.13; VIT: 23.18± 18.20; SRF: 46.59± 30.15; ERF: 33.36± 42.19; MH: 56.73± 24.71. **PG after training:** PI: 3.45± 2.54; PF:41.82± 20.16; PRF:72.73± 32.51; BP:60.64± 20.11; GHP: 52.73± 25.73; VIT: 56.36± 22.70; SRF: 69.312± 20.43; ERF: 63.65± 40.71; MH: 69.82± 25.45.	Two sessions/week, for 1 hour. 15 weeks.	To sum up, Pilates proved to be a useful tool for reducing self-reported LBP, which is the most common complaint of patients infected by the HTLV-1 and has a significant impact on their QoL.
Campos de Oliveira et al. (2015)	SF-36 - Brazilian version	PG after training: PF:93,4± 10,9; PRF: 93,4± 10,9; Pain: 90.3± 12.4; GHS: 87.2± 11.8; VIT: 90.9± 9.8; SRF: 91.6± 8.7; ERF: 95.8± 16.7; MH: 90.2± 12.7.	Two sessions/week, for 1 hour. 12 weeks.	PG participants showed improved posture and increased HRQL scores.
Eyigor et al. (2010)	EORTC QLQ-C30 and EORTC QLQ BR23	**PG before training:** EORTC QLQ-C30-Functional: 77.07± 14,96; EORTC QLQ-C30 - Symptom: 18.98± 12.18; EORTC QLQ-C30-Global: 70.16± 20.58; EORTC QLQ-C30 BR 23 functional: 77.81± 16.62 EORTC QLQ-C30 BR 23 Symptom: 21.11± 15.28 **PG after training:** EORTC QLQ-C30-Functional: 83,26± 14,70; EORTC QLQ-C30- Symptom: 20,89± 21,49; EORTC QLQ-C30-Global: 77,02± 21,81; EORTC QLQ-C30 BR 23 functional: 84,39± 10,47; EORTC QLQ-C30 BR 23 Symptom: 17,35± 18,20.	Three sessions/ week, for 1 hour. Eight weeks.	After the Pilates sessions, QoL scores improved in group 1, and symptom scores decreased.
Gandolfi et al. (2012)	SF-36	**PG before training:** PF: 67.50± 18.88; PR: 67.50± 39.82; SF: 46.88± 13.37; ER: 65.00± 45.21; GH:75.50± 9.45; VIT: 68± 21.55; MH: 70.60± 24.36; BP: 51± 6.41; PCS:65.00± 14.39; ECS: 60.83± 19.47; Total: 64± 13.41. **PG after training:** PF: 86.25± 0.58; PR: 100.00± 0.00; SF: 42.50± 13.69; ER: 100.00± 0.00; GH: 79.25± 6.34; VIT: 82.50± 14.28; MH: 79.80± 19.31; BP: 50.50± 5.10 PCS: 79.70± 3.83; ECS: 74.10± 8.37; Total: 77.60± 4.86	One session/week, for 50 min. 20 weeks.	The group of women undergoing Pilates showed an improvement in the QoL domains compared to the CG.
García-Soidán et al. (2014)	SF-36	**PG before training (M1 - Mean± SE):** FC: 77.4± 1.26; PHA: 78.9± 0.86; BP: 77.6± 0.85; GH: 63.3± 0.0,49; VIT: 52.2± 0.48; SA: 72.7± 0.15; EA: 44.2± 0.21; MH: 59.6± 0,10. **PG before training (M1 - Mean±SE) FC:** 87.6± 1.16; PHA: 86.6± 0.75; BP: 66.1± 0,90; GH: 81.0± 1.51; VIT: 71.0± 0.12; SA: 85.2± 1.30; EA: 75.3± 8,9; MH:73.4± 8.9.	Twelve weeks, two times a week, 1 hour per session.	Those in the Pilates group had an increase in QoL, general physical activity and sleep duration, and a decrease in sleep latency.
Karaman et al. (2017)	SF-36	**PG before training:** PF: 28.8± 13.8; PRL: 11.8± 26.7; Pain: 16.6± 17.5; GH: 69.3± 17.8; VIT: 36.2± 23.0; SF: 56.6± 38.6; ERL: 17.6± 35.6; MH: 47.8± 23.0; MCS: 38.8± 12.0; PCS: 30.9± 3.8; BBS: 36.9± 4.5. **PG after training:** PF: 67.6± 18.9; PRL: 64.2± 39.5; Pain: 59.1± 25.2; GH: 81.0± 16.8; VIT: 67.1± 20.4; SF: 81.6± 27.6; ERL: 76.5± 40.4; MH: 76.2± 15.8; MCS: 53.6± 10.4; PCS: 44.2± 7.1; BBS: 50.6± 3.9.	Six weeks after the day of hospital discharge.	Pilates-based exercises performed along with standard exercise programs were more effective for improving balance and QoL than standard exercise programs alone.

Continue...

Table 2. Continuation.

Author/Year	QoI Instrument	QOL Result-Score	Evaluation method of pilates practice	Pilates practice results
Kheirkhah et al (2016)	KDQOL SF	**PG before training:** Health and functioning: Satisfaction:50.4± 15.1; Importance: 48.2± 11.2. Socioeconomic: Satisfaction: 40.2± 14.2; Importance: 50.5± 14.2. Psychospiritual: Satisfaction: 51.8± 12.4; Importance: 50.1± 12.3. Family: Satisfaction: 58.5± 12.2; Importance: 56.5± 13.2. Total QoL: Satisfaction: 48.5± 13.7; Importance: 50.5± 14.1. **PG after training:** Health and functioning: Satisfaction: 55.8± 13.1; Importance: 53.6± 13.6. Socioeconomic: Satisfaction: 48.9± 13.2; Importance: 58.4± 13.1. Psychospiritual: Satisfaction: 59.6± 13.2; Importance: 60.5± 13.7. Family: Satisfaction: 66.5± 13.2; Importance: 61.5± 13.8. Total QoL: Satisfaction: 60.5± 12.8; Importance: 64.3± 13.6.	Three sessions/ weeks. Eight weeks.	Differences were significant between health and functioning, socioeconomic, psycho-spiritual, and family scores in the Pilates group before and after the intervention.
Kofotolis et al. (2016)	SF-36	**PG before training:** PF: 51.08± 14.58; RP: BP: 38.51± 12.62; GH: VIT: 44.58± 15.03; RM: 11.32± 4.11. **PG after training (post 1):** PF: 51.08± 14.58; BP: 79.14± 7.93; GH: VIT: 70.32± 9.58; RM: 3.32± 1.78.	Three sessions/ week; for 1 hour; 8 weeks.	An 8-week Pilates program improved HRQOL and reduced functional disability more than a trunk strengthening exercise program or controls among women with chronic low back pain.
Vécseyné Kovách et al. (2013)	WHOQOL	**PG before training:** Perception: 8.9± 1.4; Autonomy: 15.55± 2.5; Present, past and future: 14.2± 1.8; Sociability: 14.95± 2.15; Death: 10.7± 4.2; Intimacy: 12.55± 4.6. **PG after training:** Perception: 10.3± 1.7; Autonomy: 14.3± 2.2; Present, past and future: 13.7± 2.2; Sociability: 15.55± 1.9; Death:10.6± 3.9; Intimacy: 13.1± 3.7.	Three sessions/ weeks, four 1 hour. 6 months.	A 6-month intervention program is an appropriate tool to improve the overall physical performance of healthy, inactive older adults, regardless of the type of exercise concerning Pilates or Aquafitness but might improve only some aspects of QOL.
Küçük et al. (2016)	MusiQol	**PG before training:** Total QoL: 28.22± 9.06 **PG after training:** Total QoL: 23.82± 7.53	Two sessions/week for 45-60 min. Eight weeks.	In addition to QoL, clinical Pilates improved the participants' cognitive functions compared with the traditional exercises.
Küçükçakır et al. (2013)	SF-36	**PG before training:** PF: 58.3± 20.1; PRL:51.7± 35.9; BP: 42.3± 15.5; SF: 61.5± 18.4; MH:57.3± 16.7; ERL: 60± 34.4; VIT:46.8± 20.7; GH: 42.3± 17.6. **PG after training (1 year):** PF: 85.3± 14; PRL: 88.3± 26; BP: 70.7± 16.2; SF: 76.1± 15.7; MH: 73.9± 16; ERL: 87.8± 28.3; VIT: 68.3± 18.2; GH: 69.5± 11.8;	Two sessions/week. One year.	Our results showed that Pilates exercises might be a safe and effective treatment alternative relative to the QoL in patients with postmenopausal osteoporosis.
Lim and Park (2019)	SF-36	**PG before training adjusted:** PF: 865.00± 135.28; RLP: 293.33± 114.27; RLE: 216.67± 98.55; Energy: 207.33± 63.35; EWB: 295.33± 77.31; SF: 125.83± 40.73; Pain: 134.67± 38.82; GH:2 61.67± 87.03; HC: 39.17± 20.43; Total: 2,439.00± 524.88. .**PG after training adjusted:** PF: 916.68± 18.81; RLP: 366.46± 10.57; RLE: 291.81± 8.20; Energy: 274.92± 6.79; EWB: 378.30± 7.40; SF: 164.74± 3.92; Pain: 169.96± 4.94; GH: 343.62± 11.37; HC: 71.40± 2.87; Total: 2,979.88± 44.67.	Three sessions/ week, for 1 hour. Eight weeks.	The participants in the Pilates group had an improvement in the SF-36 domains, functional movement, and individual health.
Liposcki et al. (2019)	SF-36	**PG before training:** FC: 82.2± 15.4; PHA: 61.1± 46.9; PAIN: 67.0± 22.2; GH: 67.8± 22.5; VIT: 63.3± 23.3; SAS: 81.8± 27.3; EA:74.0± 43.4; MH: 72.8± 18.5. General QoL: 70.8± 23.9. **PG after training:** FC: 91.6± 14.3; PHA: 92.7± 14.8; PAIN: 95.7± 6.9; GH:8 9.4± 11.2; VIT: 85.5± 13.5; SAS: 97.2± 8.3; EA: 92.6± 22.0; MH: 88.8± 10.5. General QoL: 92.1± 11.2.	Two sessions/week, for 30 min. Six months.	During the study period, there was a significant increase in the QoL of women in the PG (p= 0.00), while the QoL in the CG remained unchanged.
Medeiros et al. (2020)	SF-36	**PG T0:** RS: 54.2± 21.3; GH: 38.2± 19.2; VIT: 34.6± 17.5; FC: 34.0± 17.1; RP: 23.7± 28.8; EA: 44.4± 46.3; Pain: 33.3± 17.2; MH: 57.5± 21.9. **PG T12:** RS: 54.2± 21.3; GH: 39.0± 23.6; VIT:43.8± 19.5; FC:43.5± 22.0; RP: 36.2± 38.6; EA: 43.6± 43.6; Pain: 44.9± 18.4; MH: 65.9± 27.8.	Two sessions/week. 12 weeks.	The aspects related to QoL only showed improvement in the mat Pilates group (p< 0.05).

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Table 2. Continuation.

Author/Year	QoI Instrument	QOL Result-Score	Evaluation method of pilates practice	Pilates practice results
Natour et al. (2015)	SF-36	**PG before training:** PF: 58.75± 23.69; RP: 42.70± 40.69; BP: 42.91± 21.40; GH: 63.66± 23.3; VIT: 56.04± 21.21; SF: 78.64± 28.18; ER: 78.86± 26.97; MH: 67.06± 21.85. **PG after training (t45):** PF:63.95± 25.62; RP: 47.37± 40.68; BP: 49.95± 26.79; GH: 62.79± 23.75; VIT: 61.87± 19.27; SF: 83.12± 25.26; ER: 82.20± 25.88; MH: 66.53± 22.97. **PG after training (t90):** PF: 65.83± 27.96; RP: 49.00± 37.27; BP: 54.45± 23.41; GH: 68.58± 21.92; VIT: 64.58± 21.15; SF: 83.75± 24.51; ER: 80.43± 29.72; MH: 69.30± 21.14. **PG after training (t180):** PF: 65.41± 28.01; RP: 56.37± 34.77; BP: 52.16± 24.57; GH:65.20± 22.15; VIT: 60.29± 23.41; SF: 86.04± 22.75; ER: 82.64± 24.18; MH: 67.90± 22.05.	Two sessions/week, for 50 minutes. 12 weeks	Patients with LBP can use the Pilates method to improve pain, function, and QoL (functional capacity, pain, and vitality). Moreover, this method has no harmful effects on such patients.
Odynets et al. (2019)	FACT	**PG before training:** PWB:15.33± 0.60; SFWB: 13.08± 0.48; EWB: 12.55± 0.51; FWB:15.04± 0.45; BCS:17.84± 0.51; AS: 8.93± 0.50; Total: 82.80± 2.14. **PG after training (6 months):** PWB: 19.22± 0.67; SFWB: 14.84± 0.53; EWB: 15.20± 0.51; FWB: 18.00± 0.54; BCS: 21.00± 0.48; AS:11.91± 0.50; Total:100.17± 2.11. **PG after training (12 months):** PWB: 23.75± 0.49; SFWB: 15.20± 0.48; EWB: 18.82± 0.29; FWB: 20.46± 0.45; BCS: 26.17± 0.40; AS: 16.48± 0.23; Total: 120.91± 1.26.	Three sessions/ week, for one hour. 12 months.	The participants in the Pilates group had an improvement in the FACT: PWB, SFWB; EWB; FWB.
Oliveira, Oliveira, nd Pires-Oliveira (2018)	SF-36	**PG before training (Median IQR 25th–75th percentiles):**PF: 85 (75–95); RP: 100 (88–100); BP: 62 (51–92); GH: 82 (75–90); VIT: 75 (60–83); SF:7 5 (75–100); ER: 100 (33–100); MH: 76 (66–86). **PG after training (Median IQR 25th–75th percentiles)** PF: 95 (78–95); RP: 100 (100–100); BP:82 (62–100); GH:82 (77–92); VIT: 85 (75–90); SF: 100 (87–100); ER: 100 (100–100); MH: 84 (78–96).	Three sessions/ week, for one hour. 6 months. 78 sessions.	96.1% of participants completed the follow-up. The Pilates was superior ($p< 0.05$) to WBV for muscle strength of the knee flexors at 60º /s (% Change: 16.71± 20.68 vs. 6.18± 19.42; Cohen's $d= 0.70$) and superior ($p< 0.05$) to the control group in all muscular strength variables and in four SF-36 domains.
Oliveira et al. (2019)	SF -12	**PG before training:** SF-12 - PC: 29.7± 8.4; SF-12 MC: 41.7± 7.3. **PG after training:** SF-12 - PC: 39.9± 9.0; SF-12 MC: 47.7± 9.7.	Two sessions/ week, for 50 min. 12-weeks.	In this study, patients undertaking the Pilates method for 12 weeks had less pain, better function and QoL, and increased range of joint movement.
Özyemişci Taşkiran et al. (2014)	Turkish version of NHP.	Significant differences were found in the total NHP score, mean difference (before and immediately after the intervention) in the **PG** (0.95± 14.10; $p= 0.007$).	Three sessions/week for 50 minutes. Eight weeks.	Sleep scores (-2.22± 21.57; -6.67± 18.15; 10.00± 22.04 for Pilates, yoga and control groups, respectively; $p= 0.026$) and emotional reaction subdomains (-2.08± 23.19; -6.94± 15.59; 6.82± 14.29 for Pilates, yoga and control groups, respectively; $p= 0.037$) on the NHP decreased immediately after exercise in both groups, and post hoc analyses revealed that the decrease in sleep and emotional reaction scores reached significance only in the yoga group.
Rahimimoghadam et al. (2018)	KDQOL-SF	**PG before training:** PHCS: 22.1± 12.1; MHCS: 15.3± 13.2; KDCS: 28.5± 12.0; Total QoL: 21.9± 12.4; **PG after training:** PHCS: 53.8± 11.2; MHCS: 51.5± 14.6; KDCS: 50.6± 13.3; Total QoL: 52± 13.07.	Three sessions/ week, for one hour. 12 weeks.	Comparison of the mean differences at the beginning and two months after the study in the two groups showed that the scores related to QOL dimensions in the Pilates group were more significant than in the control group ($p\leq 0.05$).
Rodrigues et al. (2010)	WHOQOL-OLD,	**PG before training:** QVG: 88.23± 6.19; **PG after training:** QVG: 89.35± 9.38.	Two sessions/week. Eight weeks	The Pilates method can offer a significant improvement in personal autonomy, static Balance, and QoL.

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Table 2. Continuation.

Author/Year	Qol Instrument	QOL Result-Score	Evaluation method of pilates practice	Pilates practice results
Saltan and Ankarali (2021)	NHP	**PG before training:** 114.21± 74.78. **PG after training:** 72.55± 65.01 (p= 0.000); **PG difference After training after Tukey's post hoc test:** -41.65± 50.06.	Three sessions/ weeks. 12 weeks.	A positive effect was found on the pain, physiological status, and QoL in the PG.
Surbala Devi et al. (2013)	SS-QOL	**PG before training:** 312.25± 11.8. **PG after training:** 326.42± 11.5.	Three sessions/ week, for 45 minutes per session. Eight weeks.	FRT (p= 0.000 in both groups), TUG (p= 0.000: Pilates and p= 0.001: Control), DGI (p= 0.000 in both groups) showed highly significant differences before and after eight weeks of intervention.
Surbala Devi et al. (2014)	RAND-36	**PG before training:** 63.9± 3.0. **PG after training:** 82.6± 2.1.	Three sessions/ week, for 45 minutes 6 weeks.	The PG was shown to have more significant improvements in QoL compared to CBT and CG.
Vancini et al. (2017)	The SF-36, translated and validated for Brazilian Portuguese.	**PG before training:** FC: 70.2± 17.2; LBPA: 65.5± 33.0; Pain: 64.7± 20.4; GH:75.3± 14.0; VIT: 47.4± 22.7; SF: 57.7± 28.9; LBEP:46.0± 40.0; MH: 60.0± 19.3. **PG after training:** FC:75.5± 17.0; LBPA: 76.2± 34.9; Pain: 75.0± 23.7; GH: 80.5± 9.9; VIT:65.9± 18.7; SF: 81.5± 24.9; LBEP: 77.8± 33.9; MH: 74.1± 22.4.	Three sessions/week for 60 minutes. Eight weeks.	The HR during the physical training sessions was significantly lower in the Pilates group (P) when compared to the walking group (W) (p< 0.0001).
Yentür et al. (2021)	Turkish version of the RAQoL	**PG before training:** 6.20± 4.58; **Aerobic group before training:** 6.80± 4.80; **Combined before training:** 8.70± 5.20. **PG after training:** 1.50± 0.30; **Aerobic group before training:** 1.60± 0.45; **Combined group after training:** 2.80± 0.71.	Three sessions/ week, for about 45 min per session.	The present study showed significant improvements for the Pilates group in fatigue, depression, aerobic capacity, QoL (p< 0.05).
Yucel and Omer (2018)	SF-36	**PG before training:** Pain (3.00± 4.00), Fatigue (5.00± 2.00); SF-36 PH (40.0± 3.0); SF-36 MH: (29.00± 5.00). **PG after training:** Pain (2.00± 2.0), fatigue (4.00± 1.00); SF-36 PH: (41.00± 4.00); SF-36 MH: (35.00± 3.00).	Three sessions/ week, for 45 minutes. 12 weeks.	Pilates affect the parameters of QoL in women with type 2 diabetes, and they might be recommended as a part of their treatment program.
Yun et al. (2017)	SS-QOL	**PG before training:** Physical:3.08± 0.54; Social: 2.70± 0.66; Psychological: 2.85± 0.42; Total QoL: 2.88± 0.47. **PG after training:** Physical:3.32± 0.64; Social:3.08± 0.66; Psychological: 3.23± 0.64; Total QoL: 3.23± 0.56.	Two sessions/week, for 1 hour .12 weeks.	Pilates sessions improved patients in the experimental group in all domains of QOL.

AS: Arm subscale; ASQOL: ankylosing spondylitis quality of life questionnaire; BASFI: Bath Ankylosing Spondylitis Functional Index; BASMI: Bath Ankylosing Spondylitis Metrology Index; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BBS: Berg Balance Score; BCS: Breast cancer subscale; BP: Bodily pain; BSA: Body self-analysis; CBT: Conventional Balance Training; CG: Control Group ; CKDS: Chronic Kidney Diseases Summar; DGI - Dynamic gait index; DS: Diet Satisfaction; DA: Daily Activities; EA: Emotional Aspects; ECS: Emotional component summary; EMH: Emotional/ Mental Health; EORTC QLQ-C30 (EORTC QLQ BR23): The European Organization for Research and Treatment of Cancer Questionnaire; ER: Emotional Role; ERF: emotional role functioning; ERL: emotional role limitation; ESSA: Emotional situation self-analysis; EWB: Emotional well-being ; FACT: Functional Assessment of Cancer Therapy; FACT-B: Functional Assessment of Cancer Therapy–Breast; FC: Functional Capacity ; FG: Factor-G (PWB + SFWB + EWB + FWB); FIQ: Fibromyalgia Impact Questionnaire; FRT - Functional reach test; FW: Financial Worries; FWB: Functional well-being; ; GH: General Health; GHP: General Health Perception; GHS: general health state; HC: Health change; HSA: Health self-analysis; HT: health changing over time or the reported health transition; HW: House Work; KDQOL-SF: The Quality of Life Short Form; LBEP: imitations because emotional problems; LBOEM: limitations because of emotional problems; LBPA: limitations because of physical aspects; MCS: Mental component summary; MF: Mental Functions; MH: Mental Health; MHCS: Mental Health Components Summary ; MHD: Mental Health Domain; MP: Mat Pilates; MusiQol: The Multiple Sclerosis International Quality of Life Questionnaire; NHP: Nottingham health profile; OMSA: Overall motility self-analysis; PCS: Physical component summary; PE: Physical Endurance; PedsQL 4.0: .Pediatric Quality of Life Inventory version 4.0; PF: Physical functioning; PG: Pilates Group; PH: Physical Health; PHA: Physical Aspects; PHCS: Physical Health Components Summary; PI: Pain intensity; PPFA: past-present-future activities; PR: Physical Role; PSCS: psychosocial; PRF: physical role functioning ; PWB: Physical well-being; QoL: Quality of Life; QOLID: Questionnaire for Quality of Life; QVG: quality of life index; RAND-36: The RAND 36-Item Health Survey ; RAQoL: Rheumatoid Arthritis Quality of Life Questionnaire; RLE: Role limitation due to emotional problems ; RLP: Role limitation due to physical health; RM: Roland Morris ; RP: Role-physical ; RS: Role Social; RT: Resistance Training; SA: Social Aspects; SAS: Social Aspects; SB: Symptom irritability; SF: Sensory functioning ; SF-12-MC: 12-Item Short-Form Health Survey—Mental Component; SF-12-PC: 12-Item Short-Form Health Survey—Physical Component ; SF- 36: Medical Outcomes Study 36-Item Short-Form Health Survey; SFWB: Social or family well-being; SI: Self Image; SLSA: Stress levels self-analysis; SP: Social Participation; SRF: social role functioning; SRS-22r: Scoliosis Research Society Questionnaire; SS- QOL: Stroke specific quality of life; TOIS: Trial Outcome Index score (PWB + FWB + BCS); TS: Total score (Factor-G + BCS); TUG - Timed up and go test; VIT: Vitality; WHOQOL: The World Health Organization quality of Life questionnaire; WHOQOL-OLD: The World Health Organization quality of Life questionnaire – Old.

Table 3. Outcomes of the included studies.

Author/Year	Statistical tests used	Outcomes	
		Main results	Is pilates practice related to better QoL?
Altan et al. (2009)	Shapiro–Wilk test. Wilcoxon test. T-test and Mann–Whitney U test. χ^2 test and Fischer's exact test.	In PG, BASFI showed significant improvement at week 12 (P= 0.031) and week 24 (P= 0.007) (post-treatment), BASMI, BASDAI, and chest expansion showed significant improvement (P= 0.005, P= 0.036, P= 0.002), while there was no significant change for ASQoL at week 12. According to the results, Pilates is an effective and safe method to improve physical capacity in patients with ankylosing spondylitis.	YES. ASQoL.
Angın et al. (2015)	Mann-Whitney-U test	BMD values increased in the Pilates group (p< 0.05), while BMD decreased in the control group (p< 0.05). Physical performance test results showed significant increases in the Pilates group (p< 0.05), whereas there were no changes in the control group (p> 0.05). The pain intensity level in the Pilates group was significantly decreased after the exercise (p< 0.05), while it was unchanged in the control group. There were significant increases in all parameters of QOL in the Pilates group.	YES. All parameters of QoL in the Pilates group.
Borges et al. (2014)	T-test.	The results provide evidence of positive effects on pain intensity and almost all domains of QoL when patients followed the Pilates exercise program described.	YES. PF; PRF; BP; VIT; GH; SRF; MH.
Campos de Oliveira et al. (2015)	Mean and standard deviation. Mann- Whitney U test. Shapiro-Wilk test. Two-way repeated-measures analysis of variance (ANOVA). Tukey's post hoc test.Kruskal-Wallis test and the Student-Newman-Keuls	EG showed significant improvements in all subscales after the intervention. However, CG showed improvement only in social role functioning. Pilates exercises improved isokinetic torque of the knee extensors and flexors, postural balance, and HRQoL.	YES. PF; PRF; Pain; GHS; VIT; SRF; ERF; MH.
Eyigor et al. (2010)	Descriptive statistics. The Mann-Whitney U Test. Fisher's Exact or χ^2. Wilcoxon test.	After the exercise program, improvements were seen in Group 1 in the 6-minute walk test, BDI, EORTC QLQ-C30 functional, and EORTC QLQC30 BR23 functional scores (P< 0.05). In contrast, no improvement was observed in Group 2 after exercise. Pilates exercises are effective and safe for female breast cancer patients.	YES: EORTC QLQ-C30-Functional; EORTC QLQ-C30-Symptom; EORTC QLQ-C30-Global; EORTC QLQ-C30 BR 23 functional; EORTC QLQ-C30 BR 23 Symptom.
Gandolfi et al. (2012)	Mean and standard deviation calculations for quantitative variables and frequency and percentages for qualitative variables. Shapiro–Wilk test.T- Student test. χ^2 test. ANOVA time-repeated measurements. Tukey test..	The PG presented improvement in the QoL evaluation scores: PF, and PCS; PF; PR; ER, VIT, PCS and ECS, but without changes in bone remodelling.	YES. PF; PCS; PR; ER; VIT; ECS.
García-Soidán et al. (2014)	Kolmogorov-Smirnov test; Two-way analysis of variance (ANOVA), with Fisher's distribution.	NR	The results showed that the Pilates Method generated important changes in middle-aged individuals, bringing benefits to the domains of QoL
Karaman et al. (2017)	Descriptive statistics as a mean± standard deviation; Shapiro-Wilk test; t-test	We found a significant difference in balance and QoL with a 6-week postoperative Pilates-based exercise program combined with standard exercise compared to standard exercise alone following TKA surgery.	YES. GH; SFD, and mental component.

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Table 3. Continuation.

Author/Year	Statistical tests used	Outcomes	
		Main results	Is pilates practice related to better QoL?
Kheirkhah et al. (2016)	χ^2 test, independent t-test, and paired t-test.	According to the results of the study, Pilates exercise can be considered an effective alternative to improve the quality of life, health, socioeconomic, psycho-spiritual, and family functioning of hemodialysis patients. In the control group, no difference was observed between the QoL scores at the beginning and at the end of the study.	YES. HEALTH AND SOCIOECONOMIC. PSYCHO-SPIRITUAL. FAMILY. TOTAL QoL.
Kofotolis et al. (2016)	Kolmogorov-Smirnov test; MANOVA; Mauchly's test; F test.	An 8-week Pilates program improved HRQoL and reduced functional disability more than a trunk strengthening exercise program or controls among women with chronic low back pain.	YES. Autonomy and perception.
Vécseyné Kovách et al. (2013)	T- test; ANOVA.	WHOQOL showed improvement in perception and autonomy in the Pilates group.	YES. Perception and autonomy.
Küçük et al. (2016)	Descriptive statistics. Wilcoxon test. Mann-Whitney U test.	The present study results showed that individuals in the Pilates group had significantly positive effects on QoL and cognitive functions compared to the control group. Showing that the use of Pilates for patients with multiple sclerosis can be beneficial.	YES. Total QoL.
Lim and Park (2019)	Analysis of variance (ANOVA). Scheffé test. Adjusted for: Health condition, role limitation due to physical health, role limitation due to emotional problems and energy.	When comparing pre-and post-exercise, we found a statistically significant difference between the three groups in FMS (F [2.89]= 15.56, $P< 0.001$), and there was an improvement in the SF-36 domains in the Pilates Group (F [2.89]= 52.36, $P< 0.001$). The Pilates group presented better results in functional movement and individual health levels when compared to the Yoga and control groups.	YES. PF; RLP; RLE; ENERGY; EWB; SF; PAIN; GH; HC; SF-36 Total.
Liposcki et al. (2019)	Attendance and percentage for qualitative variables, and means, standard deviation, minimum and maximum values for quantitative variables. Shapiro-Wilk test. The Student's T-test, Mann-Whitney U test.	After the exercise program, 89% of the women in the PG had an excellent QoL, while in the CG, 46% of the women in the CG considered their QoL to be bad or poor. The results of this study showed that Pilates could improve the QoL of sedentary elderly women	YES. General QoL. FC; PHA; PAIN; GH; VIT; SAS; EA; MH.
Medeiros et al. (2020)	Kolmogorov-Smirnov test. Levene test. ANOVA mixed model. Bonferroni post-hoc test.	There was an improvement in both groups concerning pain and function ($p< 0.05$). The QoL domains and the FABQ questionnaire showed improvements in PG. PSQI and PRCTS showed improvements only in the aquatic aerobic exercise group ($p< 0.05$). Significant improvements were observed in the two groups in relation to the disease symptoms, and no differences were observed between mat Pilates and aquatic aerobic exercise in any of the measured variables.	YES. RS; GH; VIT; FC; RP; EA; Pain; MH.
Natour et al. (2015)	Student's t-test (parametric variables) and Mann-Whitney (non-parametric variables); ANOVA; comparisons test (Post Hoc).	Statistical differences favoring the Pilates Group were found with regard to pain ($P< 0.001$), function ($P< 0.001$) and the QoL domains of FC ($P< 0.046$), pain ($P< 0.010$) and VIT ($P< 0.029$). Statistical differences were also found between groups regarding the use of pain medication at T45, T90, and T180 ($P< 0.010$), with the EG taking fewer NSAIDs than the CG.	YES. FC, PAIN, and VIT.
Odynets et al. (2019)	Shapiro-Wilk test; t-test.	The Pilates group showed better functional (20.65± 0.61) when compared to yoga and water activities.	YES. PWB; SFWB; EWB; FWB

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Table 3. Continuation.

Author/Year	Statistical tests used	Outcomes	
		Main results	Is pilates practice related to better QoL?
Oliveira et al. (2019)	Kolmogorov–Smirnov normality test was performed for quantitative variables; Shapiro–Wilk normality test for quantitative variables; Student's t-test for paired samples.	The Pilates group presented lower VAS ($P< 0.001$), lower HAQ scores ($P< 0.001$), and higher QoL scores ($P< 0.001$) compared with the control group. We found statistically significant results for the Pilates group in the range of movement for the shoulder, knee, ankle, and lumbar spine ($P< 0.001$). In the intragroup analysis, there was a significant improvement in all outcomes evaluated.	YES. QoL Scores.
Oliveira et al. (2018)	Initially, intention-to-treat analysis (ITT). Mean and standard deviation (SD), respective interquartile range (25th and 75th percentiles). Shapiro-Wilk test. The Student t-test. Levene test. One-way ANOVA. Kruskal-Wallis test. Covariance analysis (ANCOVA). As a post hoc, the Bonferroni test.	Pilates is an alternative intervention superior to WBV when the goal is linked to the strength of the knee flexor muscles.	YES. RP; BP; SF; ER.
Rahimimoghadam et al. (2018)	Kolmogorov-Smirnov, Mann-Whitney U, and Wilcoxon tests	The Pilates exercises effectively improved the participants' QOL and its dimensions. Due to the cost-effectiveness and safety of this intervention, we propose the inclusion of this exercise in CKD patients' treatment protocols	YES. PCS, MCS, and KDCS
Rodrigues et al. (2010)	Shapiro Wilk test; t-test.	Based on this study, it is possible to conclude that the practice of the Pilates method can improve the functional autonomy and static balance of elderly individuals. However, concerning QoL, we suggest that further studies be carried out using a more representative sample and a more extended period of intervention to more precisely evaluate the results of the method with respect to this variable.	YES. Sensorial abilities; social participation; privacy.
Saltan and Ankarali (2021)	Mean± standard deviation, and as frequencies (counts and percentages). Kolmogorov- Smirnov test. One-way analysis of variance. Post hoc Tukey test. Pearson's χ^2 test. Paired-samples t-test.	After the intervention, there was a significant reduction in the training groups for VAS, NHP, WHr, and BDI values ($P< 0.05$). Also, there were no significant decreases in the control group's VAS, NHP, WHr, and BDI values. When the three groups of BMI, VAS, ODI, NHP, and BDI values changed after training were compared, they were found significantly different. A post hoc Tukey test showed that the control group was significantly different from the other two groups ($P < 0.05$)	YES. NHP.
Surbala Devi et al. (2013)	Kolmogorov-Smirnov test; Mean and standard deviation; student t-test;	There was significant improvement ($p< 0.05$) in functional balance and QoL of sub-acute Stroke subjects in the Pilates group compared to the Control group after eight weeks of training.	YES. General QoL.
Surbala Devi et al. (2014)	Mean and standard deviation. Kolmogorov-Smirnov test. Repeated measure ANOVA. Student's t-test.	The 6-week PG and CBT program resulted in significant improvements in functional balance (FRT, TUG & DGI: $P= 0.000$) and QOL (RAND-36: $P= 0.000$). Both PG and CBT can improve functional balance and decrease the propensity for falls in the elderly, thus improving QoL. However, the PG was considered superior in elderly outpatients.	YES. RAND-36

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Table 3. Continuation.

Author/Year	Statistical tests used	Outcomes	
		Main results	Is pilates practice related to better QoL?
Özyemişci Taşkiran et al. (2014)	Shapiro-Wilk test. ANOVA or Kruskal-Wallis. Post hoc analyses (Tukey or Mann Whitney U test, respectively), Wilcoxon or paired-T tests.	No improvement was seen in balance scores immediately after the intervention in either group. Improvements were seen in chair stand and 8-foot up, and test scores did not reach statistical significance after the interventions (p= 0.074 and p= 0.083, respectively). These effects also did not persist after six months. Reduction in pain, depression or disability and improvements in balance or body composition were not observed.	NO.
Vancini et al. (2017)	Levene's test, mean± standard; Unilateral analysis of variance; Newman-Keuls post hoc test.	QoL, depression, and trait anxiety scores improved in the Pilates group. However, there was no better result in anxiety-state scores in this group.	YES. VIT; SFD; LBOEM; MH.
Yentür et al. (2021)	Shapiro-Wilk test, histograms, probability plots. One-way ANOVA; Kruskal-Wallis test; paired sample t-test; Wilcoxon signed ranks test.	Pilates Method can lead to beneficial effects similar to those of aerobic exercise in patients with Rheumatoid Arthritis.	YES. GENERAL QUALITY OF LIFE.
Yucel and Omer (2018)	Kolmogorov–Smirnov test. t-test.	Pilates affect the parameters of QoL in women with type 2 diabetes, and they might be recommended as a part of their treatment program.	YES. Pain, fatigue, MH; anxiety, depression, FBG; and GHV.
Yun et al. (2017)	Shapiro-Wilk test. T-test.	The practice of Pilates by stroke patients positively affected the QoL of this population. It was found through the results a statistically significant improvement in the physical, social and psychological areas and total QoL.	YES. Physical, social, psychological, and total QoL

10mW:10-meter walk ; ASQoL: ankylosing spondylitis quality of life questionnaire ; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index ; BASFI: Bath Ankylosing Spondylitis Functional Index ; BASMI: Bath Ankylosing Spondylitis Metrology Index ; BCS: Breast cancer subscale; BDI: Beck Depression Inventory ; BMI: Body Mass Index; BP: Bodily Pain ; CG: Control Group ; DS: Diet Satisfaction ; EA: Emotional Aspects; ECS: Emotional component summary; EMH: Emotional/Mental Health; EORTC QLQ-C30 (EORTC QLQ BR23): The European Organization for Research and Treatment of Cancer Questionnaire ; ER: Emotional Role; ERF: emotional role functioning ; EWB: Emotional well-being; FBG: fasting blood glucose; FC: Functional Capacity; FG: Factor-G (PWB + SFWB + EWB + FWB); FMS: Functional Movement Screen ; FW: Financial Worries; FWB: Functional well-being; GE: Experimental Group; GH: General Health; GHS: general health state; GHV: glycosylated hemoglobin values; GPA: General physical activity; HC: Health change; HT: Health Changes over time or the reported health transition; KDCS: Kidney Diseases Components; LBOEM: limitations because of emotional problems; MCS: Mental Component Summary; MH: Mental Health; NHP: Nottingham health profile; NR: Not Related; ODI: Oswestry Disability Index; PCS: Physical Health Components; PE: Physical Endurance; PF: Physical Function; PFC: physical functional capacity; PG: Pilates Group; PH: Physical Health; PHA: Physical Aspects; PPFA: past-present-future activities; PRF: physical role functioning; PR: Physical Role; PTTs: Putting on and taking off a t-shirt; PWB: Physical well-being; QoL: Quality of Life; RE: Role Emotional; RLE: Role limitation due to emotional problems; RLP: Role limitation due to physical health; RP: Role Physical; RSP: Rising from a sitting position; RVDP: Rising from a ventral decubitus position; SA: Social Apects; SB: Symptom irritability; SF: Social Function; SF – 36: Medical Outcomes Study 36-Item Short-Form Health Survey; SFD: Social Functioning Domain; SFWB: Social or family well-being; SRF: social role functioning; TKA: Total knee arthroplasty; TOIS: Trial Outcome Index score (PWB + FWB + BCS); TS: Total score (Factor-G + BCS); VAS: Visual Analogue Scale; VIT: Vitality; WHr: Waist/hip ratio.

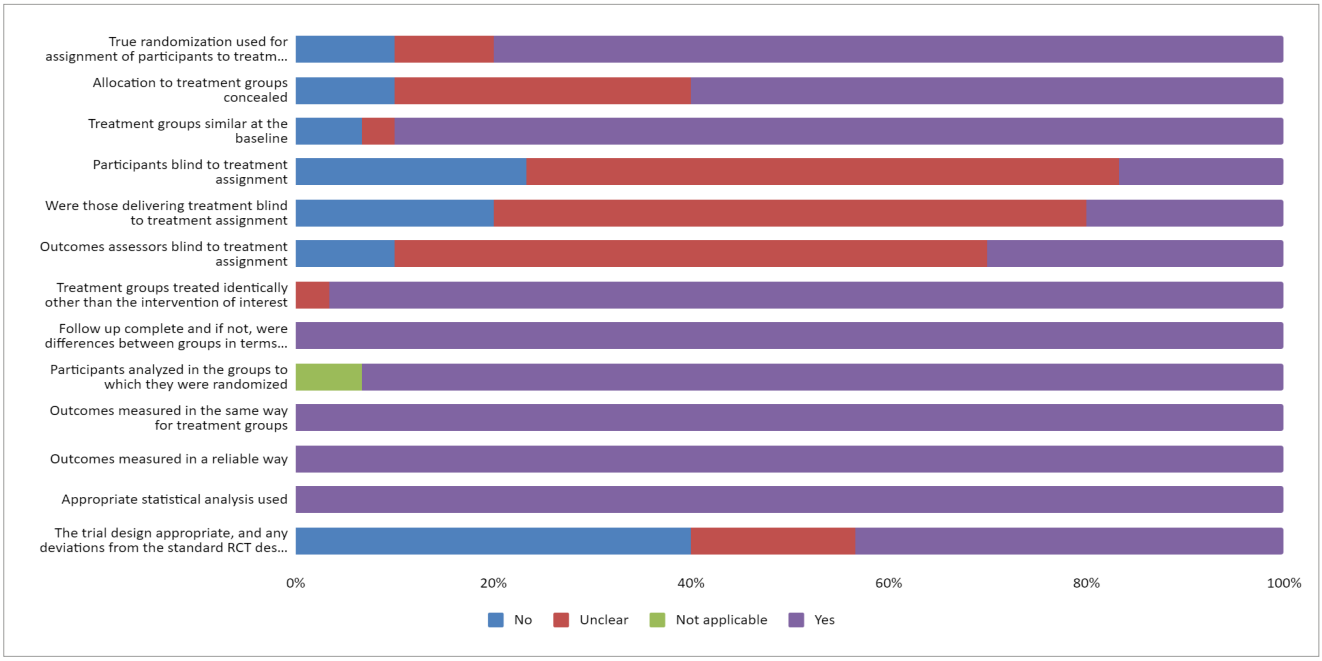

Figure 2. Assessment of the risk of bias in experimental studies (JBI Critical Appraisal Checklist).

by Brazilian and Turkish authors. Despite numerous PM practitioners in Brazil, publications on the subject are still considered incipient, with great potential for development and new records on the benefits of the technique (Macedo, Haas, & Goellner, 2015).

General characteristics of the sample and overview of the methodological aspects of the selected studies

The 30 studies selected for this systematic review demonstrated the practice of PM in individuals of both sexes, different age groups, distributed in different countries, and with different clinical conditions. It is noteworthy that it was not possible to stratify the selective age group categories since most of the selected articles worked with a wide range of ages, from the age of eighteen (García-Soidán, Arufe Giraldez, Cachón Zagalaz, & Lara-Sánchez, 2014).

The heterogeneity regarding the aetiology of the clinical conditions found in the researched studies, which involved people with neurological, endocrine, orthopedic, and oncological pathologies, may be related to PM being considered an eclectic activity with minimal contraindications related to its practice. Many individuals prevented from participating in other regular exercise programs due to certain physical and functional limitations find an open way to practice such a method that is gaining new adherents every passing day (Mallery et al., 2003; Amorim, Sousa, & Santos, 2011; Macedo et al., 2015).

Assessing QoL is always challenging for the researcher, as it comprises a series of factors with individual, subjective, and non-transferable characteristics. In this sense, the methodologies employed seek to incorporate, in the best possible way, instruments that can assess people's opinions, thus improving health-related clinical practices. In this review, SF - 36 was the most used questionnaire (43.3%) among the selected studies, possibly due to its versatility, dynamism, validation, and ease of application, in addition to having been translated to over forty languages.

Aspects related to improving the QoL of PM practitioners among the selected studies

Among the studies selected in this review, the main aspects related to QoL improvement with the practice of PM were pain relief and mental health and functional capacity improvement.

To recall the concepts, functional capacity (FC) can be defined as the ability to perform basic activities of daily living (ADL) and instrumental activities of daily living (IADL), linked to the individual's quality of life once it determines their independence, self-care, and their social participation, and is considered an essential marker of the individual's clinical situation (Yentür, Ataş, Öztürk, & Oskay, 2021).

On the other hand, mental health was defined by the WHO as the feeling of well-being in which the individual develops their personal skills, manages to deal with the stress

of life, works productively, and can contribute to their community (WHO, 1997).

According to Lopes et al. (2019), the practice of PM because it involves exercises that combine physical well-being with mental health through stretching and muscle strengthening, improves body functionality, and becomes an essential tool for reducing drug use and other analgesic therapies, contributing to mental health improvement.

The PM provides its practitioners with global benefits, evidencing increased flexibility, range of motion, body awareness, decreased pain, improved posture, and aid in treating depression, anxiety, and stress. To achieve the intended objectives, it is necessary to correctly apply the technique keeping its main pillars intact: fluidity, concentration, coordination, centralization, breathing, and precision during the execution of movements (Bezerra et al., 2020).

Improved QoL in PM practitioners compared to non-practitioners

Pilates Method has been classified as a safe and effective method to improve the functional capacity of people diagnosed with ankylosing spondylitis. It is known that functional capacity gradually affects patients affected by ankylosing spondylitis since this pathology affects peripheral joints and the spine, causing pain and movement limitation. Altan, Korkmaz, Bingol, and Gunay (2009) conducted a study with 55 participants with ankylosing spondylitis, aged between 28 and 69 years, 30 males and 25 females. By dividing the participants into an experimental group (submitted to PM practice) and a control group (not submitted to PM practice), they found a significant improvement (P= 0.003) in the functional capacity of the individuals who practiced Pilates, with pain relief and greater independence to perform ADL's.

Corroborating Altan et al. (2009), Natour et al. (2015), when carrying out a randomized clinical trial with sixty patients of both sexes, aged between 18 and 50 years, with a diagnosis of non-specific chronic low back pain for at least twelve months, found a significant improvement in pain levels (p< 0.01) in the experimental group (performing PM) compared to the control group (no intervention). The groups were formed by thirty participants each; in both, the volunteers were making use of non-steroidal anti-inflammatory drugs. After 180 days, the study concluded that PM is an important ally in chronic low back pain of non-specific origin, contributing to reducing medication use in patients. Improvement was assessed using the visual analogue pain scale (VAS). Pilates Method utilizes exercises aiming at strengthening the spinal stabilizing muscles, a region called by Joseph Pilates as the centre of force or powerhouse, promoting pain relief at rest and during gait.

Pilates Method is effective for several factors related to mobility and flexibility of the spine, correction of postural alignment, improvement of balance, reduction of pain in chronic low back pain, and improvement in health in general (Macedo et al., 2015).

It is noteworthy that regular PM practice potentializes previous directions given by doctors according to the patients' needs, limited by their necessities, with a special focus on aerobic exercises, nutritional assessment, and lung expansion activities (Ince, Sarpel, Durgun, & Erdogan, 2016).

Joseph Pilates, the creator of the method, advocated that the body should always be worked in its entirety, using exercises that promote stretching and strengthening of the musculature, centring the production of force in the abdominal region, which he called the centre of force. This factor contributes to a better functional autonomy of its practitioners, regardless of age or clinical condition (Yentür et al.,, 2021).

The recovery of bone mineral density in patients diagnosed with osteoporosis is of paramount importance, given that this pathology is associated with numerous cases of hip fractures, considered a public health problem and an economic impact associated with hospitalizations and deaths. In another study of this review, following a group of 42 postmenopausal women aged between 40 and 69 years diagnosed with osteoporosis, Angin, Erden, and Can (2015) divided them into two groups, one with the intervention of PM and a control group, which did not perform any activity. As a result, after 24 weeks, they found a significant improvement in the functional capacity associated with recovery in bone mineral density in the hip region and pain reduction in the group that practised PM (p< 0, 05) with a weekly frequency of three days.

Pilates Method stimulates the body's superficial and deep musculature through concentric, eccentric, and isometric exercises, thus transmitting a stimulus to the skeletal system, favouring the remodelling of bone mineral tissue (Angin et al., 2015).

As for cerebrovascular accident (CVA), in studies carried out in India by Surbala Devi, Ratan, Gopal, and Satani (2013) and another one carried out in Korea by Yun, Park, and Lim (2017), with 20 and 40 patients of both genders, respectively, the importance of PM in the quality of life of these individuals was demonstrated. The first, consisting of an 8-week-long intervention with three weekly sessions, showed a significant improvement in functional balance, leading to an improvement in general health compared to the control group (without activities) in the domains of the

SS-QOL questionnaire. The second mentioned study adopted a 12-week-long intervention schedule with two weekly sessions and showed significant improvements in the physiological, psychosocial, physical, and quality of life parameters of the previously mentioned questionnaire.

Exercises performed with PM can help individuals with CVA to improve tone and muscle deficits, as well as postural control through individualized activities to meet each patient's profile and their respective sequelae (Surbala Devi et al., 2013).

Balance impairment is an important dysfunction factor to consider after having a stroke, as the risk of falls is high during the first year post-injury. In turn, falls can favour injuries of different severity, highlighting that femoral fracture is considered a public health problem (Yun et al., 2017).

Influence of PM on QoL compared to other activities

Aiming to evaluate PM and yoga's influence on QoL and practitioners' functionality, Lim and Park (2015) selected 90 individuals aged between 30 and 40 years in South Korea. The selection involved 30 individuals who were beginners in PM, 30 beginners in yoga, and another 30 individuals for the control group (who did not practice any physical activities). The sample consisted of individuals of both sexes. The result showed that, among the evaluated techniques, PM is more effective in improving general health, emotional well-being, and pain, showing a significant difference compared to yoga and the control group. In the authors' view, the results may be related to the fact that PM integrates dynamic and varied body movements that require balance, stability, and mobility, allied to the methodology applied in its execution, while yoga focuses more on static exercises.

Pilates Method was also more effective than the vibrating platform in improving the QoL and torque curve of the knee flexor muscles in postmenopausal women. This evidence was obtained during a randomized controlled study carried out by Oliveira et al. (2019), in which 51 women participated, divided into a control group (n= 17), vibrating platform activity group n= 17, and PM group (n= 17). With these results, the authors believe combining the two methods can bring even better benefits than both used separately.

In a study carried out in Turkey with individuals of both sexes diagnosed with multiple sclerosis, Kuçuk, Kara, Poyraz, and İdiman (2016) showed, after 8 weeks of intervention with PM, significant improvements attributed to aspects related to ambulation, respiratory capacity, cognitive ability, and in all the domains attributed to QoL when compared to individuals belonging to the control group who performed conventional patterns of rehabilitation aimed at patients with multiple sclerosis.

Pilates Method practice in the selected studies varied between once, twice, and three times a week, with the last alternative being the most observed frequency. In addition, the average session duration was 50 minutes, and the number of sessions estimated as a research protocol in the studies ranged between eight and twelve weeks, predominantly.

Among the limitations found in this study, the lack of information in the results of some evaluated articles regarding the specificity of the domains that were successful with the practice of PM is noteworthy. However, despite these limiting factors, it is possible to consider that the compilation of information on aspects related to QoL in a systematic review study can be a first step for improving the methodological quality of studies on this topic and also another instrument for the professionals involved in the prescription of this exercise modality to base their professional practices.

CONCLUSION

From the articles observed in the present systematic review, it was possible to conclude that PM positively influences the QoL of practitioners in both sexes, different age groups, and with different clinical conditions. The main domains related to QoL improvement were functional capacity, pain relief, and mental health improvement.

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World Health Organization (WHO) (1997). Quality of Life Assessment Group. (1996). What quality of life? *World Health Forum*, *17*(4), 354-356.

Appendix 1. Search strategy and databases.

Databases	Search strategy
MEDLINE	("Pilates Practitioners"[Title/Abstract]) OR ("Young People"[Title/Abstract]) OR ("Old People"[Title/Abstract]) OR (Aged[Title/Abstract]) OR (Elderly[Title/Abstract]) OR (Young[Title/Abstract]) OR Adult [Title/Abstract] AND ("Pilates"[Title/Abstract] OR "Pilates Training"[Title/Abstract] OR "Pilates Based Exercises"[Title/Abstract] OR "exercises pilates based"[Title/Abstract] OR "Pilates Based Exercises"[Title/Abstract] OR "training pilates"[Title/Abstract] OR "Pilates Method"[Title/Abstract]) OR "Motor activity"[Title/Abstract] OR "Pilates Exercise" [Title/Abstract] OR "Pilates Activity" [Title/Abstract] AND ("Quality of life"[Title/Abstract] OR "Lifestyle"[Title/Abstract] OR "Life Quality"[Title/Abstract] OR "health related quality of life"[Title/Abstract] OR "Health Related Quality"[Title/Abstract] OR "HRQOL"[Title/Abstract]) AND (Observational OR "Observational Study" OR Survey OR "Cross - Sectional" OR "Cross sectional" OR Cohort OR Association OR Relationship OR Correlation)
EMBASE	('pilates practitioners':ab,ti OR 'young people':ab,ti OR 'old people':ab,ti OR aged:ab,ti OR elderly:ab,ti OR young:ab,ti OR adult:ab,ti OR adults:ab,ti) AND (pilates:ab,ti OR 'pilates training':ab,ti OR 'exercises pilates based':ab,ti OR 'pilates based exercises':ab,ti OR 'training pilates':ab,ti OR 'pilates method':ab,ti OR 'motor activity':ab,ti OR 'pilates exercise':ab,ti OR 'pilates activity':ab,ti) AND ('quality of life':ab,ti OR 'lifestyle':ab,ti OR 'life quality':ab,ti OR 'health related quality of life':ab,ti OR 'health related quality':ab,ti OR 'hrqol':ab,ti) AND (observational OR 'observational study' OR survey OR 'cross - sectional' OR 'cross sectional' OR cohort OR association OR relationship OR correlation)
WEB OF SCIENCE	AB=("Pilates Practitioners" OR "Young People" OR "Old People" OR Aged OR Elderly OR Young OR Adult OR Adults) AND AB=(Pilates OR "Pilates Training" OR "Pilates Based Exercises" OR "exercises pilates based" OR "Pilates Based Exercises" OR "training pilates" OR "Pilates Method" OR "Motor activity" OR "Pilates Exercise" OR "Pilates Activity") AND AB=("Quality of life" OR Lifestyle OR "Life Quality" OR "health related quality of life" OR "Health Related quality" OR "HRQOL") AND TS=(Observational OR "Observational Study" OR Survey OR "Cross - Sectional" OR "Cross sectional" OR Cohort OR Association OR Relationship OR Correlation)
SCOPUS	(TITLE-ABS-KEY ("Pilates Practitioners" OR "Young People" OR "Old People" OR aged OR elderly OR young OR adult OR adults) AND TITLE-ABS-KEY (pilates OR "Pilates Training" OR "Pilates Based Exercises" OR "exercises pilates based" OR "Pilates Based Exercises" OR "training pilates" OR "Pilates Method" OR "Motor activity" OR "Pilates Exercise" OR "Pilates Activity") AND TITLE-ABS-KEY ("Quality of life" OR lifestyle OR "Life Quality" OR "health related quality of life" OR "health related quality" OR "HRQOL") AND ALL (observational OR "Observational Study" OR survey OR "Cross - Sectional" OR "Cross sectional" OR cohort OR association OR relationship OR correlation)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "MEDI") OR LIMIT-TO (SUBJAREA , "NURS") OR LIMIT-TO (SUBJAREA , "HEAL") OR LIMIT-TO (SUBJAREA , "NEUR") OR LIMIT-TO (SUBJAREA , "PSYC") OR LIMIT-TO (SUBJAREA , "MULT"))
GOOGLE SCHOLAR	With all of the words: "Pilates Method" AND "Quality of life" AND "Pilates" With at least one of the words: "Pilates Practitioners" OR "Young People" OR "Old People" OR Aged OR Elderly OR Young OR Adult AND Pilates OR "Pilates Training" OR "Pilates Based Exercises" OR "exercises pilates based" OR "Pilates Based Exercises" OR "training pilates" OR "Pilates Method" OR "Motor activity" OR "Pilates Exercise" OR "Pilates Activity" AND "Quality of life" OR "Lifestyle" OR "Life Quality" OR "health related quality of life" OR "Health Related Quality" OR "HRQOL" AND Observational OR "Observational Study" OR Survey OR "Cross - Sectional" OR "Cross sectional" OR Cohort OR Association OR Relationship OR Correlation Where my words occurs: anywhere in the article 200 most relevant hits

Appendix 2. Excluded articles and reasons for exclusion.

Author, Year, Reference	Reason for exclusion
BAIS & PHANSOPKAR, 2021 [1];	1
CRUZ-FERREIRA et al., 2011 [2]; ULUĞ et al., 2018 [3]; LIM & HYUN, 2013 [4]; ALTAN et al., 2012[5]; SHEA & MORIELLO, 2013[6]; STAN et al., 2012 [7]; SHARMA et al., 2018 [8]; KOMATSU et al., 2016 [9]; DUARTE et al., 2017 [10]; MELLO et al., 2018 [11]; KLAUTAU et al., 2020 [12]; ARAÚJO - GOMES et al., 2018 [13]; RRECAJ- MALAJ et al., 2020[14]; FONSECA et al., 2016 [15]; MENDONÇA et al., 2013 [16]; RODRIGUÉZ - FUENTES et al., 2014 [17]; ABASIYANIK et al., 2020 [18]; LEOPOLDINO et al., 2011 [19]; VIEIRA et al., 2013 [20].	2
RUIZ- MONTERO et al., 2019 [21]; MC GRATH, O'MALLEY & HENDRIX, 2010 [22]; GASKELL, WILLIANS & PREECE, 2019[23]; LIPKO & DARMAS, 2015 [24].	3

(1) The study has not been completed, only the expectation of what is expected from the results has been presented. (2) Did not assess the outcome of interest; (3) Methodology is not applicable to the proposed objective.

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Cruz-Ferreira, A., Fernandes, J., Gomes, D., Bernardo, L. M., Kirkcaldy, B. D., Barbosa, T. M., & Silva, A. (2011). Effects of pilates-based exercise on life satisfaction, physical self-concept and health status in adult women. *Women Health*, *51*(3), 240-255. https://doi.org/10.1080/03630242.2011.563417

Uluğ, N., Yilmaz, Ö. T., Kara, M., & Özçakar, L. (2018). Effects of pilates and yoga in patients with chronic neck pain: A sonographic study. *Journal of Rehabilitation Medicine*, *50*(1):80-85. https://doi.org/10.2340/16501977-2288

Lim, E.-J. & Hyun, E.-J. (2021). The impacts of Pilates and yoga on health-promoting behaviors and subjective health status. *International Journal of Environmental Research and Public Health*, *18*(7), 3802. https://doi.org/10.3390%2Fijerph18073802

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Shea, S. & Moriello, G. (2014). Feasibility and outcomes of a classical Pilates program on lower extremity strength, posture, balance, gait, and quality of life in someone with impairments due to a stroke. *Journal of Bodywork Movement Therapies*, *18*(3), 332-360. https://doi.org/10.1016/j.jbmt.2013.11.017

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Sharma, D., Kaur, J., Rani, M., Bansal, A., Malik, M., & Kulandaivelan, S. (2018). Efficacy of Pilates based mat exercise on quality of life, quality of sleep and satisfaction with life in type 2 diabetes mellitus. *Romanian Journal of Diabetes Nutrition and Metabolic Diseases*, *25*(2), 149-156.

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Araújo-Gomes, R. C., Valente-Santos, M., Vale, R. G. S., Drigo, A. J., & Borba-Pinheiro, C. J. (2019). Effects of resistance training, tai chi chuan and mat pilates on multiple health variables in postmenopausal women. *Journal of Human Sport and Exercise*, *14*(1), 122-139. https://doi.org/10.14198/jhse.2019.141.10

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Abasıyanık, Z., Yiğit, P., Özdoğar, A., Kahraman, T., Ertekin, O., & Ozakbas, S. (2021). A comparative study of the effects of yoga and clinical Pilates training on walking, cognition, respiratory functions, and quality of life in persons with multiple sclerosis: a quasi-experimental study. *Explore*, *17*(5), 424-429. https://doi.org/10.1016/j.explore.2020.07.013

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Appendix 3. Avaliação do risco de viés dos estudos do tipo experimental (JBI Critical Appraisal Checklist for Analytical experimental Studies).
Table S2. Risk of bias for each individual study assessed by Joanna Briggs Institute critical appraisal checklist for Randomized Controlled Trials.

Studies	Criteria												
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*
Altan et al. (2012)	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Angın E, Erden Z, Can F (2015)	N	U	U	U	U	U	Y	Y	Y	Y	Y	Y	N
Borges et al. (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Campos de Oliveira, Gonçalves de Oliveira, Pires-Oliveira (2015)	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	U
Eyigor et al. (2010)	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Gandolf1 et al. (2012)	N	N	Y	N	N	N	Y	Y	NA	Y	Y	Y	Y
García - Soidán et al. (2014)	N	N	Y	U	U	U	Y	Y	NA	Y	Y	Y	N
Karaman et al. (2017)	Y	Y	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Kheirkhah et al. (2016)	Y	Y	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Kofotolis et al. (2016)	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
Kovách et al. (2013)	U	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Küçük et al. (2016)	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	U
Kuuckcakır et al. (2013)	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y	Y
Lim, Park (2019)	U	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Liposcki et al. (2018)	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
Medeiros et al. (2020)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Natour et al. (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Odynets, Briskin, Todorova (2019)	Y	Y	Y	U	Y	U	Y	Y	Y	Y	Y	Y	N
Oliveira et al. (2018)	Y	Y	Y	N	Y	N	U	Y	Y	Y	Y	Y	Y
Oliveira et al. (2019)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Özyemişci Taşkiran et al. (2014)	Y	Y	N	U	U	U	Y	Y	Y	Y	Y	Y	N
Rahimimoghadam et al. (2018)	Y	Y	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Rodrigues et al. (2009)	Y	Y	Y	U	U	U	Y	Y	Y	Y	Y	Y	U
Saltan, Ankaralı (2020)	Y	Y	Y	U	U	Y	Y	Y	Y	Y	Y	Y	Y
Surbala et al. (2013)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Surbala et al. (2014)	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N
Vancini et al. (2017)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Yentür et al. (2020)	Y	Y	Y	U	U	U	Y	Y	Y	Y	Y	Y	N
Yucel H, Omer U (2016)	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	U
Yun, Park, Lim (2017)	U	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	U

Y = Yes, N = No, U = Unclear, NA = Not applicable
1. True randomization was used for assignment of participants to treatment groups
2. Allocation to treatment groups was concealed
3. Treatment groups were similar at the baseline
4. Participants were blind to treatment assignment
5. Those delivering treatment were blind to treatment assignment
6. Outcomes assessors were blind to treatment assignment
7. Treatment groups were treated identically other than the intervention of interest
8. Follow up was complete and if not, were differences between groups in terms of their follow up adequately described and analyzed
9. Participants were analyzed in the groups to which they were randomized
10. Outcomes were measured in the same way for treatment groups
11. Outcomes were measured in a reliable way
12. Appropriate statistical analysis was used
13. The trial design was appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial

REVIEW ARTICLE

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Measurement of aquatic competence in toddlers, infants, and children between 6 months and 14 years: a systematic review

Daniel Juárez Santos-Garcia[1]*, Osvaldo Rocca[1], Archit Navandar[2], Juan Antonio Moreno[3]

ABSTRACT

The aim of this study was to carry out a systematic review of the literature on tools for measuring aquatic competence in toddlers, infants, and children between the ages of 6 months to 14 years old. A systematic review was carried out following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement. Six of the eight studies selected obtained high valuations based on the Downs and Black Quality Assessment checklist. The studies were classified into three categories, one that proposed tools that measured actual aquatic competence (*n*= 6), the other one that measured perceived aquatic competence (*n*= 1), and the other that measured both (*n*= 1). Five studies measured emotional, social, cognitive, and communicative skills apart from motor skills. Most of the studies focused the proposed assessment tool on a specific age group, while two looked at a broader age group. In conclusion, eight instruments have been developed and validated in recent years for measuring aquatic competence for children between 6 months and 14 years of age from a multipurpose perspective. These have tools designed to facilitate and improve teacher assessment and determine children's perception of their own aquatic competence.

KEYWORDS: motor development; swimming skills; water skills; assessment.

INTRODUCTION

The term aquatic competence (Langendorfer & Bruya, 1995) includes the knowledge of swimming and the readiness and ability to enter the water and submerge completely, to surface and stay afloat for at least 1 minute, to make a 360° turn, to propel oneself forward or backwards a minimum distance of 22 meters and to be able to exit the water autonomously (American Red Cross, 2014). Thus, aquatic competence is considered a combination of physical and cognitive abilities necessary to enjoy the different aquatic environments or to solve problems in them (Moreno-Murcia and Ruiz-Pérez, 2019).

Aquatic competence helps humans not only to avoid risks and save their lives (Brenner et al., 2003; Rubio et al., 2015) but also to support the integral development (cognitive, socio-affective, and motor) of the individual (Fragala-Pinkham, Haley, & O'Neil, 2008; Sigmundsson & Hopkins, 2010; Font-Ribera et al., 2011; Burac, 2015) as shown by some studies focused on young children (Terzidis et al., 2007; Brenner et al., 2009). Moreover, a good aquatic competence can make learning more advanced/specialised forms of these skills easier (Clark & Metcalfe, 2002; Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018).

The familiarisation with the aquatic environment should be done early to avoid developing fears and promote a positive environment (Becker, Nascimento, Rossignaud, Maia, & Santos, 2017; Moreno-Murcia & Ruiz-Pérez, 2019). Moreover, this can benefit the adaptation to the aquatic environment since mastering a water sport that requires complex coordination skills (of arms, legs, and breathing) along with specific water sport skills requires, as a precondition, autonomy, confidence, and satisfaction in the aquatic environment (Hulteen et al., 2018). This preparation period is located in the early childhood stage (4-6 years) (Blanksby, Parker, Bradley,

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& Ong, 1995; Parker & Blanksby, 1997; Gallahue, 2008). It is assumed that before being able to master the aquatic environment, it is necessary to acquire the basic and minimum skills necessary for safety and survival in the aquatic environment. But it is not the same to consider aquatic motor skills in an isolated manner (Moreno-Murcia & Albarracín, 2017) as all of them together in the aquatic environment in order to ascertain the acquisition of skill (Moreno-Murcia & Ruiz-Pérez, 2019).

The measurement of aquatic competence provides objective information on which to base decisions about learners, monitor progress, and gain insight into children's level of water safety. It becomes the first step that any aquatic educator needs to take before diagnosing and evaluating an intervention later. It should be emphasised that having an effective, standardised tool for the assessment of aquatic competence is very important as it provides accurate information about the level of each person, thus enabling the setting of objectives and planning of activities with the least margin of error.

Historically, the design of instruments to measure the teaching of swimming as a sport has been one of the main concerns of specialists (Navarro & Juarez, 2017). Currently, the study on the measurement of aquatic competence is generating more interest in the scientific field, creating new tools with an easy application and greater rigor, that soon can provide objective data and advances in the knowledge of this area of research. But many of these proposed test instruments or assessment tools have not presented psychometric measures of validity and reliability even though different aquatic centres use them. Since the error is inherent to measurement, it is necessary to evaluate the quality of the measuring instruments, determining whether or not they meet the metric quality criteria that every instrument must satisfy to be used with guarantees. Therefore, to measure and to do it through standardised tests is a necessity. Reviewing the tools currently available to measure aquatic competence can be very useful to optimise the aim of improving the design, methodology, and organisation of the teaching-learning process of aquatic competence and the further development of standardised and validated tools. Therefore, the aim of this study was to carry out a systematic review of the literature on tools for measuring aquatic competence in -toddlers, infants, and children between the ages of 6 months to 14 years old. This review can show the scientific evidence in this regard, which can serve to know what validated measurement instruments can be used by the teachers and coaches. Also, this review can inform if there is a need to investigate even more in this context for the adequacy of the teaching-learning process of aquatic competence.

METHODS

Design

A systematic review was carried out following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Moher, Liberati, Tetzlaff, Altman, & The Prisma Group, 2009). This guide, which has a checklist of items, was designed to improve the report integrity of systematic reviews and meta-analyses. PRISMA may also be useful for critical appraisal of published systematic reviews (Moher et al., 2009).

Procedure

For this review, an initial search strategy was conducted to find scientific literature related to measuring aquatic competence in toddlers, infants, and children (between 6 months and 14 years of age). The following search terms were used: 'aquatic skill'; 'water competence'; 'aquatic competence'; 'swimming competence', 'test', 'evaluation'; 'assessment', 'measurement', 'swimming', & 'readiness'. Different combinations of these search terms were carried out using the Boolean search method (including OR/AND) in the Web of Science, Scopus, Pubmed, Dialnet, SportDiscus, and Google Scholar databases. The search was carried out from April 1st to April 30th of 2020. To identify additional studies, reference lists of any relevant reviews and original studies were reviewed to ensure an exhaustive search for all evidence associated with swimming competence in infants and primary school children.

Eligibility criteria

Studies were included in the review if they: (a) targeted toddlers, infants, and children between 6 months and 14 years of age; (b) were original research articles in English or Spanish languages, testing the eligibility of tests that measured aquatic competence; (c) objectively measured the validity of the aquatic competence test. Articles were excluded if they (a) also included data of adolescents or adults; (b) did not detail the protocol or the age of the participants; (c) was oriented towards swimming styles or organisational aspects; (d) were specifically aimed at populations with pathologies or disabilities; (e) unavailability of the full text.

Quality assessment

The quality of the articles selected was evaluated on the Downs and Black Quality Assessment Checklist (Downs & Black, 1998). The checklist is used in systematic reviews to rate articles with different research designs, and a higher score on the scale corresponds to a better quality of the article.

The original Downs and Black Quality Assessment Checklist was used with a couple of modifications. For questions 9-12 and 14-26, an additional option of "not applicable" was included. Question 27 was scored with "Yes" (1 point — statistical significance reached), "No" (1 point — statistical significance not reached), or "Not applicable". In answering questions 5 and 25, age and sex were determined as the core confounders, whereas body weight, height, and aquatic experience were defined as other confounders. Questions scored as 'Not applicable' were not considered when calculating the final quality score of an article, which was expressed as a percentage (Equation 1):

$$(\text{total number of points/total number of applicable points}) \times 100\% \quad (1)$$

No article was excluded based on its quality score or study design. The studies were rated as follows: low, with a score ≤ 50%; (ii) good, with a score between 51% and 75%, and (iii) excellent, with a score > 75% (Sarmento et al., 2018; Santos, Marinho, Neiva, & Costa, 2021). The quality assessment was done by Archit Navandar, as this author did not participate in the other parts of the article selection process.

Data extraction and synthesis

From the eight articles selected, the study aims, population, age, type of study, mode of observation, instruments, evaluation characteristics, grading system, and conclusions were extracted. Data extraction was performed by the same two reviewers who performed the initial search, and the data validation was done by the author that performed the quality appraisal. Data were managed and analysed using Microsoft Excel® 2016 (Microsoft Corporation, Redmont, WA, USA).

RESULTS

Based on the keywords input, a total of 689 articles were found after removing duplicates. The articles were then screened based on the title and abstracts, leading to the elimination of 576 articles. From the remaining 113 articles, 95 were eliminated based on the inclusion criteria, and 10 were eliminated based on the exclusion criteria. Finally, 8 articles were included in the review (Figure 1).

All the studies on the measurement of aquatic competence included in this review were published in the last fifteen years, with a majority being in the last five years. The studies encompassed groups in Spain (n= 6), Germany (n= 1) and China (n= 1).

Six of the eight studies obtained excellent valuations (above 75%) based on the Downs and Black Quality Assessment, and the others obtained a good score (Table 1). Data extracted from the studies are presented in Tables 2 and 3.

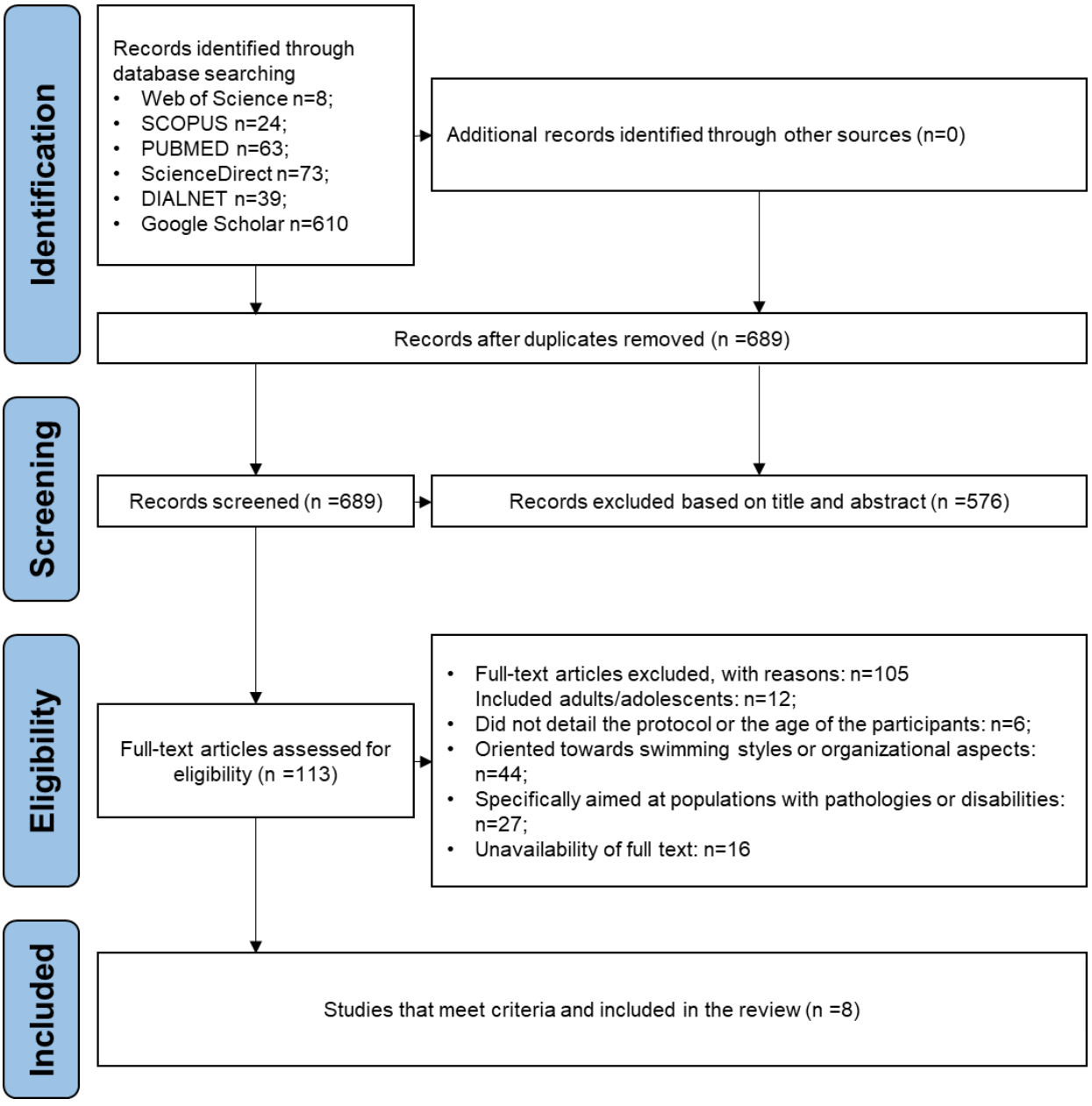
The studies can broadly be classified into three groups, one with those that propose a tool for measuring actual aquatic competence (Moreno-Murcia, 2005; Gómez-Mármol, López-Rodríguez, & Sánchez-Alcaraz Martínez, 2015; de Paula-Borges & Moreno-Murcia, 2018; Salar-Andreu, Moreno-Murcia, & Ruiz-Pérez et al., 2018; Moreno-Murcia, de Paula-Borges, & Huéscar Hernández, 2020; Vogt & Staub, 2020), and those that propose instruments to measure perceived aquatic competence in the other (Moreno-Murcia & Ruiz-Pérez, 2008). Chan, Lee, Macfarlane, Hagger, & Hamilton (2020) validated a measurement instrument that, although fundamentally measures the perceived aquatic competence, can also be used to measure the actual aquatic competence.

Concerning the dimensions to be measured with the proposed instruments, the articles study are differentiated into two groups: those studies in which the measurement is referred to the motor skills exclusively (Moreno-Murcia, 2005; Chan et al., 2020; Vogt and Staub, 2020), and those others that involve motor skills along with others, such as the emotional, social, cognitive and communicative skills (Moreno-Murcia & Ruiz-Pérez, 2008; Gómez-Mármol et al., 2015; de Paula-Borges & Moreno-Murcia, 2018; Salar-Andreu et al., 2018; Moreno-Murcia et al., 2020).

The included studies present measurement instruments for different ages up to 14 years old. Most of the studies focused on a specific age group: babies from 6 to 12 months (Salar-Andreu et al., 2018); children from 4 to 5 years old (Moreno-Murcia & Ruiz-Pérez, 2008), or 6 to 7 years old (de Paula-Borges & Moreno-Murcia, 2018; Vogt and Staub, 2020). Some studies looked at children across different ages, such as between 3 – 6 years (Gómez-Mármol et al., 2015; Moreno-Murcia et al., 2020); 4 – 8 years (De Sousa Morgado et al., 2020); 4 – 11 years (Moreno-Murcia, 2005); and 5 – 14 years (Chan et al., 2020).

DISCUSSION

Among the main objectives of measurement are: determining whether children master a particular concept or skill; informing children and families of what they know and what they can do; indicating to children where to focus for improvement; determining how to group learners; identifying individuals with special needs; and comparing the performance of groups of children locally, nationally, or internationally. Attending to the needs of the evaluation of aquatic competence, and considering the importance of this competence in childhood and adolescence, this study aimed to analyse



Source: Moher et al. (2009).

Figure 1. PRISMA flow diagram.

all the validated measurement instruments of aquatic competence at the infant and primary stage.

In this sense, the carried out review found 8 scientific publications that present the validation and proposal of an instrument to measure aquatic competence in toddlers, infants, and children.

Some of them are designed for the measurement of real aquatic competence in the first months of life (Salar-Andreu et al., 2018); some others for the infant stage (Gómez-Mármol et al., 2015; Moreno-Murcia et al., 2020); while for the 6 to 12-year stage some instruments have been designed in a more specific way (Moreno-Murcia, 2005; De Paula-Borges & Moreno-Murcia, 2018; Chan et al., 2020). On the other hand, the research of Moreno and Ruiz-Pérez (2008) and Vogt and Staub (2020) focused on the measurement of perceived aquatic competence. In general, the orientation of all validations is focused on the measurement of aquatic competence in a global way, but the studies of Salar-Andreu

Table 1. The Downs and Black Checklist scores for the articles selected.

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	%
Moreno-Murcia (2005)	1	1	1	1	1	1	0	1	0	0	1	1	1	NA	NA	NA	1	0	1	1	1	1	NA	NA	1	0	1	77
Moreno & Ruiz-Pérez (2008)	1	1	0	1	0	1	1	0	NA	1	1	1	1	NA	1	NA	1	1	1	1	1	1	NA	NA	1	0	1	82
Gómez-Mármol et al. (2015)	1	1	0	1	0.5	1	1	0	0	0	1	1	1	NA	1	NA	NA	1	1	1	1	1	0	NA	0	0	1	67
Salar-Andreu et al. (2018)	1	1	1	1	1	1	1	0	0	1	1	1	1	NA	0	NA	1	1	1	1	1	1	0	0	1	0	1	76
De Paula-Borges and Moreno-Murcia (2018)	1	1	1	1	1	1	1	0	NA	1	1	1	1	1	0	NA	1	1	1	1	1	1	1	0	1	1	1	88
Vogt and Staub (2020)	1	1	1	1	0.5	1	1	1	NA	NA	1	0	0	NA	NA	NA	1	1	1	1	UC	UC	NA	NA	0	UC	1	68
Chan et al. (2020)	1	1	1	1	0	1	1	1	0	0	1	1	1	NA	NA	NA	1	1	1	1	1	1	NA	NA	0	NA	1	81
Moreno-Murcia et al. (2020)	1	1	1	1	0.5	1	1	0	NA	1	1	1	1	NA	0	NA	NA	1	1	1	NA	NA	NA	NA	NA	0	0	75

Table 2. Study characteristics of the articles included in the review.

	Study	Sample	Age	Study Type	Mode
1	Moreno (2005)	*n*= 645	3 – 11 years	Test	Direct Observation, 1 observer
2	Moreno & Ruiz-Pérez (2008)	*n*= 100	4.5± 0.67 years	Pilot Test-Retest	Individual, perception of each child
3	Gómez-Mármol et al. (2015)	*n*= 58	4.56± 1.15 years	Test-Retest	Direct Observation, 1 observer
4	Salar-Andreu et al. (2018)	Study 1: *n*= 211 Study 2: *n*= 831	8.6± 1.9 months 8.68± 2.27 months	Pilot test Test	Direct Observation, 1 observer
5	De Paula-Borges and Moreno-Murcia (2018)	*n*= 80	6 – 7 years	Control/intervention groups	Direct Observation, 2 observers
6	Vogt and Staub (2020)	*n*= 22	6.95± 1.03 years	Test	Filming in three planes, multiple observers
7	Chan et al. (2020)	Study 1: *n*= 4959 Study 2: *n*= 1614	8.63± 1.71 years 6.4± 0.52 years	Test-retest	Individual, perception of each child
8	Moreno-Murcia et al. (2020)	Study 1: *n*= 122 Study 2: *n*= 384 Study 3: *n*= 444	n/e 4.02± 0.82 years 4.45± 0.84 years	Pilot Test	Direct Observation, 1 observer

Table 3. Instruments used, characteristics of the evaluation, scoring, and conclusions of the studies selected.

	Study	Instruments	Characteristics of the Evaluation	Scoring
1.	Moreno (2005)	Aquatic Motor Competence Scales	16 items [age: 4 – 5 years] 16 items [age: 6 – 7 years] 14 items [age: 8 – 9 years] 10 items [age: 10 – 11 years] Divided into two factors (familiarisation and immersion).	1 to 4
2.	Moreno and Ruiz-Pérez (2008)	Pictorial Scale of Perceived Aquatic Competence	10 items divided into two factors (perceived motor skills in water and attitude towards the water).	A, B & C
3.	Gómez-Mármol et al. (2015)	Observation Sheet for the Evaluation of Aquatic Psychomotor Assessment	22 items divided into five dimensions (familiarisation with the environment, balance, movement, manipulations, and social relations).	1 to 5
4.	Salar-Andreu et al. (2018)	Aquatic Developmental Aquatic Inventory	14 items divided into four areas (personal/social/emotional, communicative, cognitive, and aquatic motor skills).	1 to 4
5.	De Paula-Borges and Moreno-Murcia (2018)	Instrument for Measuring Knowledge, Ability, and Behavior in Aquatic Activities	11 items for the evaluation of knowledge. 35 items for the evaluation of ability. 16 items for the evaluation of knowing how to be.	Dichotomous
6.	Vogt and Staub (2020)	Assessment of Basic Aquatic Skills	19 consecutive tests	Dichotomous
7.	Chan et al. (2020)	Swimming Competence Questionnaire	11 items divided into two factors (distance and abilities)	Distance & dichotomous
8.	Moreno-Murcia et al. (2020)	Measurement Scale of Aquatic Competence in Infants Pictorial Scale of Perceived Aquatic Proficiency	23 items divided into three dimensions (socio-affective, cognitive, and motor). 6 items of the 'aquatic motor skills' factor.	1 to 5 A, B & C

et al. (2018) and Moreno-Murcia et al. (2020) have already begun to analyse aquatic competence in a more complete way (including the motor, cognitive and socio-affective domains).

The acquisition of technical skills can be gauged by designing an analysis specifically for it. It begins with the development of an analysis of the needs of the given population (Knudson, 2007). This helps identify an initial diagnosis, from which a specific course of action or intervention is determined. The process must always end with an assessment of the intervention carried out, which in turn involves measuring the effects of the intervention programs and making the corresponding decisions derived from this assessment. Measurement provides the information needed to design the best possible intervention strategy, and measurement also indicates to what extent this strategy has led to the desired results. Inadequate measurement of skills can lead to the acquisition and development of ineffective skills or a false sense of security (Di Paola, 2019), so validating the tools intended for skills verification is very important. From a scientific point of view, the validation of an instrument is a process that must be carried out to be able to recommend the use of a given measurement tool.

When developing aquatic competence tests, it is important to adapt these tests based on the age of the participants, making a clear identification of objectives that the children should acquire in each of these stages. In their report, De Martelaer and Soons (2014) established three different proposals to measure aquatic motor skills according to three different age groups: 6, 9, and 12 years old, where the distance of movements in the environment or the time spent in various horizontal or vertical positions increased based on age. This latter measuring instrument (De Martelaer & Soons, 2014) proposed skills in horizontal and vertical positions (displacements, floats, turns) to differentiate the competence in both positions. To this, entrance into the water through a jump was added, having aquatic security as a fundamental objective along with the measurement of the proposed skills. This gives a more holistic approach to measuring the overall motor development of the child. The authors of this paper are in favour of a broader measurement of aquatic competence, going beyond exclusively dealing with avoiding drowning as it gives an overall picture of skill acquisition in a stage when children are learning and also has an impact with regards to the transfer of skills from aquatic activities to others that they perform, thus favouring the integral development of the child.

This review has found that there is a shortage of validated measurement instruments to measure overall aquatic competence in infants and primary school. From this point of view, it would be interesting to continue to research the development and validation of instruments to measure aquatic competence, both at the elementary and primary stages, as well as in other ages, so that the teaching-learning process can be evaluated and optimised. Aquatic motor competence can be complemented with other specific instruments, such as the scale to measure perceived fear in the aquatic environment in children aged 3 to 6 years (Moreno-Murcia et al., 2020). This type of measurement can be a complement of great interest for measuring children's aquatic competence since it can provide valuable information regarding factors that may influence the actual aquatic competence itself.

CONCLUSION

The systematic review confirms that eight instruments have been developed and validated in recent years for measuring aquatic competence for children between 6 months and 14 years of age from a multipurpose perspective. These tools are designed to facilitate and improve teacher assessment, and determine children's perception of their own aquatic competence, both from the motor dimension and the emotional, social, cognitive, and communicative dimensions.

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