ISSN 1646-107X
eISSN 2182-2972

motricidade

2020, vol. 16, n. 4

SUMÁRIO

Wearing face mask during physical exercise 316
Tiago M. Barbosa

Relationship between ball possession and match outcome in UEFA Champions League 319
Vinicius Martins Farias, Wesley Bierhals Fernandes, Gabriel Gustavo Bergmann, Eraldo dos Santos Pinheiro

Reproducibility and equivalence of GDLAM protocol mobile application for the evaluation of functional autonomy 326
Rafaela C Araújo-Gomes, Claudio J Borba-Pinheiro, Eduardo L Nascimento, Rodrigo G S Vale, Alexandre J Drigo, André A Andrade, Mauro C G A Carvalho, Adriana G N Ferreira, Estélio H M Dantas

Association between Quality of life, Sleepiness, Fatigue, and Anthropometric Parameters in young University Students 333
Rosane de Almeida Andrade, Bruna Araújo Rodrigues, Thiago Medeiros da Costa Daniele, Lucas Lima Vieira, Nelson Joaquim Sousa

Comparação de indicadores antropométricos em atletas de ginástica rítmica satisfeitas e insatisfeitas com a imagem corporal.....340
Suellem Zanlorenci, Priscila Custódio Martins, Diego Augusto Santos Silva, Rozane Aparecida Toso Bleil

Changes in the functional capacity of active and institutionalized elderly 346
Igor Conterato Gomes, Genival Caetano Ferreira Neto, Luiz Victor da Silva Costa, Mike Farias Xavier, Prodamy da Silva Pacheco Neto, Júlio César Chaves Nunes Filho

Percepção de barreiras para participação de idosos em programas de atividades físicas 353
Carla Elane Silva dos Santos, Eleonora d'Orsi, Cassiano Ricardo Rech

Analysis of the behavior of volleyball coaches of youth female categories.....361
Jéssica Santos Ferreira Prazeres, Luísa Helena Silva, Leandro Vinhas de Paula, Juliana Otoni Parma, Mateus Graçano Hamdan, Renato Melo Ferreira

Design and Validation of a Scale to Measure Fear of the Aquatic Environment in children 370
Juan Antonio Moreno Murcia, Elisa Huéscar Hernández, Luciane de Paula Borges, Neus Gómez Vera

Voleibol de Praia: Análise Temporal e Respostas Endócrinas de Atletas de Nível Nacional 379
Yago Pessoa Costa, Fabricio Boscolo Del Vecchio, Jefferson Muniz de Lima, Lúcio Roberto Cançado Castellano, Gilmário Ricarte Batista

Adaptation of the Aquatic Functional Assessment Scale for Babies – AFAS-BABY©.....386
Luize Bueno de Araujo, Tainá Ribas Mélo, Vera Lúcia Israel

Comparison between Under-13 and Under-15 Soccer Players in Small-Sided and Conditioned Games 393
Davi Correia da Silva, Ítalo Bartole Resende, Fabrício Vasconcellos, Gibson Moreira Praça, Israel Teoldo

Influência do ambiente na motivação esportiva: comparação entre espaços sistematizados e não sistematizados de prática 400
Vinicius Machado de Oliveira, Marcos Roberto Brasil, Verônica Volski Mattes, Pedro Henrique Iglesiaz Menegaldo, Neidiana Braga da Silva Souza, Schelyne Ribas

Acute physiological responses during a Brazilian endurance triathlon race.....411
Danielli Mello, Eduardo Borba Neves, Wagner Romão, Antony Santos, Filipe Farias, Thiago Dias, Marcio Sena, Marcos Dias Pereira, Guilherme Rosa, Rodrigo Vale

O papel dos instrutores de fitness na adesão à prática de exercício físico em Portugal: a importância dos comportamentos de suporte e dos climas motivacionais 420
Filipe Rodrigues, Diogo Monteiro, Diogo Teixeira, Luís Cid

EDITORIAL

https://doi.org/10.6063/motricidade.21849

Wearing face mask during physical exercise

Tiago M. Barbosa[1]*

It was in November 2019 that the first cases of humans infected by COVID-19 were identified in Wuhan, China. In November 2020, the Center for Systems Science Engineering at John Hopkins University reported 55 million global cases and 1.3 million deaths. World Health Organisation broke down the global cases by regions. Until November 2020, there were 23.1 million confirmed cases in the Americas, 15.2 million in Europe, 10 million in South-East Asia, 3.5 million in Eastern Mediterranean, 1.4 million in Africa and 0.8 million in Western Pacific. These numbers show that this is a public health crisis at global scale and is not contained to a single region as happened in the recent past. Since the 2000s, there were some smaller-scale outbreaks, such as SARS (2002-2003, 700 deaths), Swine Flu (2009-2010, 200 thousand deaths) and, Ebola (2014-2016, 11.3 thousand deaths). To find a pandemic leading to a larger death toll one must go back to the 1950s and 1960s. The Asian Flu (1957-1958) killed 1.1 million people and the Hong Kong Flu (1968-1970) with 1.0 million deaths.

COVID-19 pandemic is far more than a public health crisis. It has been disrupting the livelihood of everyone, affecting the economy, and having a negative social impact on a globalised world. The landscape across several industries changed suddenly. Industries had to adapt to the pandemic, including Education and Sports. For instance, United Nations Children's Fund (UNICEF) reported in September 2020 that at least 463 million children whose schools closed due to COVID-19, had no access to home-based learning. At the peak of the first wave and lockdowns, around 1.5 billion schoolchildren were affected by school closures. One out of three children did not have any kind of formal education for more than 6 months. Now, most educational systems are providing at least remote (radio, TV, online, etc.) or blended learning. It is no different in the Sports industry. In 2019, the 6 most popular team sports in Portugal (Handball, Basketball, Football/Soccer, Futsal, Roller Hockey) had 220,000 age-group athletes. By November 2020, these 6 team sports had a total of 46,000 age-group athletes. In one year, about 174,000 young athletes dropped out of the sport or were no longer registered at the governing bodies (i.e., National Sports Federation). One may wonder the short- mid- and long-term impact of the lack of formal education and sports participation in this cohort of schoolchildren.

Countries have been putting in place guidelines allowing athletes to resume training and competition. The guidelines, its stringency and enforcement vary from country to country and there is no stablished consensus on the best practices to tackle the transmission of the virus. There is an ongoing discussion if face mask can or should be worn doing physical exercise. A few of questions are raised quite often when one is engaged in dialogs on this matter: (1) does the mask affects the athletic performance? (2) how comfortable is to exercise wearing a face mask? (3) does the mask leads to hypercapnia (the increase of partial carbon dioxide in the body)?

The number of research papers in the literature on this topic is rather scarce (as of 14 November 2020). Running a search, it was possible to retrieve seven papers addressing the abovementioned questions (Roberge et al., 2010; Goh et al., 2019; Epstein et al., 2020; Fikenzer et al., 2020; Otsuka, Komagata, & Sakamoto, 2020; Shaw et al., 2020; Wong et al., 2020). Overall, 187 participants were recruited in these seven studies (between 6 and 106 participants). Most studies requested the participants to perform endurance exercises (cycling and walking/running) during 6 to 60 minutes at moderate-vigorous intensity (Figure 1). One study did not report the duration of the exertion, one reported 60 minutes and all others less than 20 minutes. Thus, studies addressed the effect of wearing a face mask (cloth mask, surgical mask or filtering facepiece/N95) during short bouts at moderate-maximal intensity. As such, it remains unclear the effect of wearing face mask in a wide range of sports and exercise

[1]Editor-in-Chief of the Journal Motricidade; Department of Sport Sciences, Polytechnic Institute of Bragança
*Corresponding author: Campus Sta. Apolónia, Ap. 5300-253 Bragança, Portugal; Email: editor.in.chief@revistamotricidade.com

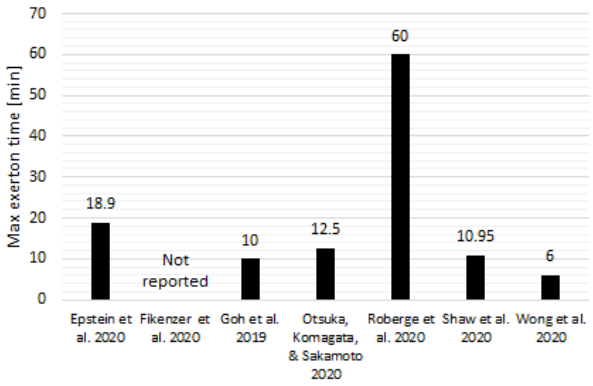

Figure 1. The maximal duration of the exertion reported in each study.

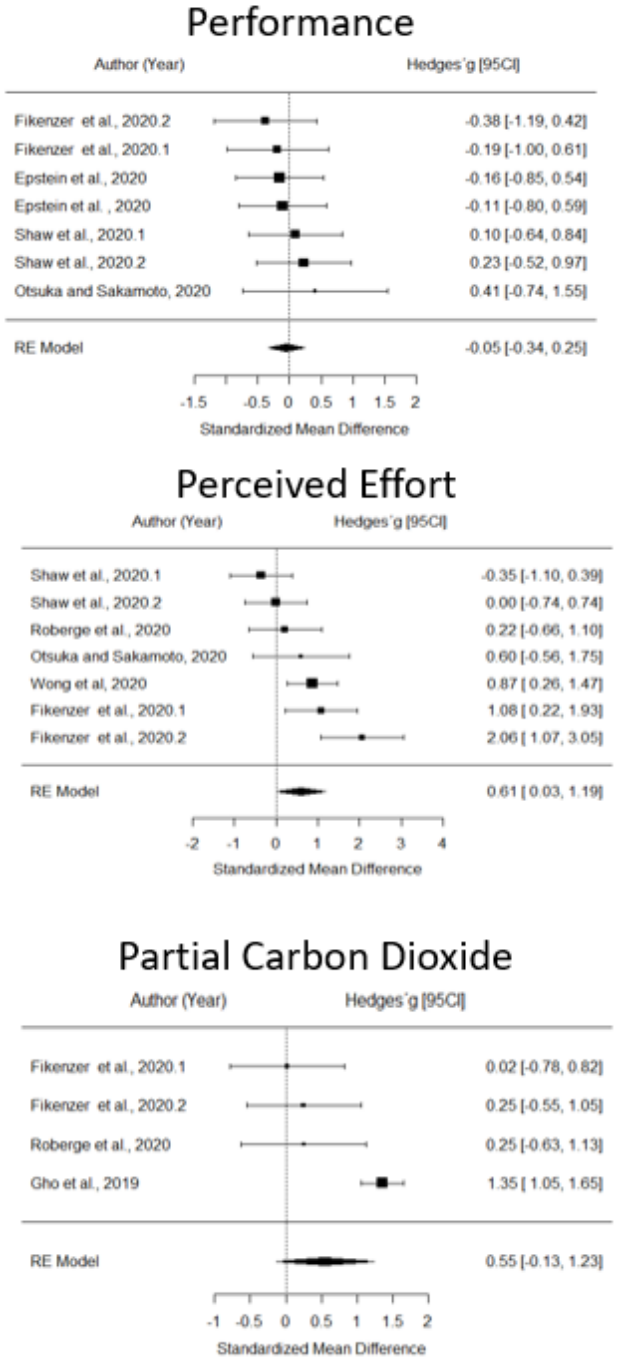

Figure 2. The effect of wearing face mask on athletic performance, perceived effort, and partial carbon dioxide.

programmes that do not require such level of physical exertion (duration and intensity).

A random effects model (restricted maximum likelihood) was run on R to estimate the effect sizes of wearing face mask (experimental conditions) in comparison to not wear it (control condition) in the athletic performance, perceived effort and partial carbon dioxide (Figure 2). Wearing face masks had a trivial effect on the athletic performance (I^2 = 0%; g = -0.05; 95CI: -0.34;0.25). Therefore, wearing the mask has no effect on the performance delivered during reasonably short bouts of moderate-maximal intensity. Face masks had a large effect on the perceived effort (I^2 = 71%; g = 0.61; 95CI: 0.03; 1.19). Thus, the mask is deemed as a discomfort during exercise. The face mask had a large effect on carbon dioxide retention (I^2 = 76%; g = 0.55, 95CI: -0.13; 1.23). Carbon dioxide increased wearing the face mask, but below 45 mm Hg, which was selected as a cut-off value for hypercapnia (Yang et al., 2015; Morales-Quinteros et al., 2019). Having said that, the upper bound of the 95% confidence interval of at least one study (Roberge et al., 2010) is close to 45 mm Hg (95CI: 37.99-46.00) wearing a filtering facepiece/N95 and walking 60 minutes at 4 km/h. Due to the small number of studies available, one should refrain from running further analyses such as subgroup comparisons (cloth masks vs surgical mask vs filtering facepiece/N95) to have insights on the statistical heterogeneity.

In summary, little is known about wearing face mask in exercise programmes and sports that do not require short bouts (6 to 20 minutes) of moderate-maximal exertion. Face mask does not change the athletic performance in 6-20 minutes bouts of moderate-maximal exertion. However, it increases the perceived effort and the partial carbon dioxide, even though below 45 mm Hg. Exercise and sport participation guidelines under COVID-19 pandemic should strike a balance between evidence furnished by public health, economy, and sport sciences. Policymakers are invited to take into consideration the sport science evidence abovementioned when drafting and updating guidelines on physical exercise in Sports and Education settings.

REFERENCES

Epstein, D., Korytny, A., Isenberg, Y., Marcusohn, E., Zukermann, R., Bishop, B., ... & Miller, A. (2020). Return to training in the COVID-19 era: The physiological effects of face masks during exercise. *Scandinavian journal of Medicine & Science In Sports*. https://doi.org/10.1111/sms.13832

Fikenzer, S., Uhe, T., Lavall, D., Rudolph, U., Falz, R., Busse, M., ... & Laufs, U. (2020). Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity. *Clinical Research in Cardiology*, 1-9. https://doi.org/10.1007/s00392-020-01704-y

Goh, D. Y. T., Mun, M. W., Lee, W. L. J., Teoh, O. H., & Rajgor, D. D. (2019). A randomised clinical trial to evaluate the safety, fit, comfort of a novel N95 mask in children. *Scientific Reports*, *9*(1), 1-10. https://doi.org/10.1038/s41598-019-55451-w

Morales-Quinteros, L., Camprubí-Rimblas, M., Bringué, J., Bos, L. D., Schultz, M. J., & Artigas, A. (2019). The role of hypercapnia in acute respiratory failure. *Intensive care medicine experimental*, *7*(1), 39. https://doi.org/10.1186/s40635-019-0239-0

Otsuka, A., Komagata, J., & Sakamoto, Y. (2020). Wearing a surgical mask does not affect the anaerobic threshold during pedaling exercise. *Journal of Human Sport and Exercise*. https://doi.org/10.14198/jhse.2022.171.03

Roberge, R. J., Coca, A., Williams, W. J., Powell, J. B., & Palmiero, A. J. (2010). Physiological impact of the N95 filtering facepiece respirator on healthcare workers. *Respiratory Care*, *55*(5), 569-577.

Shaw, K., Butcher, S., Ko, J., Zello, G. A., & Chilibeck, P. D. (2020). Wearing of Cloth or Disposable Surgical Face Masks has no Effect on Vigorous Exercise Performance in Healthy Individuals. *International Journal of Environmental Research and Public Health*, *17*(21), 8110. https://doi.org/10.3390/ijerph17218110

Wong, A. Y. Y., Ling, S. K. K., Louie, L. H. T., Law, G. Y. K., So, R. C. H., Lee, D. C. W., ... & Yung, P. S. H. (2020). Impact of the COVID-19 pandemic on sports and exercise. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, *22*, 39-44. https://doi.org/10.1016/j.asmart.2020.07.006

Yang, H., Xiang, P., Zhang, E., Guo, W., Shi, Y., Zhang, S., & Tong, Z. (2015). Is hypercapnia associated with poor prognosis in chronic obstructive pulmonary disease? A long-term follow-up cohort study. *BMJ open*, *5*(12), e008909. http://dx.doi.org/10.1136/bmjopen-2015-008909

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.18382

Relationship between ball possession and match outcome in UEFA Champions League

Vinicius Martins Farias[1]*, Wesley Bierhals Fernandes[2], Gabriel Gustavo Bergmann[2], Eraldo dos Santos Pinheiro[2]

ABSTRACT

This study aimed to verify the relationship between ball possession and match outcome in the UEFA Champions League. Official statistics from five seasons were analyzed, and descriptive analysis and the Chi-Square test were used for statistical analysis ($p<0.05$). Overall, teams with more ball possession won 49.2%, draw 22.0%, and lost 28.7% of the matches. In the group phase, teams with more ball possession won 50.5%, draw 23.0%, and lost 26.5% of the matches, while in the knockout phase, teams with more ball possession won 45.1%, draw 19.0%, and lost 35.9% of the matches. In general, teams with more ball possession won more matches in the competition, and this was especially true when the range of ball possession percentage between two teams in a match was higher.
KEYWORDS: Soccer, Sports, Match Analysis, Athletic Performance.

INTRODUCTION

Performance analysis in sport is based on the recording and examination of events that occurred in sports competitions. Performance analysis aims to improve performance by assessing performance indicators and identifying patterns related to success (Castellano et al., 2012; Hughes & Bartlett, 2002; Lago-Peñas et al., 2010). In that sense, various researchers have studied the factors that might influence soccer performance to identify those that can most relate to success (Castellano, 2008). As the number of goals in soccer matches is usually low, other indicators are commonly used to assess teams´ performance, with ball possession being one of the most popular (Goral, 2015; Kempe et al., 2014; Lago & Martín, 2007). In fact, many studies have focused on the relationship between ball possession and success in different levels of competitive soccer, among other performance indicators (Collet, 2013; Goral, 2015; Jones et al., 2004; Kempe et al., 2014; Lago-Peñas & Dellal, 2010; Parziale & Yates, 2013; Rodrigues et al., 2016).

Among the many authors that have discussed the relations between ball possession and success in soccer Liu et al. (2015a) found that ball possession was one of the variables that could distinguish teams from different levels in the UEFA Champions League. In another study by Lago-Peñas and Dellal (2010), the results showed that the mean percentage of ball possession of the top-placed teams in the Spanish League was higher than the less successful teams in the competition. The authors also found that the most successful teams presented less variation in their playing style and were able to maintain a pattern of play. In the same sense, Moura et al. (2014) studied game-related statistics from the 2006 World Cup and found that ball possession was one of the variables that could discriminate winning teams from those who draw or lose the competition. Lago-Peñas et al. (2010) also found that ball possession was one of the variables able to discriminate between winning, drawing, and losing teams in the 2008/2009 Spanish League.

In another study, Parziale and Yates (2013) found a strong correlation between points earned and ball possession in a regular season of the English Premier League, also larger ball possession rates for the top four teams in that competition. Hoppe et al. (2015) found a similar relationship between

[1]Universidade Federal do Pampa, Uruguaiana, Rio Grande do Sul, Brasil
[2]Universidade Federal de Pelotas, Pelotas, Rio Grande do Sul, Brasil
*Corresponding author: Universidade Federal do Pampa, BR 472 - Km 592 - Caixa Postal 118 - Uruguaiana - RS - CEP: 97508-000.
Email: vinicius.farias@hotmail.com

Conflict of interests: Nothing to declare. Funding: Nothing to declare.
Manuscript received at July 29th 2019; Accepted at September 20th 2020

total distances covered with ball possession and points accumulated in the 2012/2013 German Bundesliga. In the study by Liu et al. (2015b), the authors found that ball possession was one of the match statistics that had a positive effect on the probability of winning in the group stage of the 2014 World Cup. Furthermore, Goral (2015) also found that ball possession was related to success in the 2014 World Cup, as the top four teams had the most ball possession during matches. Moreover, Germany was the winner and the team with the highest mean ball possession percentage in the competition. In the same sense, Kempe et al. (2014) analyzed matches from two consecutive seasons of the Bundesliga and the 2010 World Cup, finding that the most successful teams preferred a ball possession style of play.

Nevertheless, in the study by Collet (2013), analyzing some of the most important soccer competitions, the author found that ball possession could be considered a direct predictor of match outcome, as teams with more possession shot more and scored more goals. However, when the quality of teams and home advantage were considered, and the strongest teams of the competition were removed from the analysis, the relationship was weakened overall. Also, time of possession was found to be a poor predictor of match results in those conditions. These results suggest that the relationship between ball possession and success found in that study was greatly influenced by the results of the strongest teams.

Another study showing a poor relationship between ball possession and success was the work of Gama et al. (2016), in which was found that in the Portuguese Premier League of 2010/2011 the amount of ball possession did not relate to the outcome of matches. In this study, however, the analysis included the matches of only one team, so the particular style of play adopted by the club in question, among other factors, should be considered for the interpretation of the results found. In the study of Castellano et al. (2012), analyzing the World Cups of 2002, 2006 and 2010, the authors found that ball possession was not a discriminating variable between successful and unsuccessful teams when the three competitions were analyzed altogether. However, it could have been an important success factor in the competitions of 2006 and 2010, as the results showed ball possession as one of the variables that differentiated winning, drawing and losing teams in those competitions. In another study analyzing national leagues in Europe, Evangelos et al. (2014) found that ball possession percentage was different between teams only in matches where the result's range was wide, with the winning teams having higher percentages of ball possession than losing teams. However, when the result ranges were short, the amount of ball possession found between teams was similar.

Therefore, despite a large number of studies on this subject, it remains inconclusive how much the adoption of a game model based on keeping possession of the ball can influence the outcome of a competitive match, and conflicting results are found in the literature indicate the need for more data in this area of study. One important aspect, commonly ignored when evaluating ball possession and match outcome, is the range of difference of ball possession percentages between the two opposing teams in a match. It is possible that some of the conflicting results found in literature could be related to authors not considering how large was the difference of ball possession between teams. Moreover, it is essential to emphasize that ball possession, however necessary, is only one of the many variables which can influence match outcome.

Therefore, this study aimed to investigate the relationship between the teams´ percentage of ball possession and match outcome and the influence of different ranges of the percentage of ball possession among five consecutive competitive seasons of the UEFA Champions League. The UEFA Champions League can be considered one the most important soccer competitions in the world (Parziale & Yates, 2013) as it includes the best-ranked clubs from the European national leagues (Liu et al., 2015a), so it is of most relevance to analyze the question in that context.

METHOD

The study protocol followed the guidelines following the declaration of Helsinki. Teams and players remained anonymous, and the data used was publicly available on the internet. For this reason, there was no submission of the project to the Research Ethics Committee.

Procedures

In this study, a total of 625 matches were analyzed from seasons 2014/2015, 2015/2016, 2016/2017, 2017/2018, and 2018/2019 of UEFA Champions League. Data regarding ball possession statistics and match results were obtained at the competition's official website (www.uefa.com). For each match, the percentage of ball possession of both teams and the team's match outcome with the most ball possession (win, draw or loss) was identified. The percentages were based on a sum of 100% and matches where both teams had the same percentage of ball possession (50%) were excluded from the analysis. The analysis results were split between competition stages (group stage and knockout stage) and also divided according to the difference between ball possession of the

two teams in a match, represented by the percentage of the team with most ball possession, in the following categories: group A (51-55%); group B (56-60%); group C (61-65%); group D (66-70%); and group E (≥71%).

Statistical analysis

All data were analyzed using the software SPSS Statistics. Descriptive analysis was used to quantify matches won, draw, and lost for teams with the most ball possession, and Chi-Square Test (χ^2) was used to determine significant statistical differences (Rodrigues et al., 2013). Nonparametric Pearson´s Chi-square test is used to determine the possible divergences between observed and expected frequencies of a given variable. In the present study, the number of matches won, draw, or lost by teams with the most ball possession was analyzed to determine possible statistical differences between their frequencies. The level of significance was set at $p<0.05$.

RESULTS

In the five UEFA Champions League seasons analyzed, a total of 26 matches presented the same percentage of ball possession for both teams, one in season 2014/15, eight in season 2015/16, six in season 2016/17, five in season 2017/18 and six in season 2018/19. These matches were excluded from statistical analysis. In general, the results showed that the teams with the highest percentage of ball possession won 295 (49.2%), draw 132 (22.0%), and lost 172 (28.7%) matches (p=0.000).

Results of match outcome for the team with the highest ball possession percentage are shown in tables 1 and 2. Analysis divided by categories of differences in percentages of ball possession was also made. A total of 217 matches were included in Group A, and results showed that teams with the highest ball possession percentage won 85 (39.2%), draw 58 (26.7%), and lost 74 (34.1%) matches in this group (χ^2=5.097, p=0.078). A total of 183 matches were included in Group B, and results showed that teams with the highest ball possession percentage won 85 (46.4%), draw 41 (22.4%), and lost 57 (31.1%) matches (χ^2=16.262, p=0.000). In Group C, there was a total of 130 matches, and the results showed that teams with the highest ball possession percentage won 78 (60.0%), draw 21 (16.2%), and lost 31 (23.8%) matches (χ^2=42.754, p=0.000). In Group D, there were 59 matches, and teams with the highest ball possession percentage won 42 (71.2%), draw 10 (16.9%), and lost 7 (11.9%) of them (χ^2=38.271, p=0.000). Finally, in Group E, there was a total of 9 matches, and the teams with the highest ball possession

Table 1. Match outcome for the team with the highest ball possession percentage

Season	Matches	Won	Draw	Lost	χ^2	p
2014/2015	124	65 (52.4%)	28 (22.6%)	31 (25.0%)	20.435	0.000
2015/2016	117	53 (45.3%)	21 (17.9%)	43 (36.8%)	13.744	0.001
2016/2017	119	58 (48.7%)	32 (26.9%)	29 (24.4%)	12.824	0.002
2017/2018	120	59 (49.2%)	25 (20.8%)	36 (30.0%)	15.050	0.001
2018/2019	119	60 (50.4%)	26 (21.8%)	33 (27.7%)	16.252	0.000
Total	599	295 (49.2%)	132 (22.0%)	172 (28.7%)	72.284	0.000

Table 2. Match outcome for the team with the highest ball possession percentage according to the competition stage

Season	Group Stage						Knockout Stage					
	Matches	Won	Draw	Lost	χ^2	p	Matches	Won	Draw	Lost	χ^2	p
2014/2015	95	50 (52.6%)	21 (22.1%)	24 (25.3%)	16.063	0.000	29	15 (51.7%)	7 (24.1%)	7 (24.1%)	4.414	0.110
2015/2016	88	40 (45.5%)	13 (14.8%)	35 (39.8%)	14.068	0.001	29	13 (44.8%)	8 (27.6%)	8 (27.6%)	1.724	0.422
2016/2017	90	45 (50.0%)	29 (32.2%)	16 (17.8%)	14.067	0.001	29	13 (44.8%)	3 (10.3%)	13 (44.8%)	6.897	0.032
2017/2018	93	49 (52.7%	19 (20.4%)	25 (26.9%)	16.258	0.000	27	10 (37.0%)	6 (22.2%)	11 (40.7%)	1.556	0.459
2018/2019	91	47 (51.6%)	23 (25.3%)	21 (23.1%)	13.802	0.001	28	13 (46.4%)	3 (10.7%)	12 (42.9%)	6.500	0.039
Total	457	231 (50.5%)	105 (23.0%)	121 (26.5%)	61.777	0.000	142	64 (45.1%)	27 (19.0%)	51 (35.9%)	14.887	0.001

percentage won 5 (55.6%), draw 1 (11.1%), and lost 3 (33.3%) matches (χ^2=2.667, p=0.264). Results of matches won, draw, and lost in each group are shown in Figure 1.

DISCUSSION

The present study investigated the relationship between ball possession and match outcome to determine whether teams with a higher percentage of ball possession in a match were more likely to win, draw or lose in the UEFA Champions League. Results over five consecutive seasons showed that a greater number of matches were won by the teams with a higher percentage of ball possession (P<0.05) in all five seasons 2014/15 (52.4 %), 2015/16 (45.3%), 2016/17 (48.7%), 2017/18 (49.2%) and 2018/19 (50.4%), which indicates that teams that kept most ball possession won more matches overall. These findings agree with the results of most studies found in the literature. However, the main result of the present study remains in the analysis of groups where teams had different ranges of ball possession and in different competition stages.

By splitting the results between competition stages, we aimed to analyze the results in different contexts, assuming that in the group stage, the technical difference between teams would be greater than in the knockout stage, which included only the sixteen best-qualified teams in the group stage, where the quality of teams would be more balanced. In the group stage, the results also showed most of the matches played won by the team with the highest percentage of ball possession overall and in four of the five seasons assessed, except for season 2015/2016, when the number of matches won by teams with higher ball possession (40) was very similar to the number of matches lost (35). However, results of matches in the knockout stage showed similar numbers of matches won and lost by the teams with most ball possession, as seen in three of the five seasons analyzed with no statistical differences between winning, drawing, or losing. Moreover, in the two seasons where there was a significant statistical difference, it was related to the number of draws and not between wins and losses. Therefore, it seems that possible technical differences between teams could influence the results found.

Another important factor that should be considered when evaluating match outcome is the range in ball possession percentages between the two teams in a match, in order to differentiate the results from matches where the percentages of both teams were close and matches where one of the teams had a much higher amount of ball possession than the other. Therefore, we analyzed the results by splitting the matches into groups related to the range of difference of ball possession percentages between teams. The results showed that when both teams in a match had a close percentage of

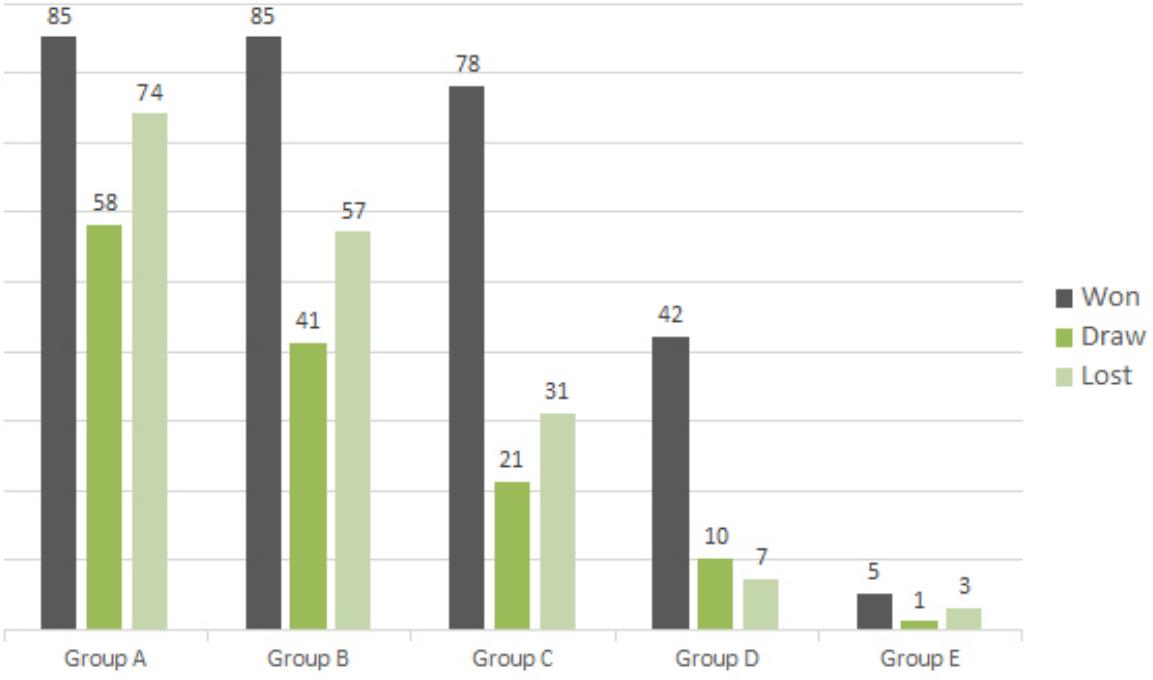

Figure 1. Match outcome for the team with highest ball possession percentage divided by groups

ball possession (Group A), there were no significant differences in the matches' outcome. However, as the difference in the percentage of ball possession between teams increased, different results were found. In Group B, with the range of ball possession between teams varying from 56-44% and 60-40%, there was a significant statistical difference between winning, drawing, and losing for the team with the most ball possession. Moreover, in group C, when the difference of percentage of ball possession between teams in a match varied from 61-39% to 65-35%, teams with most ball possession won 60.0% of the matches and lost only 23.8% ($p<0.05$). Furthermore, in group D, when ball possession differences could be up to 70-30%, the results also showed teams with higher percentages of ball possession winning 71.2% of the matches and losing 11.9% ($p<0.05$). Finally, in group E, a total of five matches were won, and three were lost by the team with the highest percentage of ball possession, with no significant statistical differences. The low number of matches found in this last group makes it difficult to assess significant statistical differences when most ball possession teams had a percentage of 71% or over. However, the same trend could be expected in the other groups, where the difference in ball possession percentage between teams was high. Besides, it is important to consider that when one of the teams has much more ball possession, the other team normally has an extremely defensive tactical posture. These characteristics impose great difficulty on the task of scoring goals. On the other hand, the team with less ball possession can create scoring opportunities from counter-attack plays. These features can help to explain the results found in the analysis of group E.

One important finding of the present study is the result showing that the range of the difference of ball possession percentage between teams in a match should also be considered for better interpretation of the relationship between ball possession and match outcome, as we found different results in matches where teams had similar percentages values and in matches where one team had a much higher percentage of ball possession than the other.

In the discussion about the relationship between ball possession and success in soccer, coaches and players should bear in mind that a ball possession style of play demands high levels of technical and tactical skills (Evangelos et al. 2014), and it might not be appropriate in all cases and contexts. According to Castellano (2008), keeping possession of the ball might help teams impose their offensive playing style. For Adams et al. (2013), keeping the ball allows a team to manipulate the opposition until creating attacking opportunities strategically. However, having possession of the ball should not be considered an aim for itself. Possession-based approaches should only be a means for better construction of offensive plays, which should be finished as best as possible with the creation of shots and goal opportunities to avoid counter-attacks and goal opportunities for the opposition (Liu et al. 2015b).

Previous studies have found similar relations between ball possession and success in soccer (Goral, 2015; Hoppe et al. 2015; Kempe et al., 2014; Lago-Peñas et al., 2010; Lago-Peñas & Dellal, 2010; Liu et al., 2015a; Liu et al., 2015b; Moura et al. 2014; Parziale & Yates, 2013). However, many studies have shown that different aspects such as quality of teams; match venue; match status; team and opposition´s identities; location of ball possession and player´s position; and level of competition can influence the relationship between ball possession and success in soccer (Adams et al., 2013; Collet, 2013; Jones et al., 2004; Lago & Martin, 2007; Rodrigues et al., 2016). The results found in the present study indicate that the range of difference of ball possession percentage between teams in a match should also be considered when evaluating the relationship between ball possession and match outcome.

According to Lago-Peñas and Dellal (2010), ball possession can be influenced by alternations of teams' styles of play during a match. In their study, Lago and Martín (2007) concluded that match status, match venue, team identity, and opposition identity could influence the differences in ball possession between teams in a match. Also, analysis of ball possession in soccer should consider factors such as the field location of possessions and the teams' strength.

In the study by Jones et al. (2004), for instance, the authors found that the three top teams of the English Premier League of 2001/2002 had significantly longer possessions than the three bottom teams in the competition. However, the results showed that in both successful and unsuccessful teams, the durations of ball possession were longer when they were losing a match than when they were winning, which implicates that match status can change ball possession characteristics. Also, the study by Adams et al. (2013) showed that the amount of ball possession of defenders in the opposition´s half of the field was an important feature of top teams in the English Premier League of 2011/2012, which indicates the importance of analyzing location and players´ positions in relation to ball possession in soccer. Another factor to be considered is the level of competition. For instance, the results of the study by Rodrigues et al. (2016), analyzing three seasons of the Brazilian Serie A and Serie B national leagues, showed median and strong correlations between ball possession and success in all seasons of Brazilian Serie A. However, no significant correlation was found in the Serie B competition.

Limitations of the study include the fact that ball possession should be considered only one of the many variables that influence soccer matches, and it is far from being the sole cause of match outcome. Thus, its results should not be interpreted as isolated from other important performance indicators in soccer. Furthermore, the results found in the present study were observed over five seasons of the same competition, the UEFA Champions League, and can only be interpreted in that context. Furthermore, in the analysis divided by groups related to the range of ball possession percentages between teams, the small number of matches included in group E could have interfered in the results of the statistical analysis. Further research, including competitions of different levels and players from different age groups, is suggested to clarify ball possession's influence on match outcome in soccer.

In terms of practical application, depending on the game model and strategy adopted, a team can either choose to keep more ball possession in a match or allow the opposition to have the ball. If, on the one hand, keeping possession of the ball by itself does not guarantee success, on the other hand, the results found indicate that, overall, teams with most ball possession win more matches than teams with less ball possession over a competitive season. This could be particularly important in long competitions with a round-robin system of points.

The present study evaluated the influence of ball possession from a different perspective from previously found in the literature, which only considered one team as having more or less ball possession than the other in a match and not considering how large was the difference of ball possession percentage between teams. Thus, according to the results found, it seems important not only to have a higher percentage of ball possession than the opposition team in a match, as we found that in matches where the difference of ball possession between teams was close, there were no statistical differences between winning, drawing or losing.

CONCLUSION

The results in this study showed that, in general, there was a trend for winning teams to have a higher percentage of ball possession in the matches of four consecutive seasons of the UEFA Champions League. However, this trend varied over seasons, and it is possible that in matches with technically balanced teams, it could be not as evident. An important result was that when the range between ball percentages of two teams in a match was higher, the number of matches won by teams with the most ball possession was also higher.

ACKNOWLEDGMENTS

Nothing to declare.

REFERENCES

Adams, D., Morgans, R., Sacramento, J., Morgan, S., & Williams, M. D. (2013). Successful short passing frequency of defenders differentiates between top and bottom four English Premier League teams. *International Journal of Performance Analysis in Sport, 13*(3), 653-668. https://doi.org/10.1080/24748668.2013.11868678

Castellano, J. (2008). Análisis de las posesiones de balón en fútbol: frecuencia, duración y transición. *Motricidad. European Journal of Human Movement, 21*, 189-207.

Castellano, J., Casamichana, D., & Lago, C. (2012). The use of match statistics that discriminate between successful and unsuccessful soccer teams. *Journal of Human Kinetics, 31*, 139-147. https://doi.org/10.2478/v10078-012-0015-7

Collet, C. (2013). The possession game? A comparative analysis of ball retention and team success in European and international football, 2007-2010. *Journal of Sports Sciences, 31*(2), 123-136. https://doi.org/10.1080/02640414.2012.727455

Evangelos, B., Aristotelis, G., Ioannis, G., Stergios, K., & Foteini, A. (2014). Winners and losers in top level soccer. How do they differ? *Journal of Physical Education and Sport, 14*(3), 398-405. https://doi.org/10.7752/jpes.2014.03061

Gama, J., Dias, G., Couceiro, M., Sousa, T., & Vaz, V. (2016). Networks metrics and ball possession in professional football. *Complexity, 21*(S2), 342–354. https://doi.org/10.1002/cplx.21813

Goral, K. (2015). Passing success percentages and ball possession rates of successful teams in 2014 FIFA World Cup. *International Journal of Science Culture and Sport, 3*(1), 86-95. https://doi.org/10.14486/IJSCS239

Hoppe, M. W., Slomka, M., Baumgart, C., Weber, H., & Freiwald, J. (2015) Match running performance and success across a season in German Bundesliga soccer teams. *International Journal of Sports Medicine, 36*(7), 563-566. https://doi.org/10.1055/s-0034-1398578

Hughes, M. D., & Bartlett, R.M. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences, 20*(10), 739-754. https://doi.org/10.1080/026404102320675602

Jones, P. D., James, N., & Mellalieu, S. D. (2004). Possession as a performance indicator in soccer. *International Journal of Performance Analysis in Sport, 4*(1), 98-102. https://doi.org/10.1080/24748668.2004.11868295

Kempe, M., Vogelbein, M., Memmert, D., & Nopp, S. (2014). Possession vs. direct play: evaluating tactical behavior in elite soccer. *International Journal of Sports Science, 4*(6A), 35-41. https://doi.org/10.5923/s.sports.201401.05

Lago, C., & Martín, R. (2007). Determinants of possession of the ball in soccer. *Journal of Sports Science, 25*(9), 969-974. https://doi.org/10.1080/02640410600944626

Lago-Peñas, C., Lago-Ballesteros, J., Dellal, A., & Gómez, M. (2010). Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league. *Journal of Sports Science and Medicine, 9*, 288-293.

Lago-Peñas, C., & Dellal, A. (2010). Ball possession strategies in elite soccer according to the evolution of the match-score: the influence of situational variables. *Journal of Human Kinetics, 25*, 93-100. https://doi.org/10.2478/v10078-010-0036-z

Liu, H., Yi, Q., Giménez, J., Gómez, M., & Lago-Peñas, C. (2015a). Performance profiles of football teams in the UEFA Champions League considering situational efficiency. *International Journal*

of Performance Analysis in Sport, 15(1), 371-390. https://doi.org/10.1080/24748668.2015.11868799

Liu, H., Gomez, M., Lago-Peñas, C., & Sampaio, J. (2015b). Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup. *Journal of Sports Sciences, 33*(12), 1205-1213. https://doi.org/10.1080/02640414.2015.1022578

Moura, F. A., Martins, L. E.B., & Cunha, S. A. (2014). Analysis of football game-related statistics using multivariate techniques. *Journal of Sports Sciences, 32*(20), 1881-1887. https://doi.org/10.1080/02640414.2013.853130

Parziale, E. J., & Yates, P. A. (2013). Keep the ball! The value of ball possession in soccer. *Reinvention: International Journal of Undergraduate Research, 6*(1), 1-24.

Rodrigues, V. A. O., Santos, E. P. A., Praça, G. M., Matias, C. J. A. S., & Greco, P. J. (2016). A influência da posse de bola na posição final das equipes do Campeonato Brasileiro Série A e B. *Revista Acta Brasileira do Movimento Humano, 6*(1), 16-26.

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.18384

Reproducibility and equivalence of GDLAM protocol mobile application for the evaluation of functional autonomy

Rafaela C Araújo-Gomes[1]*, Claudio J Borba-Pinheiro[2,3], Eduardo L Nascimento[5], Rodrigo G S Vale[6], Alexandre J Drigo[7], André A Andrade[8], Mauro C G A Carvalho[9], Adriana G N Ferreira[1], Estélio H M Dantas[4,8]

ABSTRACT

This study aimed to develop a mobile application (App) for the Latin American Group for the Development of the Elderly (GDLAM) protocol of functional autonomy in the Android environment and check its reproducibility. This study was divided into two stages: 1) creation and development of the GDLAM App, Android Studio software, and JAVA as a programming language; 2) evaluation of 63 volunteers for the GDLAM protocol using the traditional method and the App. The significance level was set at $p<0.05$. There were no statistical differences between the traditional GDLAM protocol and the App. However, the total time required to assess the GDLAM protocol using the App was significantly lower ($p<0.001$). In addition, the levels of agreement between assessments exhibited strong and very strong positive correlations with significance ($p<0.001$) for all variables. The study showed that the use of the GDLAM App is as efficient as the traditional functional autonomy protocol for the elderly, demonstrating that reproducibility is adequate, assessment time shorter, and results are obtained faster.

KEYWORDS: Mobile applications, Aged, Activities of daily living.

INTRODUCTION

The decrease in fertility and mortality rates (World Health Organization [WHO], 2015) has led to a significant increase in the number and proportion of older people in recent decades. This change has drawn attention to the care and needs of this emerging social stratum. Sports scientists have developed better training and assessment methods to improve seniors' functional autonomy and control the health-related variables (Dantas et al., 2014).

Although aging is a natural process, it causes declines in health-related variables (Filho et al., 2011; Jati et al., 2018; Vale et al., 2017). Thus, to perform the activities of daily living (ADL), it is essential to exert better control over these variables, mainly developing and preserving functional autonomy (FA) (Dantas et al., 2014; WHO, 2015).

The need for FA in the elderly goes beyond executing ADL, including walking around the house, dressing and combing one's hair. Regular physical activity also contributes to functional autonomy, good quality of life (QoL), preventing non-communicable chronic diseases, and decreasing the risk of falls (Borba-Pinheiro et al., 2016; Dantas et al., 2014). Multiple health-related variables are associated with muscular strength, flexibility, and aerobic power, which influence FA, QoL, and the performance of ADL (Azambuja et al., 2013; Passos e Borba-Pinheiro, 2016).

[1]Federal University of Maranhão (UFMA), Imperatriz, Brazil
[2]Pará State University (UEPA) Tucuruí, Brazil
[3]Federal Institute of Education, Science and Technology (IFPA) Tucuruí, Brazil
[4]Federal State University of Rio de Janeiro (UNIRIO/PPGEnfBio), Rio de Janeiro, Brazil
[5]Federal University of Pará (UFPA), Tucuruí, Brazil
[6]State University of Rio de Janeiro (UERJ), Rio de Janeiro, Brazil
[7]São Paulo State University "Julio de Mesquita Filho" (UNESP-RC) Rio Claro, Brazil
[8]University of Tiradentes (UNIT), Aracajú, Brazil; 9Catholic University of Maule, Maule, Chile.
*Corresponding author: Medici President Street, 51, Center, Postal Code: 68458-420, Tucuruí, Pará state, Brazil. E-mail: araujogomesrc@gmail.com

Conflict of interests: Nothing to declare. Funding: Nothing to declare.
Manuscript received at July 30th 2019; Accepted at June 20th 2020.

There are several valid tests and protocols that systematize procedures in order to obtain quantitative results according to age group. These procedures require maximum attention to minimize errors while maintaining the proper execution method and reproducible results (Baechle e Groves, 1992; Dantas et al., 2014; Rikli e Jones, 2008).

The protocol developed by the Latin American Group for the Development of the Elderly (Grupo de Desenvolvimento Latino Americano para Maturidade – GDLAM) is a widely used methodological tool to evaluate FA. It consists of five motor tests that measure upper arm flexibility, dynamic and restored balance, time to walk 10 meters, muscle power, and agility. All test measures are in seconds. Based on these results, a mathematical model calculates the GDLAM index (GI) for autonomy and generates a functional classification (Dantas et al., 2014).

Technological tools may help accomplish tasks and activities such as motor tests (Ferreira, 2013). New scientific research technologies have grown steadily. These include mobile applications (Apps), important tools for optimizing results, and analyzing valid and reliable assessment techniques to help professionals and the general public (Tibes et al., 2014).

However, improvements in GDLAM protocol procedures are needed, such as minimizing errors and shortening the entire protocol's execution time to provide rapid results to individuals based on their classification and generate an automatic cloud database for researchers. The GDLAM protocol is still manually applied, and a mobile application could solve the above-mentioned problems. Thus, the present study aimed to develop a mobile application (App) for the GDLAM protocol in the Android environment and check its reproducibility.

METHOD

This methodological procedure involves two steps: 1 – the construction and development of the GDLAM FA App for Android; 2 – reproducibility and equivalence of the protocol through the App.

1st Phase: Construction and development of the GDLAM FA App for Android

The GDLAM FA App consists of five steps: requirements analysis, construct definition, computational representation, system coding, and system evaluation.

Requirements analysis

Requirements analysis consists of prior knowledge of what the App must accomplish with the specific variables, dynamics, functions, and calculations (Deitel et al, 2015). Requirements included a timer, the sequence of GDLAM FA protocol procedures, creation of a folder in the mobile phone's internal memory, and data recording on a Microsoft® Office Excel worksheet.

Knowledge definition

GDLAM protocol analysis determined which variables would be included in the App (Deitel et al., 2015). Thus, system developers needed detailed knowledge of each phase of the process, including testing, GI calculation, and classifying the results. The authors Dantas et al. (2014) described the GDLAM protocol for FA and found it to be valid.

Computational representation of knowledge

This phase consists of data classification, transformation into codes, and insertion to develop the application interface (Deitel et al., 2015).

Use cases were developed to describe how the GDLAM FA App would be used and the functionalities that would be included. These use cases follow a defined pattern, in which the reader/programmer follows the path established to construct the App (Deitel et al., 2015).

System coding

JAVA was the programming language, and Android Studio, the integrated environment for GDLAM FA App development (Deitel et al., 2015).

STEP 1: When initiate coding, it was necessary to include the permissions to the device resources, which, by default, are protected by the system. The App needs to ask for permission while it is running for the first time. This provides confidence to the users and optimizes the installation process. Thus, the App can access the device's storage, as well as read and write the data.

STEP 2: A simple and objective interface helps the user record test times. It has interactive play (start counting), return (resumes counting), and stop buttons (counting ends). Moreover, after selecting the stop button, the App generates a window as a message, where the user must indicate in which test the device should record the measured time.

STEP 3: In this step, programmers created a class that works only with the tests and receives their values as a parameter in milliseconds. The system includes them in the GI formula and relates these results to the subject's age. After providing the age and clicking on the check button, the user receives the rating immediately.

STEP 4: The system created a folder in the mobile phone's internal storage and a file denominated "GDLAM.xls". The App uses an open-source and ready-to-use application programming interface (Java Excel API) that allows developers to read, write, and modify the Microsoft® Office Excel spreadsheet (Deitel et al., 2015).

2nd Phase: Protocol reproducibility and equivalence through the App

Subjects

Through convenience sampling, sixty-three elderly women underwent the GDLAM testing protocol while attending two social assistance reference centers (CRAS) in the city of Tucuruí, Pará state, Brazil.

Selection Criteria

The following selection criteria were established for participation in data collection: women aged 60 years or older, enrolled in CRAS projects, exhibiting no physical problems that would preclude their performing any of the protocol tests, such as arthrosis, arthritis, herniated disc, and rheumatoid arthritis.

Research Ethics

All volunteers provided written informed consent according to Resolution No. 510/16, which governs research with human beings (Brazil, 2016). The study was approved by the Estácio de Sá University (Rio de Janeiro state) Research Ethics Committee in partnership with the University of the State of Pará, under protocol number 1.617.605.

Intervention procedures

Before protocol reproducibility was initiated through the App, weight, and height were measured to characterize the sample on an INMETRO-approved Welmy®CH110 anthropometric scale (Brazil) with a capacity of 150 kg with 100g intervals. Height was measured with the vertical anthropometer attached to the scale (WHO, 1995), and body mass index (BMI) was calculated according to the following equation (Brasil, 2014):

$$BMI = \frac{\text{Body mass}}{\text{height}^2}$$

Protocol reproducibility through the App was conducted as follows: two experienced raters and two assistants. Rater 1 collected data in the traditional manner, and rater 2 through the application. The function of assistant 1 was to: 1) filled in a Microsoft® Office Excel spreadsheet previously organized to receive the data collected by the rater who applied the protocol using the traditional method, where the GI formula was also placed, which showed the result automatically after filling the tests times, 2) performed the classification of the tests and the GI of the volunteers comparing the data with their age according to the reference table, 3) filled in the spreadsheet the classifications found. Assistant 2 recorded the time it took to perform the complete process since the tests were performed, data collection and storage, GI result and classifications of all tests, and GI, of both forms of execution (manual and App). The evaluators repeated the evaluation process twice, reaching an intraclass correlation coefficient (ICC) of 0.95 for all the tests and the GI of the GDLAM FA protocol. The mean of the two assessments for each one test was used to represent the data.

It is important to underline that for each test, the two raters started and finished the timer simultaneously, considering each one's reaction time. The tests were performed in the following sequence: from the lowest to the highest effort, with a three-minute interval between tests: putting and taking off a t-shirt (PTTs), rising from a sitting position (RSP), rising from the ventral decubitus position (RVDP), 10-meter walk (10MW), and sitting and rising and walking around a chair (SRWC).

Statistical analysis

Statistical analysis was conducted using IBM SPSS 20.1 software with a significance level of $p < 0.05$. Descriptive statistics was initially used with measures of central tendency and dispersion for the descriptive data. The Kolmogorov-Smirnov test of normality and Levene's test for homogeneity were carried out. The student's t-test for independent samples, Pearson's correlation coefficient, and the ICC were used for rational scale data. In addition, Cohen's kappa coefficient was used to measure nominal scale agreement between the classifications generated by the different GDLAM protocol application methods.

RESULTS

GDLAM FA App

The GDLAM FA App is an Android application that assists in assessing FA. The GDLAM FA protocol governs the type of App, which is available in Portuguese, Spanish, and English. The mobile phone system supports a language change, and the App automatically appears in the same language as the system configuration.

The step-by-step application is described below:

On the initial GDLAM FA App screen, the user clicks on the name of the test, and an explanatory screen appears, describing what the test evaluates, its procedures, and the reference. The user starts the stopwatch by clicking on a triangle and resets it by clicking the back icon and clicking on a square to stop recording.

The following message then appears: to which test want to assign the time recorded? The user must choose which of the five tests the time recorded should be attributed to, which is then displayed beside the selected test. The other tests follow the same procedure until the screen displays the five tests and their recorded times. To proceed, the user clicks on the green button to generate the index. However, if all the collections must be redone, the user clicks on the reboot icon, represented by a trash can.

After the green button is clicked to generate the index, another screen appears, where the users fill in the name and age of the individual evaluated and then click on the green check button, represented by a question mark.

Finally, the classification of each test and the index according to the recorded times and proper classification for the user's age are displayed. The App then automatically shows a message that the data have been saved in the Microsoft® Office Excel file generated by the program in the phone's memory. If the user still needs to perform the tests with other volunteers, they must click on the "new test button", represented by the plus sign (+).

Product reproducibility through the App

Table 1 shows the descriptive data with central tendency and dispersion measures to identify the subjects.

A total of 7.14% of the volunteers were underweight, 38.58% were normal weight, and 54.28% were overweight. Although BMI correlates with functional autonomy, the GDLAM protocol does not use this variable in the calculations.

Table 2 shows the comparative results between the traditional method and GDLAM FA App assessments. The test results exhibited no significant difference between the two application methods. However, each evaluation's total time showed a significant difference of 2 minutes ($p < 0.001$). The GDLAM FA App took less time than the manual protocol.

Figure 1 presents the Pearson's correlation results in scatterplots, where all analyses exhibited strong and significant correlations (r and $r^2 > 0.90$; $p < 0.001$) for 10MW, RSP, RVDP, PTTs, SRWC, and GI, in addition to total time spent using the traditional GDLAM method and the App.

Table 3 shows classifications obtained using the traditional GDLAM method and the App, demonstrating strong and very strong significant correlations for all variables. It also reveals "substantial agreement" for almost all the tests, except SRWC, which had an even better rating, that is, "almost perfect agreement", according to the classification (Landis e Koch, 1977).

Table 1. Physical characteristics of the study sample.

n = 63			
Variables	Mean ± SD	Maximum	Minimum
Age (years)	68.81 ± 6.38	83.0	60.0
Weight (kg)	63.6 ± 10.07	89.5	40.8
Height (m)	1.52 ± 0.06	1.70	1.41
BMI (kg/m²)	27.41 ± 4.01	36.94	18.88

BMI – body mass index; SD – standard deviation.

DISCUSSION

There was a need to facilitate and optimize the sequence of the GDLAM FA protocol procedures. As a result, this application substitutes items such as a stopwatch, paper, and pencil, calculates indexes, and stores data on a spreadsheet, separately, thereby automating the collection and information gathering process. The entire process is concentrated into a single tool, the mobile phone, to help academics, teachers, and researchers.

Apps that facilitate health procedures and tasks are a current reality. Nussbaum et al. (2019) conducted a systematic review to determine how mobile Apps were used in the medical and rehabilitation fields and found 102 studies. One-third were used in intervention procedures, and the remainder to evaluate the App itself. They found that Apps used in exercise interventions or as a measurement tool may produce positive benefits. In this respect, the GDLAM FA App is simple, specific, and effective, in addition to reducing errors, accelerating classification, and providing enhanced data organization for researchers.

Specific applications to assess elderly performance were also found in the literature (Ferreira, 2013; Sampaio et al., 2017). Ferreira (2013) analyzed the single-leg standing and sit-to-stand exercises using the Falls Efficacy Scale and attaching a mobile device to the subjects' upper trunk. The results obtained with the App were positive when compared to other assessment methods. The Timed Up and Go (TUG) test was applied to evaluate 30 volunteers at different moments, such as rising from a sitting position, walking forward and turning and walking backward, and turning to sit down again. The sensors connected to the subject transmitted signals to an iPhone 4, which detected kinematic

patterns. As such, the system was able to receive and analyze the different subphases of the test, performed by frail and non-frail seniors.

Sampaio et al. (2017) also used the TUG and Performance Oriented Mobility Assessment (POMA) tests, which assess balance and risk of falls in the elderly. They observed that the

Table 2. Comparative results between the two assessment methods.

Variables	GDLAM Manual		GDLAM App		*p-value*
	Mean ± SD	KS	Mean ± SD	KS	
10MW (s)	7.04 ± 0.87	0.200	7.02 ± 0.72	0.200	0.917
RSP (s)	10.46 ± 2.13	0.200	10.82 ± 2.30	0.200	0.342
RVDP (s)	3.62 ± 1.13	0.051	3.88 ± 1.00	0.061	0.154
PTTs (s)	12.91 ± 3.48	0.059	13.18 ± 3.23	0.063	0.645
SRWC (s)	49.41 ± 7.84	0.200	49.95 ± 8.30	0.200	0.690
GI (score)	29.37 ± 4.24	0.200	29.94 ± 4.17	0.200	0.426
Total time (min)	5.59 ± 0.91	0.184	3.89 ± 0.70	0.072	*< 0.001*

KS = Komolgorov-Smirnov normality test

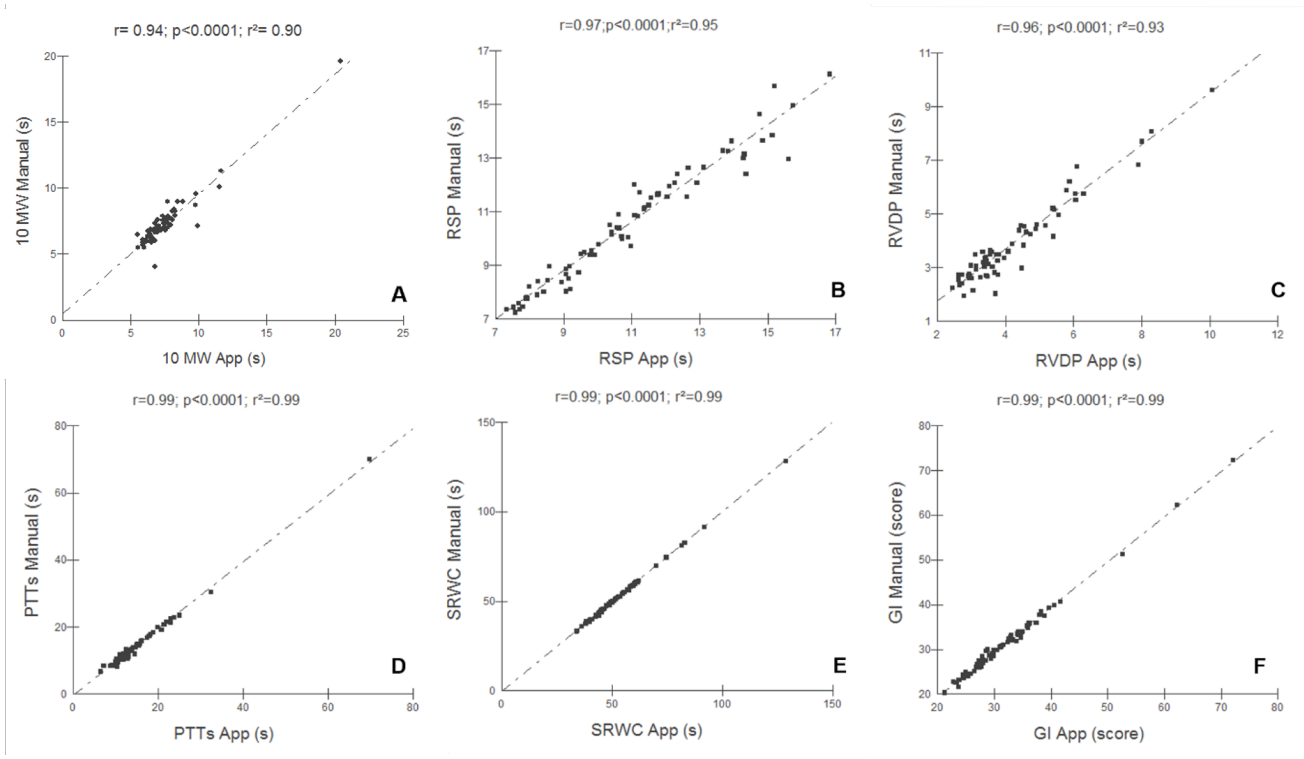

Figure 1. Scatterplot results of Pearson's correlation.

Table 3. Correlations between the two classifications of the two procedures.

Procedures	*R*	*Kappa*	*Classification*	*p-value*
10MW Manual vs. 10MW App	0.75	0.66	Substantial agreement	*< 0.001*
RSP Manual vs. RSP App	0.87	0.69	Substantial agreement	*< 0.001*
RVDP Manual vs. RVDP App	0.83	0.65	Substantial agreement	*< 0.001*
PTTs Manual vs. PTTs App	0.84	0.69	Substantial agreement	*< 0.001*
SRWC Manual vs. SRWC App	0.97	0.93	Almost perfect agreement	*< 0.001*
GI Manual vs. GI App	0.89	0.73	Substantial agreement	*< 0.001*

These GDLAM FA validity studies were published in issue 2492 of the Brazilian Journal of Industrial Property (INPI) of October 9, 2018, under process number BR512018051849-4. The GDLAM FA App is also available for free download on the Google Play Store platform.

application was able to detect oscillations during static balance, and differentiate the risk of falls, exhibiting good correlation with the traditional test. Their system showed efficiency similar to that observed in this study with the GDLAM FA App. No difference was found between manual and digital evaluations with the GDLAM FA App. Since Pearson's correlation was strong in all the tests, the GDLAM FA App demonstrated validity.

Reproducibility studies have also been conducted (Esteves, 2018; Marchi et al., 2016; Melquiades, 2018; Nogueira et al., 2018). Melquiades (2018) evaluated the intra-examiner reliability of shoulder measurements using the universal, digital, and Ratefast goniometer App, finding that, despite the widespread use of the universal goniometer, some studies report conflicting results regarding its reliability. In the present study, the digital goniometer (ICC: 0.41-0.73) and the App (ICC: 0.28-0.66) showed higher reliability and better reproducibility in relation to the universal device (ICC: 0.15-0.59).

In a case report, Nogueira et al. (2018) assessed an App used to plan total knee arthroplasty. This planning is typically done by evaluating a panoramic radiograph of the lower limbs. However, the difficulty with this assessment is the poor alignment of the peripheral components between the center of the femoral head, knee, and ankle (variation higher than 3º). Surgical planning of the case was carried out using the App and, as a control and safety measure, was also done manually, confirming that the App was reproducible, efficient, and safe for surgical planning of the case in question.

Marchi et al. (2016) compared the reproducibility and equivalence of using the Cobbmeter App with the manual measurement method to analyze the sagittal alignment of the spine, evaluating 20 spinal radiographs through the App, finding it to be a valid and reliable instrument.

Esteves (2018) aimed to determine the safety, effectiveness, and reproducibility of screening neurological patients through the App, assessing the medical records data and outcomes of 232 cases and found it to be safe, effective, and reproducible, in addition to having a positive impact on patient outcomes and requiring less screening time. Thus, it appears that in addition to these Apps being reproducible and safe, they also reduce screening time and are less susceptible to errors, as demonstrated in this study.

The applicability of the GDLAM FA App is also confirmed by the level of agreement between the two methods (manual and App). It was considered adequate and exhibited strong and very strong significant correlations ($p < 0.001$) for all variables, resulting in "substantial agreement" for almost all the tests and "almost perfect agreement" for the SRWC.

Tibes et al. (2014) conducted an integrated review of the literature searching for mobile Apps in Brazil and found that most studies assessed App importance. These Apps facilitate and optimize procedures, and are sustained by academic knowledge, reliable databases and validated protocols. Likewise, the App studied here aims to increase usage of a valid, easy-to-use, and accessible technological resource in order to increase public health interventions.

There is a need for Apps in several areas, and with the increasing use of cell phones, they can be used as a source of information or work tool, highlighting the rapid expansion of mHealth Apps that have proven to be safe, exhibit significant potential to improve information access, decrease the time spent on certain tasks, and increase the reliability of recorded data (WHO, 2018).

As such, the authors intend to make this tool available free of charge to health and research professionals who work with the FA of older adults in social programs and fitness centers. The GDLAM FA App aims to optimize a valid fitness test battery protocol, increase the speed of execution and data archiving, and provide immediate classification results.

CONCLUSION

The study showed that the GDLAM App is as efficient as the traditional functional autonomy protocol for the elderly, demonstrating adequate reproducibility, shorter evaluation time, and faster results.

It can also be applied during the data collection of larger groups in university extension programs, providing immediate test results. Thus, the App can be used to evaluate FA, due to its speed in showing results in different extension events, research, and day-to-day professional practice.

ACKNOWLEDGMENTS

Nothing to declare.

REFERENCES

Azambuja, C. R., Machado, R. R., & Santos, D. L. (2013). Correlação entre Estilo de Vida e Nível de Atividade Física de Idosas Sedentárias e Ativas. Revista Brasileira de Ciência e Movimento, 21(3), 141-148. Available in: http://dx.doi.org/10.18511/0103-1716/rbcm.v21n3p142-149

Baechle, T. R., & Groves, B. R. (1992). Weight training: steps to success. Champaign, IL: Human Kinetics.

Borba-Pinheiro, C. J., Dantas, E. H., Vale, R. G., Drigo, A. J., Carvalho, M. C., Tonini, T., et al. (2016). Resistance training programs on bone-related variables and functional independence of postmenopausal

women in pharmacological treatment: A randomized controlled trial. Archives of gerontology and geriatrics, 65, 36-44. doi: 10.1016/j.archger.2016.02.010.

Brasil. (2014). Ministério da Saúde. Caderneta de saúde da pessoa idosa (3a ed.). Brasília – DF. Available in: http://bvsms.saude.gov.br/bvs/publicacoes/caderneta_saude_pessoa_idosa.pdf

Brasil. (2016). Comissão Nacional de Ética em Pesquisa: resolução atualizada N°510/16 pesquisa com humanos. Brasília: Conselho Nacional de Saúde. Available in: http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf

Dantas, E. H., Figueira, H. A., Emygdio, R. F., & Vale, R. G. (2014). Functional Autonomy GDLAM Protocol Classification Pattern in Elderly Women. Indian Journal of Applied Research, 4(7), 262-266. Available in: https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/recent_issues_pdf/2014/July/July_2014_1404558390__159a.pdf

Deitel, P., Deitel, H., & Deitel, A. (2015). Android how to program, with an introduction to JAVA (2a ed.) São Paulo: Bookman.

Esteves, L. A. (2018). Avaliação da segurança, efetividade e reprodutibilidade da utilização da telemedicina para triagem neurocirúrgica (Tese de Doutorado). Faculdade de Ciências Médicas. Universidade Estadual de Campinas – UNICAMP, Campinas, São Paulo, Brasil.

Ferreira, M. I. T. (2013). O Uso do Smartphone na Avaliação do Risco de Queda associado ao Envelhecimento [Dissertação de Mestrado]. Porto: Escola Superior de Tecnologia da Saúde do Porto, Instituto Politécnico do Porto. Available in: https://core.ac.uk/download/pdf/47137044.pdf

Filho, M. L., Rodrigues, B. M., Aidar, F. J., Reis, V. M., Polito, M. D., Venturini, G. P., et al. (2011). Influência dos exercícios aeróbio e resistido sobre perfil hemodinâmico e lipídico em idosas hipertensas. Revista Brasileira de Ciência e Movimento, 19(4), 15-22. Available in: https://bdtd.ucb.br/index.php/RBCM/article/viewFile/2391/2116

Jati, S. R., Borba-Pinheiro, C. J., Vale, R. G., & Dantas, E. H. (2018). Bone Density and Functional Autonomy in Postmenopausal Women Submitted to Adapted Capoeira Exercises and Walking. Journal of Exercise Physiology Online, 21(2), 214-226. Available in: https://www.asep.org/asep/asep/JEPonlineAPRIL2018_Jati.pdf

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. Biometrics.

Marchi, L., Fortti, F., Amaral, R., Oliveira, L., Nogueira-Neto, J., Jesen, R., & Pimenta, L. (2016). Reproducibility and equivalence of Cobbmeter application in the sagittal evaluation of the spine. Coluna/Columna, 15(4), 279-282. Available in: http://dx.doi.org/10.1590/S1808-185120161504165101

Melquiades, H. (2018). Confiabilidade intra-examinador das medidas de flexão, extensão, abdução e adução horizontal ativas do ombro com uso do goniômetro universal, goniômetro digital easyangle e aplicativo Ratefast Goniometer (Trabalho de Conclusão de Curso). Faculdade de Fisioterapia. Universidade Federal de Juiz de Fora – UFJF, Juiz de Fora, Minas Gerais, Brasil.

Nogueira, J. B. S., Carvalho, A. C. G. S., Filho, E. M. B., Araújo, L. H. C., Bezerra, M. J. C., & Leite, J. A. D. (2018). Planejamento de artroplastia total do joelho através de aplicativo para dispositivos móveis: relato de caso. Rev. Bras. Ortop., 53(6), 792-796. Available in: https://doi.org/10.1016/j.rbo.2017.05.006

Nussbaum, R., Kelly, C., Quinby, E., Mac, A., Parmanto, B., & Dicianno, B. (2019). A Systematic Review of Mobile Health Applications in Rehabilitation. Archives of Physical Medicine and Rehabilitation, 100(1), 115-127. Available in: https://doi.org/10.1016/j.apmr.2018.07.439

Passos, I. S., & Borba-Pinheiro, C. J. (2016). Analysis of the influence of practice time of different physical exercises in the variables health and quality of life. Revista Brasileira de Qualidade de Vida, Ponta Grossa, 8(2), 100-118. Available in: https://periodicos.utfpr.edu.br/rbqv/article/viewFile/3831/2781

Rikli, R., & Jones, C. (2008). Physical Fitness Test for the Elderly. Barueri, São Paulo: Manole.

Sampaio, L. V. P., Castilho, L. B., & Carvalho, G. A. (2017). Development of an application for mobile devices to evaluate the balance and risk of falls of the elderly Revista Brasileira de Geriatria e Gerontologia, 20(6), 811-819. Available in: http://dx.doi.org/10.1590/1981-22562017020.170017

Tibes, C. M., Dias, J. D., & Zem- Mascarenhas, S. H. (2014). Mobile applications developed for the health sector in Brazil: an integrative literature review. Revista Mineira de Enfermagem [In portuguese], 18, 471-448. doi: 10.5935/1415-2762.20140035

Vale, R. G., Castro, J. B., Oliveira, R. D., Pernambuco, C. S., Oliveira, F. B., Mattos, R. S., et al. (2017). Original investigation effects of Hydrogymnastics on igf-1 and functional autonomy in elderly women. MOJ Gerontology and Geriatric, 1(5), 142-147. doi:10.15406/mojgg.2017.01.00029

World Health Organization [WHO] (1995). Physical status: the use and interpretation of anthropometry. Geneva; Technical Report Series 854. Available in: http://www.who.int/childgrowth/publications/physical_status/en/

World Health Organization [WHO] (2015). World Report on Aging and Health. WHO / FWC / ALC / 15.01. Available in: http://apps.who.int/iris/bitstream/10665/186468/6/WHO_FWC_ALC_15.01_por.pdf

World Health Organization [WHO] (2018). Seventy-first world health assembly. Provisional agenda item 12.4. A71/20. 26. mHealth: Use of appropriate digital technologies for public health (Report by the Director-General). Available in: https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_20-en.pdf.

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.18747

Association between Quality of life, Sleepiness, Fatigue, and Anthropometric Parameters in young University Students

Rosane de Almeida Andrade[1,2]*, Bruna Araújo Rodrigues[3], Thiago Medeiros da Costa Daniele[4], Lucas Lima Vieira[1], Nelson Joaquim Sousa[5,6]

ABSTRACT

Cardiovascular risks are now an epidemiological reality among adults and teenagers. This scenario leads to impairments in quality of life and represents a burden in healthcare and government costs. This study aimed to evaluate the association between risk factors for cardiovascular diseases, quality of life, daytime sleepiness, fatigue, and anthropometric parameters on university students in Fortaleza/CE, Brazil. It was a descriptive, crossectional, correlational study, made through epidemiological assessment in young university students, with primary data and quantitative analysis. The results showed a negative influence of daytime sleepiness and fatigue on the overall quality of life. Functional capacity, a component of the quality of life, which represents the ability to perform tasks and activities in their life, and limitations due to emotional aspects could impact a person's well-being and health. Moreover, excessive daytime sleepiness showed a strong correlation with almost all domains of quality of life. It was found that although volunteers did not show a low quality of life, fatigue levels and sleepiness presented as relevant variables. There is a need to comprehend and control these variables to promote students' health and, consequently, to live healthier adulthood.

KEYWORDS: sleepiness; fatigue; quality of life; anthropometry; young adults; university.

INTRODUCTION

In Brazil, cardiovascular diseases (CVD) accounts for 30% of deaths and are the leading cause of deaths worldwide (Rocha & Martins, 2017). Furthermore, risk factors such as dyslipidemia, smoking, and obesity, known as non-communicable chronic diseases (NCCD), are responsible for 71% of deaths worldwide, ranging from 37% in low-income countries, to 88% in developed countries (Organização Pan-Americana de Saúde, 2018). It has been established a correlation between the development of CVD and NCCD, particularly obesity with central fat distribution (Lima, 2018; Mendonça, 2016; Oliveira et al., 2010).

Though these cardiovascular risks were considered significant only in older adults and elderly, but recent studies demonstrated that these risks also affect young adults (Carvalho et al., 2015; Dantas et al., 2015; Dwyer et al., 2009; George et al., 2017; Yano et al., 2016; Zeller & Modi, 2006). This epidemiological scenario not only implies a significant reduction in life quality but also represents a burden to society in health care costs (Rocha & Martins, 2017).

The risk of death in obese adults who were also obese during childhood is significantly higher than eutrophic adults, which presented normal weight during childhood. The quality of life and psychological well-being is improved as a consequence of weight loss (Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica, 2016). Together, these data points that obesity is associated with low-grade chronic inflammation (Ying et al., 2019). In addition,

[1]Centro Universitário FANOR, UniFanor, Fortaleza, Brazil.
[2]Centro Universitário Grande Fortaleza, UniGrande, Fortaleza, Brazil.
[3]Mestranda em Saúde Coletiva, Universiade Estadual do Ceará (UECE), Fortaleza, Brasil.
[4]Grupo de Pesquisa em Psifisiologia do Exercício Físico; Universidadade de Fortaleza (UNIFOR), Fortaleza, Brazil.
[5]Northern Region Health Administration ACES Grande Porto I - Santo Tirso/Trofa, Santo Tirso, Portugal.
[6]Research Center in Sport Science, Health Sciences and Human Development, CIDESD, Vila Real, Portugual.
*Corresponding author: Rua 08, 420, Parque Dois Irmaos, 60761-320. Fortaleza - CE Brasil. E-mail: roandradeef@yahoo.com.br

Conflict of interests: nothing to declare. Funding: nothing to declare.
Manuscript received at October 25, 2019; Accepted at August 10, 2020.

islet macrophages also impair the insulin secretory capacity of β-cells, comprising the quality of life (Ying et al., 2019). Other dysfunctions associated with obesity are sleeping disorders. Studies associate a higher prevalence of sleepiness with main components of Metabolic Syndrome and CVD (Mansur et al., 2015; Polido-Arjona et al., 2018; Rawat et al., 2019;). However, weight loss has been shown to attenuate sleeping disorders' severity (Patel & Mehra, 2015).

For children and adults, the number of night sleeping hours is conversely associated with Body Mass Index (BMI) and obesity in cross-sectional studies and obesity incidence in longitudinal studies. These changes are consistent with chronic sleeping deprivation, leading to increases in obesity risk and the propensity to inflammatory disorders (ABESO, 2016; Pereira et al., 2020).

Consequently, evidence points towards an increased manifestation of fatigue associated with sleeping deprivation and obesity in young university students and correlated with years of study and BMI (Amaducci et al., 2010; Hershner & Chervin, 2014; Maugeri et al., 2018).

Although the number of studies with university students is limited, those who previously assessed these parameters showed fatigue, which might impact learning, quality of life, and professional graduation. Studies regarding stress in undergraduate students demonstrated psychological stress, sleeping disorders, and other physically expressed symptoms (Li & Hasson, 2020; Núñez et al., 2019; Whittier et al., 2014).

Therefore, this study aimed to assess and associate risk factors of CVD, quality of life, daylight sleepiness, fatigue, and anthropometric parameters in a sample of university students in Fortaleza/CE, Brazil.

METHODS

This observational, analytical cross-sectional study was made through an epidemiological assessment of university students, and simple random sampling was used.

Participant consent and recruitment

Participants were recruited from the general population through flyer advertisements and advertisements on the Centro Universitário Fanor|Wyden. The data were acquired during the second semester of 2018. The present study intended to focus on the age range of students who are mostly present at university centers. The research team subsequently phoned the parents of the identified children to verify their interest and to check that their children fulfilled the inclusion criteria: (a) Aged between 18 to 30 years; (b) absence of chronic medical problems, such as epilepsy and asthma; (c) able to perform the tests, and (d) accept to participate in the study voluntarily. After written consent, three trained researchers conduct all protocols.

Initially, 98 students opted to participate, and eight did not participate in the experiment (due to illness or forgetting the appointment). For this sample, 90 young university students were randomly chosen, composed of 23 males (25,6%) and 67 females (74,4%). The research protocol was approved by the Human Research Ethics Committee of UniFAMETRO University under the protocol 2.089.272 and CAAE: 65185717.8.0000.5618. All participants voluntarily signed the term of consent for this research.

Study design and measures

Study design

Individual appointments took place between 7 am, and 9 am at the Centro Universitário Fanor|Wyden. On arrival, a physical examination was performed. Then the students completed a questionnaire in a separate room and were left alone with the research team for the rest of the study. The volunteers completed self-report questionnaires when necessary, with the help of the investigating group.

Instruments

BMI was assessed through height and weight with a measuring tape with 1mm accuracy and a digital scale (Plenna®), respectively. Hip Circumference (HC), Waist-to-Hip Ratio (WHR), and Neck circumference (NC) were measured using an anthropometric tape made of glass fiber and with 200cm of length. Measurements were made accordingly to the Anthropometric Standardization Reference Manual guidelines (Lohman et al., 1988). All measurements were made twice, and a mean between results was established. A third measurement was made, and the values that lead to differences were discarded in case of discrepancy between the first and the second measurements.

To assess physical activity levels, it was used the short version of the International Physical Activity Questionnaire (IPAQ), developed by the World Health Organization in 1998 to acquire worldwide data regarding physical activity. IPAQ has been previously used to assess university students' physical activity levels in Brazil and other countries (Fagaras et al., 2015; Melo et al., 2016;). IPAQ questionnaire classifies the respondents as follows: Sedentary, irregularly active, active, and very active considering the amount of time spent doing physical activity weekly, frequency, and intensity (Matsudo et al., 2001).

It was used the Sleepiness scale EPWORTH (ESE) to evaluate daytime sleepiness. The ESE is a questionnaire

that reports the probabilities of sleep in eight situations involving daily activities. The global score ranges from 0 to 24 points. Scores above 10 indicated excessive diurnal sleepiness (Bertolazi et al., 2009).

The Fatigue Severity Scale (FSS) was used to analyze fatigue symptoms. It contains nine affirmative sentences where participants sign a score ranging from 1 to 7 regarding how that affirmative fits his present condition. Number 1 implies that the participant strongly disagrees with the affirmative, and seven implies that he strongly agrees. Total score ranges from 9 to 63, in which scores above 28 are indicatives of fatigue.

Procedures

For this study, inclusion criteria were: to be aged 18 years or more, been regularly registered to a university course, and do not present any kind of condition that limits anthropometric data collection. Recruitment of volunteers was made by advertising the study in classrooms and other locations of the university

Anthropometric assessment and questionnaire application were madmade by professionals. Initially, body weight and height, waist, hip, and neck circumference were measured. Then, participants answered the questionnaires regarding physical activity levels, daytime sleepiness, and fatigue.

Statistical Analysis

Data were expressed as mean, standard deviation, and percentage values. It was used Kolmogorov-Smirnov to assess residual normality, and the Levene test to verify the homogeneity of variances. Fisher's test was used for comparisons between categorical variables in this study. Yates' correction test was used to compare genders. ANOVA was used for data with normal distribution and homogeneity of variances and Kruskall-Wallis test to non-parametric variables to compare more than two groups. Student's T-test or Mann-Whitney test were used to compare two groups. Multiple linear regression was also used in this study. The significance level was determined as 95%. Data were plotted and analyzed in statistical software SPSS® for Windows (SPSS21).

RESULTS

Clinical and demographical characteristics

In the present study, students BMI ranged from 16.8 to 39.0 (23.2±4.1) kg/m². Our data showed that waist circumference values varied from 64.0 to 105.0 (77.0±10.1) cm while waist-hip ratio ranged from 0.65 to 1.27 (0.77±0.77). Neck circumference values fluctuated from 29.0 to 42.0 (33.3±3.2) cm. The assessment of students' Daytime Sleepiness demonstrated a mean score of 10.9±4.4. The fatigue symptoms mean score was reported as 28.1±11.2 (Table 1).

Comparison between genders

After a gender analysis, it was found that values for waist circumference in men (84.1±10.3) were higher compared to women (74.7±9.0) (p=0.000), although no differences in BMI were found between genders (p=0.52). Similar results were found for WHR (0.83±0.1 vs. 0.74±0.05. p=0.000) and NC (38.5±2.1 vs. 33.0±2.2. p=0.000). Regarding physical activity levels, no differences were found between genders (p=0.99). In addition, no significant correlations were found between genders and daytime sleep (P=0.74) and fatigue (p=0.96) (Table 2).

Table 1. Anthropometric, daytime sleepiness and fatigue data gathered from young university students.

Variables	Mean	Standard Deviation
Daytime sleepiness	10.9	4.4
Fatigue symptoms	28.1	11.2
Anthropometric measures		
BMI	23.2	4.1
WC	77.0	10.1
WHR	0.77	0.07
NC	34.3	3.2

Notes: WC: Waist Circumference (cm), NC: Neck Circumference (cm), BMI: Body Mass Index (kg/m²), WHR: Waist Hip Ratio.

Table 2. Comparison of Anthropometric and physical activity levels between genders.

Variables	Male N=23(25.6%)	Female N=67(74.4%)	p value
Anthropometric values			
BMI (Kg/m²). (Mean±SD)	23.7(±3.6)	23.1(±4.3)	0.52
WC (cm)	84.1(±10.3)	74.7(±9.0)	0.000**
WHR (Mean±SD)	0.83(±0.1)	0.74(±0.05)	0.000**
NC (Mean±SD)	38.5(±2.1)	33.0(±2.2)	0.000**
Physical activity levels	IPAQ. n. (%)		
Sedentary	3(14.3%)	8(12.9%)	
Irregularly active	6(28.6%)	19(30.6%)	0.99
Active	6(28.6%)	18(29%)	
Very active	6(28.6%)	17(27.4%)	

Notes: WC: Waist Circumference (cm), NC: Neck Circumference (cm), BMI: Body Mass Index (kg/m²), N: number of subjects, WHR: Waist-Hip Ratio.

Correlation between physical activity, quality of life, and fatigue symptoms

In the present study, physical activity levels did not influence sub-items of quality of life, excessive daytime sleepiness, or fatigue symptoms.

Linear regression between daytime sleepiness and quality of life domains demonstrated that Excessive daytime sleepiness was negatively correlated with Functional capacity (p=0.01. r=-.25), General health (p=0.001. r=-.35), vitality (p=0.004. r=-.30), social aspects (p=0.008. r=-.27), limitations due to emotional aspects (p=0.02. r=-.24) and mental health (p=0.000. r=-.36). Limitations due to physical aspects and pain were not correlated with excessive daytime sleepiness (Table 3).

Linear regression results from fatigue and quality of life showed a negative correlation between fatigue score and "Limitations due to emotional aspects" domain (Table 4). Fatigue was not correlated with any other quality of life domain.

DISCUSSION

The main results of this study indicate a negative influence of daytime sleepiness and fatigue on quality of life. These data show that functional capacity, a component of life quality representing the ability to perform tasks and activities in their life, and limitations due to emotional aspects could impact a person's well-being and health. Furthermore, excessive daytime sleepiness demonstrates a strong negative association with almost all domains in the quality of life questionnaire.

Daytime sleepiness and poor sleep quality could be related to alterations in the biological clock and circadian cycle. The suprachiasmatic nucleus may present alterations and abnormal function, which could lead to changes in serum glucose, cortisol, and blood pressure (Froy, 2011; Kreier et al., 2007). The effects of daytime sleepiness are related to glucose metabolism. Studies have shown that autonomic dysfunction is associated with an increased risk of developing diabetes in young and elderly (Stamatakis & Punjabi, 2010).

To date, there is no consensus regarding the duration and intensity of daily physical activity to reduce excessive daytime sleepiness in patients with type 2 diabetes. However, it is well established that more time of planned physical activity is associated with benefits due to improvements in psychological and psychosocial interactions. Thus, physical activity may intervene positively in mood and sociability, which might reduce sleepiness symptoms (Okay et al., 2009).

In the present study, physical activity levels were not sufficient to interfere with analyzed variables. However, it could be hypothesized that increasing health habits and physical activity levels would be more efficient in the quality of life of young university students. Effting et al. (2019) reported relevant data regarding resistance exercise as a tool to treat obesity and being also important to manage metabolic alterations and to maintain quality of life.

Although we were unable to find alterations in anthropometric measures, it is well known that obesity impacts quality of life. Low Cardiorespiratory fitness seems to affect cardiovascular risk factors in teenagers negatively, a stage in life which antecedes university entry, especially regarding excessive weight in both genders and biochemical profile in male, thus, urging for preemptive actions during childhood and teenagehood (Rodrigues et al., 2007).

There are reports from cases which hypertension (Carvalho et al., 2013), obesity (Poeta et al., 2010), CVD prevalence (Teston et al., 2016), demographic and social economic factors related to health and lifestyle (Ascef et al., 2017) negatively affected the quality of life in these patients.

Table 4. Linear regression between fatigue and quality of life.

			Coefficient	t	p-value
	B	SD	Beta		
(Constant)	35.016	6.443		5.434	.000
FC	-.029	.078	-.050	-.369	0.71
LPA	-.001	.044	-.003	-.023	0.93
PN	-.099	.072	-.180	-1.365	0.13
GH	-.055	.077	-.116	-.716	0.42
VIT	.053	.098	.094	.544	0.51
SA	.102	.078	.210	1.313	0.19
LEA	-.080	.040	-.276	-2.029	0.04*
MH	.007	.119	.011	.058	0.95

Notes: FC – Functional capacity; LPA – Limitations due physical aspects; GH – General Health; VIT – Vitality; SA – Social Aspects; LEA – Limitations due to emotional aspects; MH – Mental Health; PN – Pain; SD – Standard Deviation.

Table 3. Linear regression between daytime sleepiness and quality of life.

		FC	LPA	PN	GH	VIT	SA	LEA	MH
Daytime sleepiness	Pearson's	-.251	-.203	-.082	-.356**	-.302**	-.278**	-.241*	-.366**
	p value	0.01**	0.05	0.4	0.001**	0.004**	0.008**	0.02**	0.000**

Notes: FC – Functional capacity; LPA – Limitations due physical aspects; GH – General Health; VIT – Vitality; SA – Social Aspects; LEA – Limitations due to emotional aspects; MH – Mental Health; PN – Pain.

These findings corroborate with other factors that impacted the quality of life in other studies, such as concentration, sleep, energy level, ability to perform daily activities, leisure time, and negative emotions (bad mood, despair, anxiety, and depression). These variables are related to the success of the graduation process in performance in academic activities. Although, these factors were not correlated with university evasion, which was practically non-existent in the last decade (Catunda & Ruiz, 2008; Tatjana et al., 2011;).

Domains of quality of life such as: functional capacity, limitations due to emotional aspects, general health, vitality, social aspects, and mental health presented negative correlations with sleepiness. This data supports previous studies (Diaferia et al., 2013; Tassinari et al., 2016). Another interesting finding regards the association of fatigue and the subitem "limitations due to emotional aspects".

Studies have found symptoms of anxiety, depression, a significant incidence of fatigue, and low physical energy among young adults with sleeping problems (Mill et al., 2010; Muler & Guimarães, 2007). Reports found a prevalence of moderate/intense fatigue in young university students, which, in turn, described moderate/intense impairments in daily activities, showing a positive between fatigue with the graduation year, body mass index, and depression. Academic activities were the main ones responsible for fatigue (Amaducci et al., 2010).

It is expected that young university students to have a better quality of life and health. However, daytime sleepiness and fatigue are variables that might impact both. Moreover, daytime sleepiness and fatigue were also associated with obesity and well-being in young university students (Vgontzas et al., 2006).

It is well established that alterations in the circadian cycle might have genetic influence, but it also might be adjusted by daily circumstances such as work, jet lag, among other situations. A previous study has demonstrated greater sympathetic tonus in subjects with reduced hours of sleep, which may lead to increases in appetite and blood pressure, resulting in obesity and metabolic disorders (Gangwisch, 2009). Thus, a student organization and the work of university students should be well observed.

The findings of this study have important clinical implications. The strengths of the study are the stringent methodological design and clinical evolutions. However, interpretation requires consideration of the methodological limitations of this study procedure, where laboratory analyses could not be conducted. These data should improve our results. Second, the sample size was relatively small, and most students were recruited from the same university, although sample characteristics were comparable to other studies. Future research should aim to replicate findings and investigate the amount and frequency, and quality of sleep, fatigue, and anthropometric parameters on young university students in order to achieve a significant effect. It would also be important to test the effect of physical activity on behaviors in this population.

CONCLUSION

In summary, the levels of physical activity did not influence the sub-items of quality of life, excessive daytime sleepiness, and symptoms of fatigue in university students. However, excessive daytime sleepiness negatively impacts sub-items of quality of life such as functional capacity, general health, vitality, social aspects, limitations due to emotional aspects, and mental health, whereas fatigue only affects the emotional aspects of quality of life. There is a need to understand and control these variables to promote an improvement in the health of college students and, consequently, have a healthier adult life.

ACKNOWLEDGMENTS

Nothing to declare.

BIBLIOGRAPHIC REFERENCES

Amaducci, C. D. M., Mota, D. D. F. D. C., & Pimenta, C. A. D. M. (2010). Fadiga entre estudantes de graduação em enfermagem. *Revista da Escola de Enfermagem da USP, 44*(4), 1052-1058. https://doi.org/10.1590/S0080-62342010000400028

Ascef, B. D. O., Haddad, J. P. A., Álvares, J., Guerra Junior, A. A., Costa, E. A., Acurcio, F. D. A., Guibu, I. A., Costa, K. S., Karnikowski, M. G., Soeiro, O. M., Leite, S. N., & Silveira, M. R.,(2017). Qualidade de vida relacionada à saúde dos usuários da atenção primária no Brasil. *Revista de Saúde Pública, 51*(suppl 2), 22s. https://doi.org/10.11606/S1518-8787.2017051007134

Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. (2016). *Diretrizes brasileiras de obesidade 2016* (4ª Ed.). ABESO.

Bartel, K. A., Gradisar, M., & Williamson, P. (2015). Protective and risk factors for adolescent sleep: a meta-analytic review. *Sleep medicine reviews, 21*, 72–85. https://doi.org/10.1016/j.smrv.2014.08.002

Bertolazi, A. N., Fagondes, S. C., Hoff, L. S., Pedro, V. D., Menna Barreto, S. S., & Johns, M. W. (2009). Validação da escala de sonolência de Epworth em português para uso no Brasil. *Jornal brasileiro de pneumologia. Brasília, 35*(9), 877-883.

Bombelli, M., Facchetti, R., Fodri, D., Brambilla, G., Sega, R., Grassi, G., & Mancia, G. (2013). Impact of body mass index and waist circumference on the cardiovascular risk and all-cause death in a general population: data from the PAMELA study. *Nutrition, metabolism, and cardiovascular diseases: NMCD, 23*(7), 650–656. https://doi.org/10.1016/j.numecd.2012.01.004

Carvalho, C. A. D., Fonseca, P. C. D. A., Barbosa, J. B., Machado, S. P., Santos, A. M. D., & Silva, A. A. M. D. (2015). Associação entre fatores de risco cardiovascular e indicadores antropométricos de obesidade em universitários de São Luís, Maranhão, Brasil. *Ciência & Saúde Coletiva, 20*(2), 479-490. https://doi.org/10.1590/1413-81232015202.02342014

Carvalho, M. V. D., Siqueira, L. B., Sousa, A. L. L., & Jardim, P. C. B. V. (2013). A influência da hipertensão arterial na qualidade de vida. *Arquivos Brasileiros de Cardiologia, 100*(2), 164-174. https://doi.org/10.5935/abc.20130030

Catunda, M. A., & Ruiz, V. M. (2008). Qualidade de vida de universitários. *Pensamento plural, 2*(1), 22-31.

Dantas, E. M. D. S., Pinto, C. J., Freitas, R. P. D. A., & Medeiros, A. C. Q. D. (2015). Concordância na avaliação de risco cardiovascular a partir de parâmetros antropométricos. *einstein (São Paulo), 13*(3), 376-380. https://doi.org/10.1590/S1679-45082015AO3349

Diaferia, G., Badke, L., Santos-Silva, R., Bommarito, S., Tufik, S., & Bittencourt, L. (2013). Effect of speech therapy as adjunct treatment to continuous positive airway pressure on the quality of life of patients with obstructive sleep apnea. *Sleep medicine, 14*(7), 628-635. https://doi.org/10.1016/j.sleep.2013.03.016

Dwyer, T., Magnussen, C. G., Schmidt, M. D., Ukoumunne, O. C., Ponsonby, A. L., Raitakari, O. T., Zimmet, P. Z., Blair, S. N., Thomson, R., Cleland, V. J., & Venn, A. (2009). Decline in physical fitness from childhood to adulthood associated with increased obesity and insulin resistance in adults. *Diabetes care, 32*(4), 683–687. https://doi.org/10.2337/dc08-1638

Fagaras, S. P., Radu, L. E., & Vanvu, G. (2015). The level of physical activity of university students. *Procedia-Social and Behavioral Sciences, 197*, 1454-1457. https://doi.org/10.1016/j.sbspro.2015.07.094

Froy, O. (2011). The circadian clock and metabolism. *Clinical Science, 120*(2), 65-72. https://doi.org/10.1042/CS20100327

Gangwisch, J. E. (2009). Epidemiological evidence for the links between sleep, circadian rhythms and metabolism. *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity, 10*(Suppl 2), 37–45. https://doi.org/10.1111/j.1467-789X.2009.00663.x

George, M. G., Tong, X., & Bowman, B. A. (2017). Prevalence of Cardiovascular Risk Factors and Strokes in Younger Adults. *JAMA neurology, 74*(6), 695–703. https://doi.org/10.1001/jamaneurol.2017.0020

Hershner, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college students. *Nature and science of sleep, 6*, 73–84. https://doi.org/10.2147/NSS.S62907

Kreier, F., Kalsbeek, A., Sauerwein, H. P., Fliers, E., Romijn, J. A., & Buijs, R. M. (2007). "Diabetes of the elderly" and type 2 diabetes in younger patients: possible role of the biological clock. *Experimental gerontology, 42*(1-2), 22-27. https://doi.org/10.1016/j.exger.2006.07.004

Lima, L. (2018). *Obesidade: A arte de remover esse peso* (1ª Ed.). Haryon ED.

Li, Z.-S., & Hasson, F. (2020). Resilience, stress, and psychological well-being in nursing students: A systematic review. *Nurse Education Today, 90,* 104440. https://doi.org/10.1016/j.nedt.2020.104440

Lohman, T. G., Roche, A. F., & Martorell, R. (1988). *Anthropometric standardization reference manual.* Human Kinetics Books.

Mansur, A. D. P., Rocha, M. A., Leyton, V., Takada, J. Y., Avakian, S. D., Santos, A. J., ... & Rohlfs, W. J. (2015). Fatores de risco para doença cardiovascular, síndrome metabólica e sonolência em motoristas de caminhão. *Arquivos Brasileiros de Cardiologia, 105*(6), 560-565. https://doi.org/10.5935/abc.20150132

Matsudo, S., Araújo, T., Matsudo, V., Andrade, D., Andrade, E., Oliveira, L. C., & Braggion, G. (2001). Questionário internacional de atividade física (Ipaq): estupo de validade e reprodutibilidade no Brasil. *Revista Brasileira de Atividade Física & Saúde, 6*(2), 5-18. https://doi.org/10.12820/rbafs.v.6n2p5-18

Maugeri, A., Medina-Inojosa, J. R., Kunzova, S., Agodi, A., Barchitta, M., Sochor, O., Lopez-Jimenez, F., Geda, Y. E., & Vinciguerra, M. (2018). Sleep Duration and Excessive Daytime Sleepiness Are Associated with Obesity Independent of Diet and Physical Activity. *Nutrients, 10*(9), 1219. https://doi.org/10.3390/nu10091219

Melo, A. B., Carvalho, E. M., Sá, F. G. D. S. D., Cordeiro, J. P., Leopoldo, A. S., & Lima-Leopoldo, A. P. (2016). Nível de atividade física dos estudantes de graduação em educação física da Universidade Federal do Espírito Santo. *Journal of Physical education, 27*. https://doi.org/10.4025/jphyseduc.v27i1.2723

Mendonça, V. F. (2016). A Relação Entre o Sedentarismo, Sobrepeso e Obesidade com as Doenças Cardiovasculares em Jovens Adultos: uma Revisão da Literatura. *Saúde e Desenvolvimento Humano, 4*(1), 79-90. https://doi.org/10.18316/2317-8582.16.21

Mill, J. G., Hoogendijk, W. J., Vogelzangs, N., van Dyck, R., & Penninx, B. W. (2010). Insomnia and sleep duration in a large cohort of patients with major depressive disorder and anxiety disorders. *The Journal of clinical psychiatry, 71*(3), 239–246. https://doi.org/10.4088/JCP.09m05218gry

Müller, M. R., & Guimarães, S. S. (2007). Impacto dos transtornos do sono sobre o funcionamento diário e a qualidade de vida. *Estudos de psicologia (Campinas), 24*(4), 519-528. https://doi.org/10.1590/S0103-166X2007000400011

Núñez, P., Perillan, C., Arguelles, J., & Diaz, E. (2019). Comparison of sleep and chronotype between senior and undergraduate university students. *Chronobiology international, 36*(12), 1626–1637. https://doi.org/10.1080/07420528.2019.1660359

Okay, D. M., Jackson, P. V., Marcinkiewicz, M., & Papino, M. N. (2009). Exercise and obesity. *Primary Care: Clinics in Office Practice, 36*(2), 379-393. https://doi.org/10.1016/j.pop.2009.01.008

Oliveira, M. A. M., Fagundes, R. L. M., Moreira, E. A. M., Trindade, E. B. S. M., & Carvalho, T. (2010). Relação de Indicadores Antropométricos com Fatores de Risco para Doença Cardiovascular. *Arquivos Brasileiros de Cardiologia, 94*(4), 478-485. https://doi.org/10.1590/S0066-782X2010005000012

Organização Pan-Americana de Saúde. (2018). 10 principais causas de morte no mundo. Folha informativa. Disponivel em: https://www.paho.org/bra/index.php?option=com_content&view=article&id=5638:10-principais-causas-de-morte-no-mundo&Itemid=0

Patel, S. R., & Mehra, R. (2015). The Weighty Issue of Obesity Management in Sleep Apnea. *Chest, 148*(5), 1127-1129. https://doi.org/10.1378/chest.15-1010

Pereira, D., Silva, L., Lopes, S. O., Ribeiro, S., Franceschini, S., & Priore, S. E. (2020). Cytokines and body adiposity in young female undergraduate students. Citoquinas y adiposidad corporal en estudiantes universitarias jóvenes. *Nutricion hospitalaria, 37*(2), 299–305. https://doi.org/10.20960/nh.02860

Poeta, L. S., Duarte, M. D. F. D. S., & Giuliano, I. D. C. B. (2010). Qualidade de vida relacionada à saúde de crianças obesas. *Revista da Associação Médica Brasileira, 56*(2), 168-172. https://doi.org/10.1590/S0104-42302010000200014

Roberts, R. E., Roberts, C. R., & Chen, I. G. (2002). Impact of insomnia on future functioning of adolescents. *Journal of psychosomatic research, 53*(1), 561–569. https://doi.org/10.1016/s0022-3999(02)00446-4

Pulido-Arjona, L., Correa-Bautista, J. E., Agostinis-Sobrinho, C., Mota, J., Santos, R., Correa-Rodríguez, M., Garcia-Hermoso, A., & Ramírez-Vélez, R. (2018). Role of sleep duration and sleep-related problems in the metabolic syndrome among children and adolescents. *Italian journal of pediatrics, 44*(1), 9. https://doi.org/10.1186/s13052-018-0451-7

Rawat, A., Gangwar, A. K., Tiwari, S., Kant, S., Garg, R. K., & Singh, P. K. (2019). Sleep quality and insulin resistance in adolescent subjects with different circadian preference: A cross-sectional study. *Journal of family medicine and primary care, 8*(7), 2502–2505. https://doi.org/10.4103/jfmpc.jfmpc_400_19

Rocha, R. M., & Martins, W. A. (2017). *Cardiovascular prevention manual.* Planmark.

Stamatakis, K. A., & Punjabi, N. M. (2010). Effects of sleep fragmentation on glucose metabolism in normal subjects. *Chest, 137*(1), 95–101. https://doi.org/10.1378/chest.09-0791

Pekmezovic, T., Popovic, A., Tepavcevic, D. K., Gazibara, T., & Paunic, M. (2011). Factors associated with health-related quality of life among Belgrade University students. *Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation, 20*(3), 391–397. https://doi.org/10.1007/s11136-010-9754-x

Tassinari, C. C., Piccin, C. F., Beck, M. C., Scapini, F., Oliveira, L. C., Signori, L. U., & Silva, A. M. (2016). Capacidade funcional e qualidade de vida entre sujeitos saudáveis e pacientes com apneia obstrutiva do sono. *Medicina (Rib Preto), 49*(2), 152-159.

Whittier, A., Sanchez, S., Castañeda, B., Sanchez, E., Gelaye, B., Yanez, D., & Williams, M. A. (2014). Eveningness chronotype, daytime sleepiness, caffeine consumption, and use of other stimulants among Peruvian university students. *Journal of caffeine research, 4*(1), 21-27. https://doi.org/10.1089/jcr.2013.0029

Yano, Y., Reis, J. P., Colangelo, L. A., Shimbo, D., Viera, A. J., Allen, N. B., Gidding, S. S., Bress, A. P., Greenland, P., Muntner, P., & Lloyd-Jones, D. M. (2018). Association of Blood Pressure Classification in Young Adults Using the 2017 American College of Cardiology/American Heart Association Blood Pressure Guideline With Cardiovascular Events Later in Life. *JAMA, 320*(17), 1774–1782. https://doi.org/10.1001/jama.2018.13551

Ying, W., Fu, W., Lee, Y. S., & Olefsky, J. M. (2020). The role of macrophages in obesity-associated islet inflammation and β-cell abnormalities. *Nature Reviews Endocrinology, 16*(2), 81-90. https://doi.org/10.1038/s41574-019-0286-3

Ying, W., Lee, Y. S., Dong, Y., Seidman, J. S., Yang, M., Isaac, R., ... & McNelis, J. (2019). Expansion of islet-resident macrophages leads to inflammation affecting β cell proliferation and function in obesity. *Cell metabolism, 29*(2), 457-474. https://doi.org/10.1016/j.cmet.2018.12.003

Zeller, M. H., & Modi, A. C. (2006). Predictors of health-related quality of life in obese youth. *Obesity, 14*(1), 122-130. https://doi.org/10.1038/oby.2006.15

ARTIGO ORIGINAL

https://doi.org/10.6063/motricidade.19232

Comparação de indicadores antropométricos em atletas de ginástica rítmica satisfeitas e insatisfeitas com a imagem corporal

Comparison of anthropometric indicators in rhythmic gymnastics athletes satisfied and dissatisfied with body image.

Suellem Zanlorenci[1]*, Priscila Custódio Martins[1],
Diego Augusto Santos Silva[1], Rozane Aparecida Toso Bleil[2]

RESUMO

O objetivo do presente estudo foi comparar o índice de massa corporal [IMC], dobra cutânea do tríceps (DCTR), subescapular (DCSE) e gordura corporal (%GC) em atletas de ginástica rítmica (GR), satisfeitas e insatisfeitas com a imagem corporal (IC), Tratou-se de um estudo transversal, com 38 atletas praticantes de GR do Oeste Paranaense. A IC foi avaliada com o Body Shape Questionnaire, a massa corporal e a estatura foram aferidas e o IMC calculado. As DCTR e DCSE foram utilizadas para o cálculo do %GC (equação de Slaughter). O nível econômico foi verificado com o Critério de Classificação Econômica Brasil e a maturação sexual foi autorreferida com pranchas de Tanner. Foi empregado Teste T independente, Qui-quadrado e análise de covariância (ANCOVA) controlando a interferência do nível econômico e do estágio maturacional, com $p<0,05$. Ginastas insatisfeitas com a IC apresentaram maiores valores de IMC (média: 19,01 Kg/m²; desvio-padrão [DP]: 0,65 Kg/m²), DCTR (média: 9,26 mm; DP: 0,65 mm), DCSE (média: 7,33 mm; DP: 0,55 mm) e %GC (média: 20,75; DP: 0,96), quando comparadas às ginastas satisfeitas com a IC, mesmo após o controle do nível econômico e do estágio maturacional. Atletas de GR insatisfeitas com a IC apresentaram maiores valores para os indicadores antropométricos.

PALAVRAS-CHAVE: composição corporal, tecido adiposo, distorção da percepção, desempenho atlético, ginástica.

ABSTRACT

This study aimed to compare body mass index [BMI], triceps skinfold (DCTR), subscapular skinfold (DCSE) and body fat (%BF) in rhythmic gymnastics (GR) athletes, satisfied and dissatisfied with body image (CI). Through a cross-sectional study with 38 athletes practicing GR from Oeste Paranaense. The CI was assessed with the Body Shape Questionnaire, body mass and height were measured, and the BMI was calculated. The DCTR and DCSE were used to calculate the %GC (Slaughter equation). The economic level was verified with the Brazil Economic Classification Criterion, and sexual maturation was self-reported with Tanner boards. Independent T-test and Chi-square and covariance analysis (ANCOVA) were employed to control the interference of economic level and maturational stage, with $p<0.05$. Gymnasts dissatisfied with HF presented higher BMI values (mean: 19.01 Kg/m²; standard deviation [SD]: 0.65 Kg/m²), DCTR (mean: 9.26 mm; SD: 0, 65 mm), DCSE (mean: 7.33 mm; SD: 0.55 mm) and %BF (average: 20.75; SD: 0.96) when compared to gymnasts satisfied with HF, even after control economic level and maturational stage. GR athletes dissatisfied with HF presented higher values for anthropometric indicators.

KEYWORDS: body composition, body fat, perception distortion, athletic performance, gymnastics.

[1]Centro de Desportos, Núcleo de Pesquisa em Cineantropometria e Desempenho Humano (NUCIDH), Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina, Brasil.
[2]Universidade Federal da Fronteira Sul. Realeza, Paraná, Brasil.
*Autor correspondente: Universidade Federal de Santa Catarina, Departamento de Educação Física, Florianopolis, SC, Brasil. CEP: 880900-00. E-mail: suellemzan@gmail.com

Conflito de interesses: nada a declarar. Financiamento: nada a declarar
Artigo recebido a 01 15, 2020; Aceite a 08 05, 2020

INTRODUÇÃO

A Ginástica Rítmica (GR) proporciona várias oportunidades de movimento, auxiliando o desenvolvimento de todas as características aos praticantes, aperfeiçoando as capacidades psicomotoras, físicas, de ritmo, lateralidade, equilíbrio, estruturação espacial, orientação temporal, esquema corporal, além dos domínios cognitivo, afetivo e social (de Aquino et al., 2012). Algumas particularidades do treinamento esportivo na GR devem ser levadas em consideração, pois a modalidade tem como característica a busca pela perfeição na execução dos movimentos corporais e com os aparelhos, sendo necessária a atenção nos pequenos detalhes (Boaventura, 2011).

Verifica-se na GR preocupação exacerbada com a imagem corporal (IC), isso pode ser resultado da imposição da mídia e dos treinadores que impõem a IC estereotipada que corresponde a aparência irreal de magreza (Oliveira et al., 2003). Atletas de GR se deparam com demandas intensas de treinamento e, principalmente, com estereótipo de corpo magro, orientado para objetivos de competição, ou seja, possuir forte desejo de ser perfeito em todos os aspectos da modalidade, a fim de alcançar maior potencial (Di Palma, 2016). As atletas geralmente baseiam o sucesso com aparência estética e habilidades atléticas, o que pode resultar em limitação excessiva de ingestão de alimentos, aumentando os níveis de ansiedade e estresse, o que impacta negativamente na percepção da IC (Borrione et al., 2013).

A fase da adolescência tem características específicas de acordo com o nível econômico, no qual a adolescente está inserida e de acordo com o estágio maturacional (Salles, 1998). Meninas com maior nível econômico tendem a desenvolver maior insatisfação com a IC em comparação com as meninas de menor nível econômico (Archibald et al., 1999). As atletas de GR, em geral, apresentam nível econômico elevado,além de ser uma modalidade que preconiza o baixo peso corporal e enaltece a estética como um dos critérios de avaliação do desempenho (Fortes et al., 2012). Em relação ao estágio maturacional, estudos demonstraram que as constantes transformações relacionadas ao desenvolvimento puberal, somadas à emergência da sexualidade, valorização da função social e a dificuldade em estabelecer a própria identidade geram inquietudes e sofrimento, e por isto, a adolescência (após o início da puberdade) é considerada período crítico para o desenvolvimento de distúrbios de IC (Braga et al., 2010; Campagna & Souza, 2006).

A literatura a respeito da composição corporal e percepção da IC em atletas de GR é escassa, como foi verificado pelo estudo de Moraes et al. (2019), cujo objetivo foi mapear a produção científica sobre GR, publicada em periódicos da América Latina, Caribe e países ibéricos. A pesquisa encontrou 48 artigos publicados em 27 periódicos diferentes, distribuídos no período de 2001 a 2017. O estudo apresentou artigos relacionados à preparação física e aptidão física das atletas de GR, características e qualidades físicas, biológicas, fisiológicas, análises de equilíbrio, maturação biológica e métodos de treinamento (Lima Moraes et al., 2019), porém, não foi relatado nenhum estudo que se referiu à composição corporal de atletas de GR, controlando a interferência do nível econômico e do estágio maturacional, o que demonstra falta de evidências acerca desta inter-relação.

Identificar a distorção da IC em diferentes momentos da carreira esportiva dessas ginastas pode contribuir para compreensão dos mecanismos que desencadeiam tais processos prejudiciais à saúde das atletas (Vieira et al., 2009). Estudos relacionados à composição corporal e IC controlando a interferência do estágio maturacional e do nível econômico de atletas de GR, são necessários com objetivo de melhorar a qualidade técnica, a qualidade de vida e saúde das atletas dessa modalidade.

Desta forma, o objetivo do presente estudofoi comparar os indicadores antropométricos em atletas de ginástica rítmica, satisfeitas e insatisfeitas com a IC, controlando a interferência do estágio maturacional e o nível econômico.

MÉTODO

O projeto foi apresentado à coordenadora de cada equipe selecionada, informando os objetivos da mesma. Após o aceite e autorização pela equipe e patrocinadores, o projeto foi encaminhado e aprovado pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal da Fronteira Sul (CEP/UFFS), sob parecer 1.857.618. Após a aprovação foi encaminhada carta informativa para cada equipe e em seguida definido o melhor período para a coleta de dados, a fim de não interferir nos treinamentos e campeonatos já agendados. A pesquisa seguiu os procedimentos de acordo com a Declaração de Helsinquia.

Amostra

Estudo transversal, realizado com adolescentes do sexo feminino, em queforam avaliadas 38 atletas adolescentes (10 a 18 anos), praticantes de GR do Oeste Paranaense. As atletas treinavam de quatro a seis horas por dia de segunda a sábado, em dois municípios considerados como referência na modalidade de acordo com a Federação Paranaense de Ginástica.Todas as atletas do rendimento das duas equipes selecionadas foram convidadas a participar da pesquisa e não houve negativas em nenhum dos parâmetros avaliados.

O tamanho da amostra foi calculado a posteriori considerando o erro do tipo I (α=0,05) e erro de tipo II (β=0,80) para identificar diferença entre as atletas satisfeitas e insatisfeitas com IC com tamanho de efeito médio (0,50) (Cohen, 2013) para os indicadores investigados.Para análise de covariância (ANCOVA), a análise posteriori indicou que com α=0,05 e β=0,80, a amostra de 38 atletas permitiu encontrar diferenças na comparação de médias com tamanho de efeito de 0,50. Todos os cálculos foram realizados no software *G*Power*® versão 3.1.9.2 (Universitat Dusselfodorf, Alemanha).

Procedimentos de coleta de dados

As atletas foram avaliadas individualmente, por três pesquisadoras estudantes do curso de nutrição da UFFS – Campus Realeza. As avaliadoras foram previamente treinadas para a coleta de dados pela professora coordenadora da pesquisa,em que uma das pesquisadoras ficou responsável pela aplicação dos questionários (imagem corporal, nível econômico), uma pesquisadora ficou responsável pela realização das medidas antropométricas e explicar os procedimentos da avaliação da maturação sexual e outra pesquisadora ficou responsável pela aplicação do questionário de freqüência alimentar que aconteceram no próprio local de treinamento, durante o horário de treinamento e foram agendadas previamente com a coordenadora de cada equipe. A coleta de dados foi realizada em sua totalidade em três dias.

Variáveis dependentes

A massa corporal foi obtida em balança digital, da marca Marte® (São Paulo, Brasil), com capacidade de 200kg e precisão de 50g e a estatura determinada com estadiômetro marca Sanny® (São Paulo, Brasil), com capacidade de 210cm e precisão de 1,0mm. A partir dessas informações, o índice de massa corporal (IMC) foi determinado pela fórmula: IMC= massa corporal (kg)/estatura (m)^2 epara avaliação do estado nutricional, foram usadas as Curvas de Crescimento da Organização Mundial da Saúde (Organization, 2016), em relação ao IMC/idade para crianças e adolescentes de cincoa 19 anos.Para a avaliação do percentual de gordura corporal (%GC) foram mensuradas as dobras cutâneas triciptal e subescapular com adipômetro da marca Cescorf® (Porto Alegre, Brasil), com precisão de 0,1 mm, e em seguida calculadas a partir da equação de Slaughter et al. (Slaughter et al., 1988). A referida fórmula varia de acordo com o somatório das dobras cutâneas triciptal e subescapular. Se a soma das duas dobras cutâneas for ≤ que 35,0 mm se utilizou a seguinte fórmula:

1,33 x (tríceps + subescapular) – 0,013 x (tríceps + subescapular)^2 – 2,5

Se a soma das duas dobras cutâneas for > 35 mm utilizou-se a seguinte fórmula:

0,546 x (tríceps + subescapular) x 9,7

Variáveis independentes

A percepção da IC foi avaliada por meio do questionário *Body Shape Questionnaire*– BSQ, validado para a população brasileira (Di Pietro, 2003). O instrumento contém 34 itens, com seis opções de respostas: 1) nunca; 2) raramente; 3) às vezes; 4) frequentemente; 5) muito frequente; e 6) sempre. De acordo com a resposta marcada, o valor do número correspondente à opção feita é computado como ponto para a questão. A classificação dos resultados é feita pelo total de pontos obtidos e reflete os níveis de preocupação com a IC. Caso a pontuação seja inferior a 81, a atleta não apresenta distorção da IC(satisfeita com a IC) e acima de 81 pontos reflete algum tipo de distorção da IC (insatisfeitas com a IC). A versão em português utilizada foi a apresentada por Di Pietro e Silveira (Di Pietro, 2003) e a classificação da pontuação foi realizada de acordo com o estudo de Oliveira et al. (Oliveira et al., 2003).

Covariáveis

O nível econômico foi verificado de acordo com o questionário proposto pelo Critério de Classificação Econômica Brasil, descrito pela Associação Brasileira de Empresas de Pesquisa - ABEP (2015) e os resultados foram classificados em "alto" (A1, A2, B1, B2) e "baixo" (C1, C2, D, E), o mesmo foi preenchido com auxílio dos pais e/ou responsáveis de cada atleta e a classificação foi realizada pelos autores do manuscrito.

A maturação sexual foi autoavaliada com base no desenvolvimento das mamas e dos pelos púbicos, conforme critérios propostos por Tanner (1962).O estágio1 corresponde à fase infantil (pré-púbere) e o estágio 5 à fase pós-puberal, adulta. Os estágios 2, 3 e 4 caracterizam o período puberal. Foram considerados os dois parâmetros avaliados (caracteres sexuais secundários), casos específicos em que a atleta se autoavaliou no estágio 1 para desenvolvimento das mamas e 4 para pêlos púbicos, por exemplo, considerou-se o menor estágio assinalado(Tanner, 1962).

Análise estatística

Inicialmente foi empregada estatística descritiva (média, desvio-padrão [DP]) e assimetria e curtose (-2 +2) para verificar a normalidade dos dados. Foi empregado o Teste T independente, o teste do Qui-quadrado e o teste Exato de Fisher para verificar diferenças entre os grupos (satisfeitas

e insatisfeitas pela IC) e posteriormente, foi realizada a ANCOVA controlando a interferência do nível econômicoe do estágio maturacional (modelos ajustados), com nível de significância de 0,05. Todas as análises foram realizadas no *SoftwareStata*® (*Statistical Software for Professionals*, Texas, Estados Unidos), versão 13.0.

RESULTADOS

As ginastas insatisfeitas com a IC apresentaram média de 15 anos (DP: 1,96) de idade, média de massa corporal em 47 kg (DP:8,81) e média de IMC em 19,0 kg/m² (DP: 2,48). Dasatletas avaliadas, 41,4% insatisfeitas com a IC se autoclassificaram com nível econômico alto e púbere no estágio maturacional (Tabela 1).

As ginastas insatisfeitas com a IC apresentaram maiores valores de IMC, dobra cutânea do tríceps, subescapular e %GC, quando comparadas às ginastas satisfeitas com a IC, nos modelos bruto e ajustado (Tabela 2).

DISCUSSÃO

Os resultados do presente estudo foram que as atletas de GRinsatisfeitas com a IC apresentaram maiores valores de IMC, dobra cutânea do tríceps, subescapular e %GC, quando comparadas às atletas de GR satisfeitas com a IC mesmo controlando a interferência do nível econômico e do estágio maturacional.

Resultado semelhante foi encontrado em estudo com 580 atletas (464 meninos e 116 meninas) de 10 e 19 anos de idade, de várias modalidades, dos estados do Rio de Janeiro e Minas Gerais, Brasil, em que atletas com maiorIMC e %GC apresentaram maior insatisfação com a IC (Fortes et al., 2012). Possível justificativa para os achados pode residir na seleção natural que algumas modalidades (exemplo: nado sincronizado, natação e GR) buscam atletas comcaracterísticas especificas (magreza). Além disso, a intensidade do treinamento auxilia para que as atletas apresentem menor IMC e %GC (Fortes et al., 2012). Nesse sentido, apesar do ambiente competitivo trazer maior pressão na busca de um corpo estético

Tabela 1. Distribuição das variáveis investigadas segundo a percepção da imagem corporal das atletas de ginástica rítmica (n=38).

	Satisfeitas com a IC (n=23)	Insatisfeitas com a IC (n=15)	p-valor	d de Cohen
	Média (DP)	Média (DP)		
Idade (anos)	12,67 (1,74)	15,15 (1,96)	<0,01	1,33
Massa corporal (kg)	37,64 (8,62)	47,07 (8,81)	<0,01	1,08
Estatura (m)	1,48 (0,10)	1,56 (0,06)	0,01	0,97
Índice de massa corporal(kg/m²)	16,78 (2,02)	19,01 (2,48)	<0,01	0,98
Dobra cutânea do tríceps (mm)	7,69 (1,71)	9,26 (2,60)	0,03	0,71
Dobra cutânea subescapular (mm)	6,04 (1,52)	7,33 (2,16)	0,03	0,69
Gordura corporal total (%)	18,23 (2,51)	20,75 (3,77)	0,01	0,78
	n (%)	n (%)	p-valor	V-Cramer
Estágio maturacional			0,66	
Pré-pubere	06 (66,7)	03 (33,3)		
Púbere	17 (58,6)	12 (41,4)		
Pós-púbere	-	-	-	
Nível economico			0,83	
Baixo	04 (57,1)	03 (42,9)		
Alto	19 (61,3)	12 (38,7)		
Índice de Massa Corporal			0,26	0,23
Eutrofia	20 (50,1)	15 (42,9)		
Magreza	3 (100,0)	0 (0,0)		
Gordura Corporal				
Baixo	19 (63,3)	11 (36,7)	0,59	0,16
Adequada	03 (60,0)	02 (40,0)		
Moderadamente alto	01 (33,7)	02 (66,3)		

DP: desvio-padrão; IC: Imagem Corporal.

Tabela 2. Comparação dos indicadores antropométricos entre atletas de ginástica rítmica satisfeitas e insatisfeitascom a imagem corporal (n=38).

	Satisfeitas com a IC (n=23)	Insatisfeitas com a IC (n=15)		R^2	d de Cohen
	Média (DP)	Média (DP)	p-valor		
Índice de massa corporal					
Modelo bruto	16,78 (0,42)	19,01 (0,65)	<0,01	0,20	0,25
Modelo ajustado	16,84 (0,42)	18,93 (0,52)	0,04	0,37	0,58
Dobra cutânea do tríceps					
Modelo bruto	7,69 (0,37)	9,26 (0,65)	0,03	0,12	0,13
Modelo ajustado	7,73 (0,42)	9,20 (0,52)	0,03	0,22	0,28
Dobra cutânea subescapular					
Modelo bruto	6,04 (0,33)	7,33 (0,55)	0,03	0,11	0,12
Modelo ajustado	6,07 (0,35)	7,28 (0,43)	0,04	0,25	0,33
Gordura corporal total					
Modelo bruto	18,23 (0,54)	20,75 (0,96)	0,01	0,14	0,16
Modelo ajustado	18,29 (0,59)	20,66 (0,73)	0,01	0,30	0,42

Modelo ajustado por estágio maturacional e nível econômico; IC: imagem corporal; DP: desvio-padrão; R^2 poder de explicação ajustado.

considerado socialmente perfeito, o treinamento intenso "modela" o corpo para que o desenvolvimento físico das atletas de elite assemelhe-se ao padrão corporal ideal valorizado na sociedade (magreza) (Fortes et al., 2012).

A IC se associa diretamente com parâmetros neurofisiológicos e indicadores antropométricos (Pereira et al., 2011). Apesar disso, estudos direcionam para a importância dos determinantes sociais nos sentimentos de satisfação e insatisfação com o corpo, especialmente na adolescência, sugerindo, que as influências culturais e de padrões de beleza podem ser constituídas de formas singulares de acordo com o nível econômico e estágio maturacional (Pereira et al., 2011; Williams et al., 2015). No presente estudo foi observado que mesmo após o controle da interferência do nível econômico e da maturação sexual, as atletas de GR com maiores indicadores antropométricos apresentaram maior insatisfação com a IC. Possível justificativa para os achados pode residir na maior exposição que as atletas de maior nível econômico estão submetidas, como a cobrança dos técnicos, da própria família ea maior facilidade aos meios midiáticos, principalmente às redes sociais, sendo a internet representada como potente meio sociocultural que contribui para a distorção da IC, tornando-se assim grupo de risco (Tiggemann & Slater, 2013).

A maturação sexual parece também exercer grande influência na IC entre atletas. Estudo realizado com 126 atletas de GR de nível nacional e internacional (idade: 11,95 ± 3,09 anos) em Budva (Montenegro), verificou associação negativa entre maturação sexual e treinamento, demonstrando que a maturação tardia pode ser desejável na GR com o intuito de melhorar o desempenho (Purenović-Ivanović et al., 2017). Ainda, estudo realizado na Alemanha com 215 adolescentes de ambos os sexos identificouque os adolescentes com maior IMC e o %GC apresentaramestágios de maturação sexual mais avançados (Buyken et al., 2009).

A GR possui elementos corporais que influenciam arealização dos movimentos como, leveza e feminilidade acompanhados de flexibilidade eprincipalmente força muscular, tudo em harmonia com a música (Laffranchi, 2001).Estudo demonstrou que em algumas modalidades esportivas, a influência exercida pelos treinadores, patrocinadores e familiares, por meio dos comentários relativos ao peso corporal e à forma corporal das atletas, podem representar um elemento de instalação de comportamentos anormais relacionados à IC, ou seja, mesmo apresentando valores considerados dentro da normalidade para os parâmetros, essas atletas não se sentem satisfeitas com a IC e demonstram desejo pela aparência mais magra (McLaren et al., 2001).

Existe carência de estudos com medidas antropométricas controlando a interferência do nível econômico e estágio maturacional, nesse sentido, pode se levar em consideração a dificuldade temporal e operacional para esse tipo de estudo, haja vista que as atletas necessitam abrir mão do treino para coleta dos dados. Limitação da pesquisa é o tamanho da amostra, pois comesta reduzida o poder dos testes estatísticos aplicados pode ser inferior. Outra limitação da pesquisa

foi o não cálculo do erro técnico de medida e do coeficiente de correlação intraclasse do antropometrista que realizou as mensurações antropométricas. Por outro lado, somente um antropometrista realizou as medições o que minimiza os erros de medida. O estudo também apresenta pontos fortes que devem ser destacados, como a utilização de medidas simples e de baixo custo, como as medidas antropométricas que podem ser utilizadas por treinadores com o objetivo de monitorar a composição corporal das atletas de GR.

CONCLUSÕES

Concluiu-se que as atletas de GR insatisfeitas com a IC apresentaram maiores valores de IMC, dobra cutânea do tríceps, subescapular e %GC, independente do nível econômico e do estágio maturacional.

AGRADECIMENTOS

A autora PCM agradece à Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) pela bolsa de estudos durante o período de construção do artigo

REFERÊNCIAS

Archibald, A. B., Graber, J. A., & Brooks-Gunn, J. (1999). Associations among parent-adolescent relationships, pubertal growth, dieting, and body image in young adolescent girls: A short-term longitudinal study. *Journal of Research on Adolescence*, *9*(4), 395–415.

Boaventura, P. L. B. (2011). *Técnica, dor, feminilidade: Educação do corpo na ginástica rítmica*.

Borrione, P., Battaglia, C., Fiorilli, G., Moffa, S., Tsopani, D., Piazza, M., & Di Cagno, A. (2013). Body image perception and satisfaction in elite rhythmic gymnasts: A controlled study. *Medicina dello sport*, *66*(1), 61–70.

Braga, P. D., Molina, M. del C. B., & Figueiredo, T. A. M. de (2010). Representações do corpo: Com a palavra um grupo de adolescentes de classes populares. *Ciência & Saúde Coletiva*, *15*, 87–95.

Buyken, A. E., Karaolis-Danckert, N., & Remer, T. (2009). Association of prepubertal body composition in healthy girls and boys with the timing of early and late pubertal markers. *The American journal of clinical nutrition*, *89*(1), 221–230.

Campagna, V. N., & Souza, A. S. L. de. (2006). Corpo e imagem corporal no início da adolescência feminina. *Boletim de psicologia*, *56*(124), 9–35.

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.

de Aquino, M. F. S., Browne, R. A. V., Sales, M. M., & Dantas, R. A. E. (2012). A psicomotricidade como ferramenta da educação física na educação infantil. *RBFF-Revista Brasileira de Futsal e Futebol*, *4*(14).

Di Palma, A. (2016). *Examining the phenomena of eating habits and body image satisfaction: An in depth study of the elite rhythmic gymnast as they transition into retirement from the sport*.

Di Pietro, M. (2003). Desempenho da escala "Body Shape Questionnaire" em uma população de estudantes universitários. *Trabalho apresentado no V Encontro do Transtornos Alimentares e Obesidade*.

Fortes, L. de S., Almeida, S. de S., & Ferreira, M. E. C. (2012). Impacto de variáveis antropométricas sobre a insatisfação corporal e o comportamento alimentar em jovens atletas. *Jornal brasileiro de psiquiatria*, *61*(4), 235–241.

Laffranchi, B. (2001). *Treinamento desportivo aplicado à ginástica rítmica*. Unopar.

Lima Moraes Lic, L. C., Moraes e Silva Dr, M., Barbosa Rinaldi Dra, I. P., Roberto Rojo M Sc, J., & Couto Gomes, L. (2019). Ginástica rítmica: Perfil sobre a produção científica em periódicos da américa latina, caribe e países ibéricos. *Pensar en Movimiento: Revista de ciencias del ejercicio y la salud*, *17*(1), 122–144.

McLaren, L., Gauvin, L., & White, D. (2001). The role of perfectionism and excessive commitment to exercise in explaining dietary restraint: Replication and extension. *International Journal of Eating Disorders*, *29*(3), 307–313. https://doi.org/10.1002/eat.1023

Oliveira, F. P. de, Bosi, M. L. M., Vigário, P. dos S., & Vieira, R. da S. (2003). Comportamento alimentar e imagem corporal em atletas. *Revista Brasileira de Medicina do Esporte*, *9*(6), 348–356.

Organization, W. H. (2016). Growth reference data for 5-19 years. 2007. *Disponível hein: http://www. who. int/growthref/en*.

Pereira, E. F., Teixeira, C. S., Gattiboni, B. D., Bevilacqua, L. A., Confortin, S. C., & Silva, T. R. da. (2011). Percepção da imagem corporal e nível socioeconômico em adolescentes: Revisão sistemática. *Rev Paul Pediatr*, *29*(3), 423–429.

Purenović-Ivanović, T., Popović, R., & Moskovljević, L. (2017). The contribution of pubertal development to performance scores in high-level rhythmic gymnasts. *Acta Gymnica*, *47*(3), 122–129.

Salles, L. M. F. (1998). *Adolescência, escola e cotidiano: Contradições entre o genérico e o particular*. Editora UNIMEP.

Slaughter, M. H., Lohman, T. G., Boileau, R., Horswill, C. A., Stillman, R. J., Van Loan, M. D., & Bemben, D. A. (1988). Skinfold equations for estimation of body fatness in children and youth. *Human biology*, 709–723.

Tanner, J. M. (1962). *Growth at adolescence*.

Tiggemann, M., & Slater, A. (2013). NetGirls: The Internet, Facebook, and body image concern in adolescent girls. *International Journal of Eating Disorders*, *46*(6), 630–633.

Vieira, J. L. L., Amorim, H. Z., Vieira, L. F., Amorim, A. C., & Rocha, P. G. M. da. (2009). Distúrbios de atitudes alimentares e distorção da imagem corporal no contexto competitivo da ginástica rítmica. *Revista Brasileira de Medicina do Esporte*, *15*(6), 410–414.

Williams, D., Collingwood, L., Coles, J., & Schmeer, S. (2015). Evaluating a rugby sport intervention programme for young offenders. *Journal of Criminal Psychology*, *5*(1), 51–64. https://doi.org/10.1108/JCP-05-2014-0008

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.19630

Changes in the functional capacity of active and institutionalized elderly

Igor Conterato Gomes[1], Genival Caetano Ferreira Neto[2], Luiz Victor da Silva Costa[3], Mike Farias Xavier[3], Prodamy da Silva Pacheco Neto[4*], Júlio César Chaves Nunes Filho[5]

ABSTRACT

This study aimed to observe changes in the functional capacity of the elderly. Eighteen elderly individuals (mean 74.3 years) were divided into two groups: water aerobics (GH, n = 08) and institutionalized (GI, n = 10). Functional capacity was identified through the battery of tests proposed by Rikli and Jones (1999). After the intervention period, both groups showed reductions in the valences evaluated. However, in GI the reductions were more accentuated. For Cardiorespiratory Capacity, Mobility, and Strength of lower limbs, there were reductions for GH of (-4.22%, -9.42%, and -19.23%) and GI of (-52.20, -135.43%, and -28%) respectively. For the Time up and Go test (TUG), statistical effect was present for time (with lower time post vs. pre; p = 0.021) as well as a significant interaction for time*group (p = 0.027), respectively. Physical exercise programs for the elderly can reduce the rate of decline in functional capacity, with healthier aging.

KEYWORDS: aging, exercise, water aerobics.

INTRODUCTION

Life expectancy is increasing in the world population. Aging is a complex process that alters the morphology and functions of the organism and among these changes is the reduction in functional capacity (Murabito et al., 2008).

Functional capacity is related to the ability to perform activities of daily living such as eating, bathing, riding a bus, making a phone call, and walking, and its decrease is associated with an increased risk of falls, increased hospitalizations, and mortality (Fried, 2004; Gonçalves et al., 2010; Rockwood, 2005; Silva et al., 2006;).

In addition to the aging process, one of the factors affecting functional capacity is a sedentary lifestyle. In this sense, studies report that functional capacity and physical exercise are positively related and could be responsible for postponing the degenerative process of functional capacities due to aging (ACSM, 2009; Hunter et al., 2001).

Due to the importance of physical exercise for maintaining relevant aspects of functional capacity, its practice should be directed to both community and institutionalized elderly. The literature has shown that physical exercise is useful in the prevention and treatment of frailty in institutionalized elderly, as the elderly living in institutions who did not perform physical exercise programs presented greater losses in functional capacity and higher mortality (Ferreira et al., 2018; Freitas & Scheicher, 2010; Sahin et al., 2018).

Changes in functional capacity in the elderly are directly related to lack of physical exercise; however, this is not well established in the literature, as the decrease occurs in both active and sedentary elderly. In addition, there is a lack of studies analyzing this relationship in elderly people living in long-term care facilities for the elderly. Thus, the objective of the present study was to observe the changes in the functional capacity of active and institutionalized elderly.

[1]Universidade Salvador (UNIFACS), Salvador-BA, Brasil;
[2]Universidade Federal do Rio Grande do Norte (UFRN), Natal-RN, Brasil;
[3]Universidade Maurício de Nassau (UNINASSAU), Natal-RN, Brasil;
[4]Instituto Integrar, Fortaleza-CE, Brasil;
[5]Universidade Federal do Ceará (UFC), Fortaleza-CE, Brasil.
*Corresponding author: Rua Santa Cecília, 1940, casa 55, Bairro: Pires Façanha – Eusébio, 61760-000, Fortaleza – CE, Brazil E-mail: prodamypn@hotmail.com

Conflict of Interest: nothing to declare, Funding: nothing to declare
Manuscript received at 03 07 2020; Accepted at 06 30, 2020.

METHODS

Participants

This observational study with a longitudinal design and a convenience sample was carried out from September 2017 to August 2018. A research was conducted in a long-term institution of the elderly, non-profit, and water aerobics health center, both located in the municipality of Natal, Rio Grande do Norte, Brazil. Participants were divided into two groups: sedentary institutionalized elderly (GI) and non-institutionalized elderly practitioners of water aerobics (GH). To participate in this study, participants should meet the following criteria: elderly of both sexes, apparently healthy, and acceptable to participate in the research. As exclusion criteria: for both groups, 1) elderly people in wheelchairs or with serious communication problems; for the participants of the IG, 2): an elder who returned to the family during the seven months of observation or at any time performed any physical exercise; for GH, 3) individuals who participated in less than 75% of classes during the study period.

Thus, participated in the present study 18 elderly people, who were divided into two groups: Water aerobics group (GH, n = 8 elderly, of these 5 women, aged 60-86 years) and Institutionalized Group (GI, n = 10 elderly, of these 3 women, aged 61-95 years). All the elderly people invited to participate in the present study received clarification about the objectives and methodology used for the data collection. Only those who signed the Free and Informed Consent Form were included in the sample. Research Ethics Committee of the Universidade Estadual Paulista de Presidente Prudente reviewed and approved all protocols, with protocol no. 298/2008.

Procedures

The first evaluation was carried out in September 2016. For the data collection, the two groups were evaluated in the morning between 8:00 and 10:00 a.m.. Age was recorded from the date of birth to the date of the evaluations. To verify functional capacity at the first (September 2017) and second moments (April 2018), the functional tests of the Fullerton Battery were used, proposed by Rikli and Jones (Rikli & Jones, 1997).

The Fullerton battery is composed of six functional tests:

1) Sit and Stand Test

The objective of the test is to evaluate the strength of the lower limbs. The test was performed with the participant sitting in a chair without a backrest, with the trunk in an upright position and the feet resting on the floor. The arms were crossed against the chest, with hands resting on the shoulders. At the "ready" signal, the elderly participant stood up completely and returned to the starting position. The evaluator motivated the elder before and during the test to complete the movement as many times as possible in 30 seconds. After the demonstration and practice of three repetitions, the test itself started.

2) Arm flexion

The objective of the test is to assess the strength of the upper limbs. The test was performed with the elder sitting in the chair with the trunk in an upright position and feet resting on the floor. The participant chose which limb to use to perform the test. At the "ready" signal, the elder performed elbow flexions without moving the elbow forward, executing as many repetitions as possible in 30 seconds.

3) Stationary Walk

The objective of the test is to assess cardiorespiratory fitness. The test was performed with the elder standing and required to raise the knee to the 90-degree point in relation to the trunk. The elderly were instructed to perform the greatest number of repetitions in 2 minutes. To score at the test, 1 point was awarded each time the right knee reached the maximum point.

4) Sit and Reach;

The objective of the test is to assess the flexibility of the trunk and lower limbs. The test was performed with the elderly sitting in a chair. The knee of one of their legs was flexed at approximately 90°, and the foot rested on the floor while the other leg was extended. With arms outstretched and middle fingers overlapping, the elder performed a hip flexion over the extended leg, reaching as far as possible and remaining in this position for two seconds while the evaluator measured the result. This measure was the distance between the middle fingers and the tip of the foot, the distance being considered negative when before the tip of the foot and positive when the fingers passed the tip of the foot, using the tip of the foot as the zero mark. All distances were measured in centimeters. The elderly chose the body's side to perform the test and was allowed two attempts, with the best result being recorded.

5) Reaching Behind Back;

The objective of the test is to assess the flexibility of the shoulder and upper limbs. The test was performed with the elderly standing and touching their backs with one hand over the shoulder and the palm facing the back, while the other hand was held under the shoulder and with the palm

facing outwards. The goal is to approximate the middle fingers, with the zero mark being the touching of the fingertips. A positive value was the distance that the elderly could pass the zero mark, and a negative distance the gap between the fingers. This distance was measured in centimeters.

The elderly chose the body's side to perform the test and was allowed two attempts, with the best result being recorded.

6) Timed Up and Go;

The goal of the test is to assess mobility, agility, and dynamic balance. The elderly began the test sitting in the middle of the chair in an upright position with the feet flat on the floor and hands on the thighs. At the "ready" signal, the elder got up from the chair and walked quickly (without running), turned at a cone within six feet of the chair, and returned to the starting position. On giving the start signal, the evaluator started the stopwatch and only stopped it when the participant sat back in the chair. After a demonstration and a practice attempt, the elderly´s were allowed two attempts to record the best result.

Statistics

The *Shapiro-Wilk* test was performed and verified that the data did not present normality, so nonparametric analysis was used. The quantitative variables are presented as mean, standard deviation, median, and interquartile range (25% - 75%). All variables were distributed and compared according to groups (institutionalized and water aerobics). For the intergroup analysis, the Mann-Whitney test for independent samples was used, and for the intra-group analysis, the Wilcoxon test for dependent samples. To identify the effect of changes in functional capacity after seven months of follow-up, the intra-group percentage delta (Δ%) was performed. For this analysis, the *SPSS* program (*SPSS inc. Chicago, IL*), version 22 was used, and a significance level of less than 5% was adopted.

RESULTS

The elderly who participated in this study presented a mean age of 74.06 years. Regarding the variables age and functional capacity, after seven months, the elderly presented a statistically significant difference in age, upper limb strength, mobility, and agility (Table 1).

The results of the variables age and functional capacity comparison between and within groups before and after seven months indicated the following: the Δ%, that is, the changes in the functional capacity of the GI were higher than the GH. After seven months, the institutionalized elderly presented a higher decrease in functional capacity, except for lower limbs flexibility, although both groups suffered functional capacity losses during this period. The intergroup evaluation demonstrated that only age and flexibility of the upper limbs at the post moment did not present statistically significant differences; however, in the other variables, the GH presented better functional capacity at the two analyzed moments.

The intra-group evaluation showed that the GI presented statistically significant decreases in functional capacity in the variables cardiorespiratory fitness and agility/mobility, whereas the GH presented decreases only in the flexibility of the lower limbs (Table 2).

Table 3 presents the effect of the pre and post-intervention moments (time) and group influences in the motor tests in the elderly.

Table 1. Description of the variables age and functional capacity of all participants before and after 7 months of follow-up.

Variables	Mean (SD)	Median	Interquartile Range 25% - 75%	P
LL Strength Pre	11.11 (6.02)	10.00	6.00 – 15.50	0.082
LL Strength Post	9.06 (5.16)	9.50	5.25 – 13.25	
UL Strength Pre	15.67 (7.27)	15.50	7.75 – 22.00	0.043
UL Strength Post	13.44 (7.11)	15.00	9.75 – 18.50	
APT. Cardiorespiratory Pre	50.28 (35.70)	34.00	17.50 – 94.00	0.085
APT. Cardiorespiratory Post	44.44 (37.59)	31.00	12.50 – 85.50	
LL Flexibility Pre	-8.00 (10.47)	-5.00	-15.50 – 01.00	0.243
LL Flexibility Post	-11.06(12.97)	-8.50	-19.25 – 00.00	
UL Flexibility Pre	-26.44(20.47)	-23.00	-41.00 – -10.25	0.363
UL Flexibility Post	-38.33(20.50)	-22.50	-38.75 – -13.50	
Mobility and Agility Pre	18.83 (13.83)	9.00	8.00 – 30.25	0.003
Mobility and Agility Post	38.39 (42.58)	12.00	9.00 – 70.00	

LL: lower limbs; UL: upper limbs; APT: Fitness; SD: Standard Deviation.

Table 2. Inter and intra-group comparison of the variables age and functional capacity for GI and GH before and after 7 months of follow-up.

Variables	Institutionalized (n=10)	Water aerobics (n=8)	p
	Mean (SD)		
LL Strength Pre	7.60 (2.72)	15.50 (6.23)	0.002
LL Strength Post	5.90 (4.43)	13.00 (2.72)	0.001
Δ%	-28.00%	-19.23%	
p	0.107	0.440	
UL Strength Pre	11.30 (5.70)	21.12 (5.03)	0.001
UL Strength Post	9.20 (6.43)	18.75 (3.41)	0.002
Δ%	-22.83%	-12.64%	
p	0.091	0.183	
APT. Cardiorespiratory Pre	21.40 (9.57)	86.37 (17.23)	0.001
APT. Cardiorespiratory Post	13.70 (12.13)	82.87 (14.30)	0.001
Δ%	-56.20%	-4.22%	
p	0.046	0.779	
Flexibility LL Pre	-14.00 (10.25)	-0.50 (3.89)	0.003
FlexibilityLL Post	-17.70 (13.65)	-2.75 (5.23)	0.010
Δ%	-26.43%	-450.00%	
p	0.592	0.018	
FlexibilityUL Pre	-36.00 (22.70)	-14.50 (7.87)	0.022
FlexibilityUL Post	-36.20 (24.48)	-18.50 (7.21)	0.067
Δ%	-0.56%	-27.59%	
p	0.833	0.225	
Mobility and Agility Pre	25.40 (14.14)	10.62 (8.30)	0.019
Mobility and Agility Post	59.80 (47.26)	11.62 (7.63)	0.012
Δ%	-135.43%	-9.42%	
p	0.008	0.340	

LL: lower limbs; UL: upper limbs; APT: Fitness; SD: Standard Deviation.

Table 3. Multivariate comparison of the effect of Time and Group on applied Functional Tests

Functional Tests	Value	f	p	power observed
Reaching Behind Back				
time	0.14	2,285[b]	0.15	0.29
time * group	0.04	0.618[b]	0.44	0.11
Sit and Stand Test				
time	0.19	1.894[b]	0.19	0.25
time * group	0.30	0.439[b]	0.51	0.09
Stationary March				
time	0.13	2.101[b]	0.16	0.27
time * group	0.01	0.245[b]	0.62	0.07
Sit and Reach				
time	0.02	0.387[b]	0.54	0.08
time * group	0.02	0.310[b]	0.58	0.08
Arm flexion				
time	0.01	0.273[b]	0.6	0.07
time * group	0.11	1.785[b]	0.2	0.23
Timed Up and Go				
time	0.32	6.809[b]	*0.021*	0.68
time * group	0.30	6.071[b]	*0.027*	0.63

p = 95% confidence interval, reflected in the value of (<0.05) in MANOVA using the Pillai Screening test. B. Accurate Statistics ç. Calculated using alpha = 0.05

For the Reaching Behind Back, Sit and Stand Test, Stationary March and Sit and Reach tests, the significant effect over time and the influence of the group ($p < 0.05$) were not verified. However, for the TUG test, the statistical effect was present for time (with lower time post vs. pre; $p = 0.021$) and a significant interaction for time*group ($p = 0.027$), respectively.

DISCUSSION

The objective of the present study was to observe the changes in functional capacity, for seven months, on active elderly water aerobics practitioners, and institutionalized elderly, with an average age pre of 74.06 years. Whether active or institutionalized, the elderly presented reduced functional capacity in all the tests observed, emphasizing upper limb strength, mobility, and agility.

However, as in our research, other studies have shown that institutionalized elderly individuals present unique functional and social conditions, marked by sedentarism and functional incapacity when compared with those living in the community (Conwell, 2009; Gawryszewski, 2010).

Although both groups demonstrated declining functional capacity, the active group achieved significantly better scores and lower reductions, which is in agreement with the literature since research indicates that participation in physical exercise programs represents an alternative for reducing or preventing several functional declines associated with aging. These results can be explained as, despite the unavoidable consequences of aging, the possibility of physiologically modifying this process through an appropriate exercise program as a preventive health strategy (Bezerra et al., 2018).

Regarding upper limb strength and mobility, the present study observed that older adults presented lower values of strength and mobility. These findings were expected since, with the aging process, there is a decrease in motor neuron connections with muscle fiber, especially those of fast contraction, which, consequently, increases the chance of sarcopenia, especially in the elderly of 80 years and over (Santos et al., 2017).

In a study with institutionalized elderly, Geraldes et al. (2018) demonstrated that the reduction in upper limb strength in fragile elderly is associated with loss of functionality, which, in turn, increases dependency levels. In our findings, the upper limb strength of the GH was higher pre and post when compared to the GI (Geraldes et al., 2008).

Macedo et al. (2014) analyzed arm strength and functional mobility in the elderly with different levels of physical activity. To this end, 44 elderly people aged 60 or older were divided into three groups: 18 elderly people practicing volleyball adapted for the elderly, 13 active elderly people practicing a physical activity not related to sports practice, and 13 sedentary elderly. The authors concluded that both arm strength and functional mobility were better in the volleyball group.

Regarding the variable flexibility, especially of the lower limbs, it can be observed that only the GH presented significant decreases. It is important to point out that the flexibility of the lower limbs is related to alterations in the gait pattern (ACMS, 2009), which influences the daily activities of the elderly. For Justine et al. (2012), as improvements in flexibility are not as visible as those related to muscle strength, they are not given adequate importance in the majority of studies.

Costa Moreira et al. (2017) analyzed 90 women aged 50 to 70 years for 12 weeks, divided into three groups, two groups of water aerobics and a control group. The results identified that the groups practicing water aerobics, regardless of the class objectives, obtained greater gains in flexibility. Studies indicate that physical exercise programs are of great importance for the maintenance and improvement of functional capacity, including flexibility (ACMS, 2009; Thaís et al., 2015)

The present study verified that the two groups observed (GI and GH) presented decreased flexibility of lower limbs, but for the GH, this loss was statistically significant.

Contrary to our findings, studies indicate that the practice of water aerobics can facilitate improvements in the flexibility of the lower limbs of the elderly (Thaís et al., 2015). Corroborating this statement, Colpo et al. (2013), in a study of 20 individuals aged 50 years and over, reported maintained flexibility after three months of water aerobics.

Due to the methodological differences in the articles regarding the intensity and volume of the water aerobics sessions, we cannot affirm the importance they present to maintain the flexibility of the elderly, especially in periods over three months. However, we understand that studies, which control variables such as intensity and volume, are necessary to infer the importance of these variables to improve this population's flexibility.

In the present study, at both evaluation moments, the institutionalized elderly individuals presented a statistically significant difference compared to the elderly who practiced water aerobics. In addition, after seven months of follow-up, only the GI presented significantly decreased agility/mobility; the same did not occur for the GH. Studies that observed mobility in institutionalized elderly verified that despite being institutionalized, if the elderly people practiced physical leisure activities, such as dance, they demonstrated improvement of up to 16% in agility and mobility (Marchon et al., 2010).

The progressive loss of functionality can be attributed to some morphophysiological modifications that occur in the

individual during the aging process. In the group of institutionalized elderly, these alterations lead to an even more pronounced reduction in functional capacity, especially in institutions that do not offer physical exercise programs (Freitas & Scheicher, 2010). Active elderly are less prone to problems with agility and dynamic balance since their functional mobility resembles young individuals (Alfieri et al., 2009).

This study presented some limitations: first, the reduced number of participants, which limited the power of extrapolation of the results; second, the lack of data on drug use, since polypharmacy (continuous use of 3 or more drugs) in institutionalized elderly reduces functional capacity and mobility, as it increases the risk of falls (Ferreira et al., 2016).

However, as this is a cohort study with seven months of follow-up, we understand that this limitation applies only to the inter-group comparison and not to the intra-group, since the elderly did not increase their number of medications in a little more than half a year.

This study also presents strengths: first, few studies analyzed functional capacity in institutionalized elderly in northeastern Brazil; second, this study presented questioning data on the performance of water aerobics for the deleterious effects of aging.

CONCLUSION

After seven months of follow-up, the elderly generally reduced functional capacity, especially upper limb strength, mobility and agility. However, this reduction was greater among the institutionalized elderly, with an average of 20%.

From this study, it is concluded that, to reduce the rate of decline in functional capacity and for healthy aging, it is necessary to disseminate public policy programs focused on the offer of physical activity for this population.

To advance, further research on the subject it is suggested, analyzing changes in the functional capacity of elderly residents in institutions that practice physical activity programs compared with sedentary and active elderly living in society, as well as other types of physical training involved.

ACKNOWLEDGMENTS

Nothing to declare.

REFERENCES

Alfieri, F. M., Werner, A., Roschel, A. B., Melo, F. C., & Santos, K. I. da S. (2009). Mobilidade Funcional De Idosos Ativos E Sedentários Versus Adultos Sedentários. *Brazilian Journal of Biomotricity*, *3*(1), 89–94.

American College of Sports Medicine, et. al. (2009). ACSM Position Stand: exercise and physical activity for older adults. *Medicine & Science in Sports & Exercise*, *41*(1),1510-1530.

Bezerra, E. S., Moro A. R. P., Orssatto L. B. D. R., da Silva M. E., Willardson J. M., & Simão R. (2018). Muscular Performance and Body Composition Changes Following Multi- versus Combined Multi- and Single-Joint Exercises in Aging Adults. *Applied Physiology, Nutrition, And Metabolism*, *43*(6),602-608.

Colpo, I. M. S., Daronco, L.S.E., & Balsan, L. A. G. (2013). Avaliação Postural, Dor E Aptidão Física De Praticantes De Hidroginástica. *Revista da Dor*, *14*(1),35-38.

Conwell, Y., & Li, L. W. (2009). Effects Of Changes In Depressive Symptoms And Cognitive Functioning On Physical Disability In Home Care Elders. *The Journal of Gerontology: Series A Biological Sciences And Sciences Medicine*, *64*(Supl. 2), 230-236.

Costa Moreira, O., Lopes, G. S., de Matos, D. G., Mazini-Filho, M. L., Aidar, F. J., Silva, S. F., & de Oliveira, C. E. (2019). Impact of two hydrogymnastics class methodologies on the functional capacity and flexibility of elderly women. *The Journal of Sports Medicine and Physical Fitness*, *59*(1), 126–131.

Ferreira, C. B., Teixeira, P. D. S., Alves Dos, S. G., Dantas, M. A. T., Americano do Brasil, P, & Souza, V. C., et al. (2018). Effects Of A 12-Week Exercise Training Program On Physical Function In Institutionalized Frail Elderly. *Journal Of Aging Reseach*, *11*, 7218102.

Ferreira, L. M. B. M., Jerez-Roig, J., Andrade, F. L. J. P., Oliveira, N. P. D., Araújo, J. R. T., & Lima, K. C. (2016). Prevalência De Quedas E Avaliação Da Mobilidade Em Idosos Institucionalizados. *Revista Brasileira De Geriatria E Gerontologia*, *19*(6), 995-1003.

Freitas, M. A. V., & Scheicher, M. E. (2010). Qualidade De Vida De Idosos Institucionalizados. *Revista Brasileira de Geriatria e Gerontologia, 13*(3), 395-401.

Fried, L. P., Ferrucci, L., J. D., Williamson, J. D., & Anderson, G. (2004). Untangling The Concepts Of Disability, Frailty, And Comorbidity: Implications For Improved Targeting And Care. *The Journal of Gerontology: Series A Biological Sciences And Sciences Medicine, 59*(3), 255-263

Gawryszewski, V. P. (2010). A Importância Das Quedas No Mesmo Nível Entre Idosos No Estado De São Paulo. *Revista da Associação Médica Brasileira, 56*(Supl. 2), 162-167.

Geraldes, A. A. R., Oliveira, A. R. M., Albuquerque. R. B., Carvalho, J. M., & Farinatti P. T. V. A. (2008). Força De Preensao Manual É Boa Preditora Do Desempenho Funcional De Idosos Frageis: Um Estudo Correlacional Múltiplo. *Revista Brasileira de Medicina do Esporte, 14*(1),12-16.

Gonçalves, L. H. T., Silva, A. H., Mazo, G. Z., Benedetti, T. R. B., Santos, S. M. A., & Marques, S, et al. (2010). O Idoso Institucionalizado: Avaliação Da Capacidade Funcional E Aptidão Física. *Caderno de Saúde Pública*, *26*(9), 1738-1746.

Hunter, S.K., Martin, W. T., & Rogers, D. A. (2001) Reaction Time, Strength, And Physical Activity In Women Aged 20-89 Years. *Journal Of Aging and Physical Activity, 9*(1), 32-42.

Justine, M., Hamid, T. A., Mohan, V., & Jagannathan, M. (2012). Effects Of Multicomponent Exercise Training On Physical Functioning Among Institutionalized Elderly. *International Scholarly Research Network Rehabilitation*, Article ID124916, 1-7.

Macedo, D. O., Freitas, L. M., & Scheicher, M. E. (2014). Preensão Palmar E Mobilidade Funcional Em Idosos Com Diferentes Níveis De Atividade Física. *Fisioterapia e Pesquisa, 21*(2), 151-155.

Marchon, R. M., Cordeiro, R. C., & Nakano, M. M. (2010). Capacidade Funcional: Estudo Prospectivo Em Idosos Residentes Em Uma Instituição De Longa Permanência. *Revista Brasileira de Geriatria e Gerontologia*, *13*(2), 203-214..

Murabito, J. M., Pencina, M. J., Zhu, L., Kelly-Hayes, M., Shrader, P., & D'agostino, R. B. (2008). Temporal Trends In Self-Reported Functional Limitations And Physical Disability Among The Community-Dwelling Elderly Population: The Framingham Heart Study. *The American Journal of Public Health*, *98*, 1256-62.

Rikli, R. E., & Jones, C. J. (1999). Development And Validation Of A Functional Fitness Test For Community-Residing Older Adults. *Journal of Aging and Physical Activity*, *7*(2), 129-61.

Rockwood, K. (2005). O Que Tornaria Uma Definição De Fragilidade Bem-Sucedida? *Idade e Envelhecimento, 34*(5), 432-434.

Sahin, U. K., Kirdi, N., Bozoglu, E., Meric, A., Buyukturan, G., Ozturk, A., & Doruk, H. (2018). Effect Of Low-Intensity Versus High-Intensity Resistance Training On The Functioning Of The Institutionalized Frail Elderly. *International Journal of Rehabilitation Research*, *41*(3), 211-217.

Santos, V. R., Christofaro, D. G. D., Gomes, I. C., Viezel, J, Freitas Júnior, I. F., & Gobbo, L. A. (2017). Analysis Of Relationship Of High Fat Mass And Low Muscle Mass With Lipid Profile In Brazilians Aged 80 Years Or Over. Diabetes & Metabolic Syndrome, *11*(Suppl 1), S115-S120.

Silva, T. A. A., Frisoli Junior, A, Pinheiro, M. M., & Szejnfeld, V. L. (2006). Sarcopenia Associada Ao Envelhecimento: Aspectos Etiológicos E Opções Terapêuticas. *Revista Brasileira de Reumatologia, 46*, 391-397.

Thaís, R., Prado, A., Kanitz, A., & Kruel, L. (2015). Efeitos Da Hidroginástica Sobre A Capacidade Funcional De Idosos: Metanálise De Estudos Randomizados. *Revista Brasileira de Atividade Física & Saúde*, *20*(5), 447, 2015.

ARTIGO ORIGINAL

https://doi.org/10.6063/motricidade.19770

Percepção de barreiras para participação de idosos em programas de atividades físicas

Barriers to participation in physical activity programs among older adults

Carla Elane Silva dos Santos[1]*, Eleonora d'Orsi[2], Cassiano Ricardo Rech[3]

RESUMO

Este estudo investigou a percepção de barreiras para participação de idosos em programas de atividades físicas. A amostra foi composta por idosos (≥60 anos) do Estudo EpiFloripa Idoso (n = 1140) entrevistados em 2013/2014. Os dados foram coletados por entrevista face-face no domicílio. O desfecho foi identificado pela pergunta: qual o principal motivo que levou ou levaria o(a) Sr.(a) a desistir de um programa de atividade física? As condições de saúde, os compromissos cotidianos, as atitudes perante a prática de atividades físicas e os aspectos ambientais foram às barreiras mais reportadas. Considerar a percepção dos idosos é essencial para planejar e desenvolver intervenções mais efetivas e duradouras.

PALAVRAS-CHAVE: idoso, atividade física, promoção da saúde

ABSTRACT

This study investigated the perception of barriers to the participation of older adults in physical activity programs. The sample consisted of older adults (≥60 years) from the EpiFloripa Ageing Study (n = 1140) interviewed in 2013/2014. Data were collected through face-to-face interviews at home. The outcome was identified by the question: what is the main reason that led or would lead you to give up a physical activity program? Health conditions, daily commitments, attitudes towards physical activity, and environmental aspects were the most reported barriers. Considering the perception of older adults is essential to plan and develop more effective and lasting interventions

KEYWORDS: older adults, physical activity, health promotion

INTRODUÇÃO

A prática regular de atividade física (AF) em idosos apresenta relação positiva com a saúde, sendo que a realização de ≥150 minutos/semana de atividade física de intensidade moderada à vigorosa (AFMV) proporciona melhorias fisiológicas (Figueiró et al, 2019), bem-estar e longevidade (Dunlop et al., 2015). Apesar dos reconhecidos benefícios à saúde, estima-se que pouco mais de 20% dos idosos em todo o mundo cumprem as recomendações de AF (Hallal et al., 2012), e redução dos níveis de AF que se acentuam com o avanço da idade (Santos et al., 2018), apresentam disparidade entre os sexos, faixa etária e nível de escolaridade (Santos et al., 2018).

Neste contexto desafiador, diferentes estratégias de incentivo a um estilo de vida ativo têm sido fomentadas, como o Plano de Ação Global para Prevenção e Controle de Doenças Crônicas não Transmissíveis 2013-2020 (World Health Organization [WHO], 2013), e o Plano de Ação Global para Atividade Física 2018-2030 (WHO,2018), que incluem dentre outras medidas, a disseminação de conhecimentos sobre AF, o fortalecimento de parcerias multisetoriais, e a criação de ambientes ativos com oferta de programas de AF, com vistas a alcançar pessoas de todas as idades e com diferentes capacidades.

Tornar a AF uma prática cotidiana e sustentável a longo prazo por meio de programas tem sido alvo de diferentes

[1]Universidade Federal de Santa Catarina, Centro de Desportos, Florianópolis, Brasil.
[2]Universidade Federal de Santa Catarina, Centro de Ciências da Saúde, Florianópolis, Brasil.
[3]Universidade Federal de Santa Catarina, Centro de Desportos, Florianópolis, Brasil.
*Autor correspondente: Campus Universitário Reitor João David Ferreira Lima - Prédio administrativo - Centro de Desportos, sala 200 – 2° andar, Trindade - Florianópolis - Santa Catarina, Brasil. CEP: 88040-900; E-mail: carlaef_uesb@hotmail.com

Conflito de interesses: nada a declarar. Fonte de financiamento: Conselho Nacional de Desenvolvimento Científico e Tecnológico
Artigo recebido a 03 27, 2020; Aceite a 09 29, 2020.

políticas públicas de saúde (Valdés-Badilla et al., 2019), haja vista os efeitos positivos produzidos pelas intervenções nos níveis de AF, e nas diferentes capacidades físicas (Valdés-Badilla et al., 2019). No Brasil, a promoção da AF por meio da Política Nacional de Promoção da Saúde, tem possibilitado dentre outras ações, financiar projetos inseridos no Sistema Único de Saúde, integrando um conjunto de iniciativas da Atenção Primária em Saúde (Malta et al., 2016).

Embora as intervenções coletivas como a caminhada, danças, alongamento/relaxamento e ginástica realizadas nas Unidades Básicas de Saúde/território (Amorim et al., 2013), e mais recentemente os grupos de corrida, ginástica (aeróbia, localizada, funcional, etc), jogos e brincadeiras, atividades esportivas e artes marciais implementadas pelo Programa Academia da Saúde (Brasil, 2017) alcançarem principalmente os idosos (Amorim et al., 2013; Brasil, 2017) nota-se nesta população prevalência de 23,3% no cumprimento de AFMV (Brasil, 2018).

Estudos demonstram relações inversas entre a percepção de barreiras (obstáculos que impedem/dificultam a adoção de um comportamento relacionado à saúde) (Champion & Skinner, 2008), e a participação de idosos em programas de AF. Fatores intrapessoais, como a limitações físicas e medo de cair; fatores interpessoais que incluem a desinformação sobre opções de programas de AF, falta de orientação profissional, profissionais desmotivados, falta de companhia para a prática de AF (Bethancourt et al., 2014), e fatores ambientais percebidos pela ausência de local apropriado (Gomes et al., 2019) e programas pouco envolventes ou muito desafiadores (Bethancourt et al., 2014), inibem a participação de idosos em programas de AF.

Compreender as barreiras para a participação em programas de AF, a partir da percepção dos idosos, é essencial para planejar e desenvolver intervenções mais efetivas e duradouras (Bauman et al., 2012). No entanto, no Brasil esta temática é pouco explorada, uma vez que os estudos sobre barreiras estão relacionados em sua maioria à prática de AF (Eiras et al., 2010; Krug et al., 2015), e quando envolvem a percepção dos idosos sobre a participação em programas de AF são fornecidas informações de populações mistas (adultos e idosos) (Ferreira et al., 2019), não sendo possível identificar claramente as barreiras referidas apenas pelos idosos.

Assim, diante desta lacuna, o presente estudo tem como objetivo analisar a percepção de barreiras para participação de idosos em programas de atividades físicas em uma amostra de idosos de uma cidade do Sul do Brasil.

MÉTODO

Trata-se de um estudo transversal, descritivo, domiciliar, de base populacional, realizado com dados da segunda onda do estudo de coorte intitulado "Condições de saúde de idosos do município de Florianópolis, SC: estudo de base populacional EpiFloripa idoso", realizado na área urbana de Florianópolis, Santa Catarina. (https://epifloripa.paginas.ufsc.br/).

O estudo EpiFloripa Idoso foi aprovado pelo Comitê de Ética em Pesquisa da Universidade Federal de Santa Catarina (CAAE 16731313.0.0000.0121). Todos os entrevistados assinaram o termo de consentimento livre e esclarecido.

Delineamento e população do estudo

A amostra do presente estudo foi composta por idosos não institucionalizados, de ambos os sexos (≥ 60 anos). Os métodos para o planejamento amostral da linha de base (2009/2010) e seguimento (2013/2014) foram publicados previamente (Schneider et al., 2017). Resumidamente, a amostra da linha de base foi composta por 1.702 idosos. Para realização do seguimento, foram identificados 217 óbitos, 159 perdas (idosos que não puderam ser entrevistados, incluindo 111 por não localização), e 129 recusas (idosos que se negaram a ser entrevistados mesmo após receber a visita no domicílio), totalizando 1.197 entrevistas (taxa de resposta de 70,3%).

Instrumentos e procedimentos

Barreiras para participação em programas de atividades físicas

O desfecho investigado no presente estudo foi a percepção de barreiras para participação em programas de AF, identificada pela pergunta: qual o principal motivo que levou ou levaria o(a) Sr.(a) a desistir de um programa de atividade física? As opções de resposta eram: aulas não adequadas (desmotivante, muito intensa, exercícios inadequados); influência negativa do ambiente (local inadequado, sem segurança); compromisso com afazeres domésticos; cuidados familiares (cuidar do (a) esposo (a), filhos ou netos); limitação por doença (já instalada e/ou aparecimento de doença que compromete a prática de atividade física); cansaço; falta de disposição; problemas pessoais com o professor ou colegas de grupo; sentir dor quando realizava os exercícios físicos; e o medo de cair ao realizar os exercícios. Além dos itens supracitados, foi possibilitado ao participante mencionar outro motivo (resposta aberta), caso nenhuma das opções disponíveis representasse o principal motivo de desistência.

Níveis determinantes para participação em programas de atividade física

As respostas individuais sobre a percepção de barreiras fornecidas pelos participantes foram agrupadas de acordo com o modelo socioecológico (Sallis et al., 2006) que refere as

interações das pessoas com o ambiente sociocultural e físico. Os níveis de influência do modelo incluíram-se: intrapessoais (variáveis biológicas e psicológicas), interpessoais (variáveis culturais/organizacionais), e ambientais (construído/natural).

Outras variáveis

Foram incluídas no estudo as seguintes variáveis sociodemográficas: sexo (feminino e masculino), idade (anos completos), escolaridade (anos completos), estado civil (solteiro, casado, divorciado/separado, viúvo). Em relação às variáveis de saúde incluíram-se: percepção de saúde (muito boa, boa, regular, ruim, muito ruim), rastreamento para declínio cognitivo (sim/não), identificada pelo Mini Exame do Estado Mental, a partir do ponto de corte de Almeida (1998): provável declínio cognitivo (<19 pontos para os analfabetos e <24 pontos para aqueles com algum nível de escolaridade); presença de quedas no último ano (sim/não), número de morbidade (0-1, ≥ 2), com opções de resposta: doença espinhal ou dorsal, artrite ou reumatismo, bronquite ou asma, tuberculose, cirrose, osteoporose, doença renal crônica, insuficiência cardíaca, diabetes, hipertensão, doenças cardíacas ou cardiovasculares e acidente vascular cerebral (sim/não); Índice de massa corporal (kg/m2), classificado posteriormente em normal/baixo peso e excesso de peso (Brasil,2011), e nível de atividade física de lazer (Benedetti et al., 2004), considerado insuficientemente ativos os idosos que relataram 10 a 149 min/semana de AFMV e ativos ≥150 minutos/semana (Nelson et al., 2007).

Análise estatística

Para análise dos dados foi utilizado o software Stata 13.0® (Stata Corporation, College Station, EUA), considerando os pesos amostrais. Estatística descritiva (média, desvio padrão para variáveis contínuas, e proporção para as do tipo categórica). A percepção de barreiras para a participação em programas de AF foi expressa em frequência relativa e absoluta, e em seguida agrupadas de acordo com o nível de determinantes do modelo socioecológico (intrapessoais, interpessoais e ambientais (Sallis et al., 2006). O teste Qui-quadrado de Pearson foi utilizado para verificar existência de diferenças entre as barreiras (intrapessoais, interpessoais e ambientais) e o sexo, faixa etária, nível de atividade física e escolaridade dos participantes. O nível de significância adotado foi de $p < 0,05$.

RESULTADOS

A amostra analisada incluiu apenas as entrevistas respondidas pelos idosos (n= 1.140), devido o desfecho (barreiras para participação em programa de AF ser obtido a partir da autopercepção). No entanto, somente 1.002 entrevistas (87,9%) continham informações a cerca das barreiras para análise. Na tabela 1, a média de idade dos

Tabela 1. Características dos participantes do Estudo EpiFloripa Idoso. Florianópolis, Brasil, 2013-2014 (n = 1.140).

Variáveis	n	%
Gênero		
Masculino	403	35,4
Feminino	737	64,6
Faixa etária		
60-69	405	35,5
70-79	499	43,8
≥ 80	236	20,7
Escolaridade (anos)		
0-4	488	42,9
5-11	368	32,3
≥ 12	283	24,8
Estado Civil		
Casado	637	55,9
Solteiro	69	6,1
Divorciado/Separado	85	7,4
Viúvo	349	30,6
Percepção de Saúde		
Muito boa/boa	643	56,4
Regular	417	36,6
Muito ruim/ruim	80	7,0
Déficit Cognitivo[a]		
Não	872	77,1
Sim	260	22,9
Presença de quedas no último ano		
Não	793	69,6
Sim	347	30,5
Número de morbidades		
0-1	269	23,6
≥ 2	871	76,4
IMC[b]		
Baixo/adequado	510	45,4
Sobrepeso	614	54,6
Atividade Física no lazer[c]		
Insuficientemente ativo	826	72,7
Suficientemente ativoe	310	27,3

[a] Déficit cognitivo examinado pelo Mini Exame do Estado Mental; [b] Índice de massa corporal: baixo/peso adequado: <27 kg / m^2 e sobrepeso:> 27 kg / m^2 ;[c] realizada durante uma semana habitual;[d] cumprir ≥150 min/semana de atividade física moderada-a-vigorosa.

participantes foi de 73,4 anos (desvio padrão de 6,7 anos), com maior proporção de mulheres (64,6%). A maioria dos participantes tinha baixa escolaridade (42,9%), eram casados (55,9%), percebiam a saúde como muito boa/boa (56,4%), não apresentavam provável déficit cognitivo (77,1%) e nem sofreram quedas no último ano (69,6%), reportaram duas ou mais morbidades (76,4%), foram classificados com sobrepeso (54,6%), e eram insuficientemente ativos no lazer (72,7%).

Entre as nove barreiras investigadas que levou ou levaria os idosos a desistirem de um programa de AF, a limitação física (70,6%) e o cansaço e falta de vontade (17,1%) foram as mais frequentes (Figura 1). No entanto quando observado a resposta aberta, 19,8% dos entrevistados reportaram ainda que as condições físicas, seguido da falta de tempo (12,5%), o fato de não gostar de AF (12,5%), a falta de vontade/prazer pela AF (9,9%), a preguiça (9,9%) e o clima (6,3%) como as barreiras mais prevalentes (Tabela 2).

A Figura 2, mostra as barreiras para participação em programa de AF de acordo com os níveis de influência do modelo socioecológico. Em geral, observa-se que as barreiras mais reportadas foram as do tipo intrapessoal para o sexo, faixa etária, nível de AF e escolaridade. Embora não tenham sido encontradas diferenças estatísticas, observa-se proporcionalmente que os homens, os idosos mais jovens, os participantes insuficientemente ativos, e aqueles com maior escolaridade percebem mais as barreiras intrapessoais. Além disso, mesmo em menor proporção, observou-se que as barreiras interpessoais e ambientais também são consideradas pelos idosos para não participar de programas de AF.

Tabela 2. Percepção de outras barreiras à participação de idosos em programas de atividades físicas. Florianópolis, Brasil, 2013-2014 (n=192)*.

Barreiras	n	%
Limitação Física	38	19,8
Falta de tempo	24	12,5
Não gosta de atividade física	24	12,5
Falta de vontade/prazer pela atividade física	19	9,9
Preguiça	19	9,9
Clima	12	6,3
Custo com o programa	6	3,0
Orientação médica	6	3,0
Distância	5	2,6
Falta de companhia para conduzir os idosos ao programa	5	2,6
Tipo de atividade física ofertada pelo programa	5	2,6
Ausência de local	4	2,1
Comodismo	4	2,1
Ineficiência do programa	4	2,1
Não gosta de sair de casa	4	2,1
Idade	3	1,6
Responsabilidade quanto à participação nos programas	3	1,6
Horário do programa	2	1,1
Local inapropriado	2	1,1
Falta de equipamento	1	0,5
Problemas familiares	1	0,5
Viagens pessoais	1	0,5

*Das 216 respostas abertas, 24 foram desconsideradas devido à falta de clareza, totalizando 192 respostas.

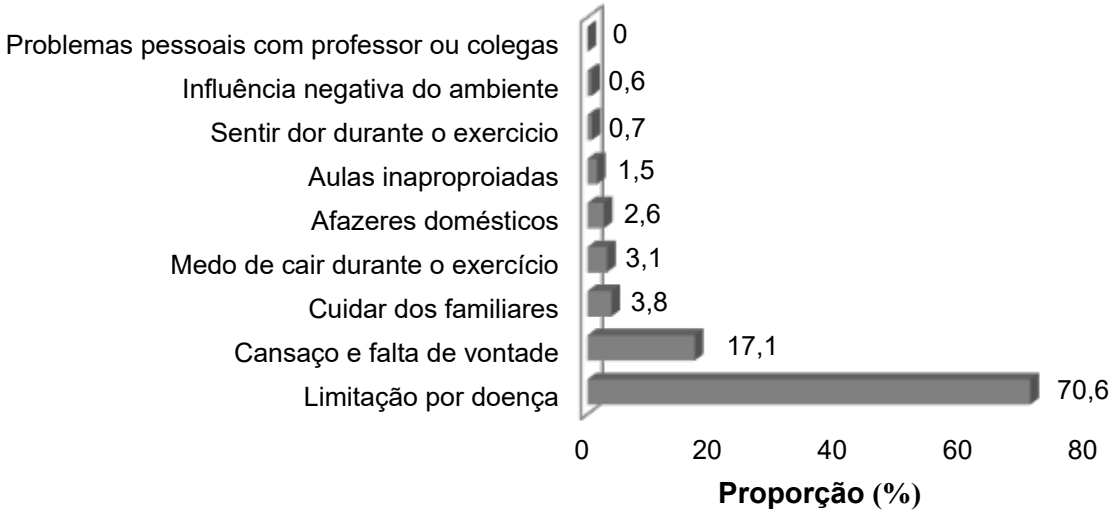

Figura 1. Barreiras à participação de idosos em programas de atividades físicas. Florianópolis, Brasil, 2013-2014 (n = 810).

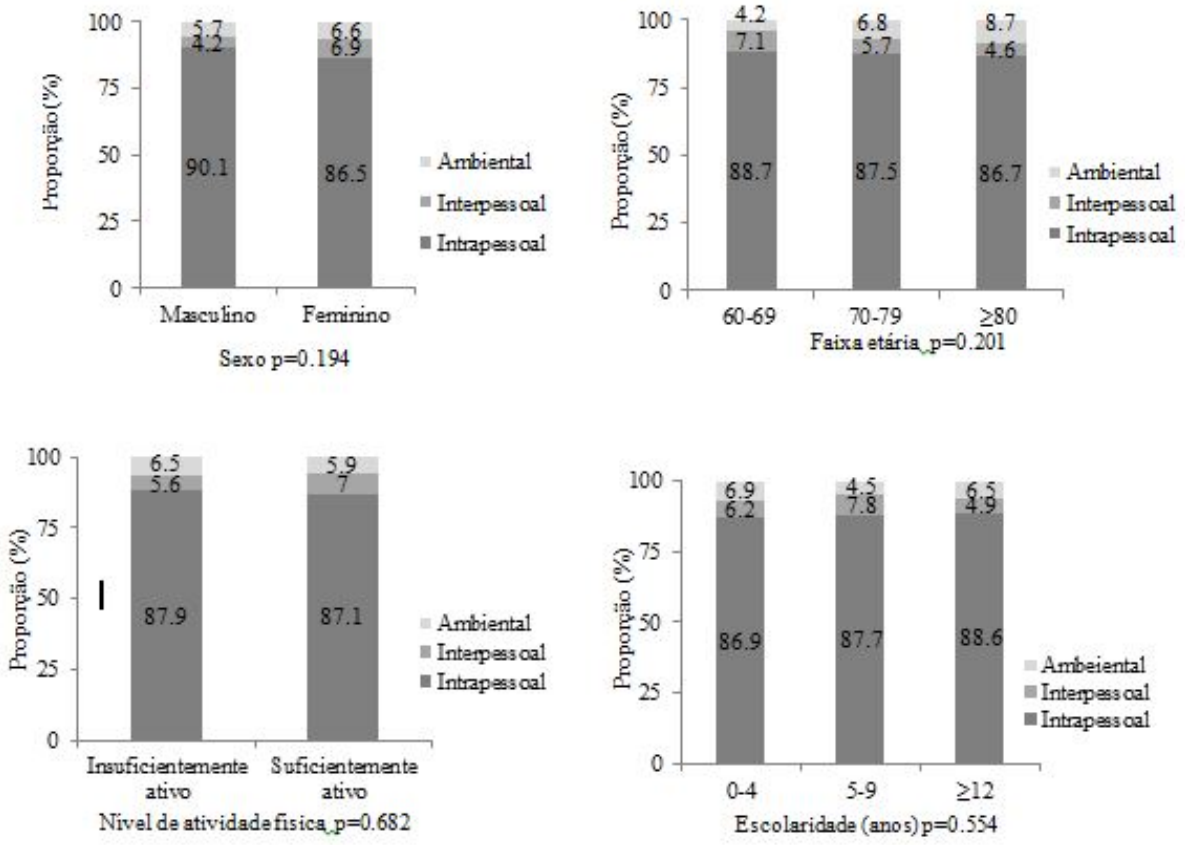

Figura 2. Barreiras percebidas para participação em programas de atividade física, em cada nível do modelo socioecológico, de acordo com o gênero, faixa etária, escolaridade e nível de atividade física. Florianópolis, Brasil, 2013-2014. P=p-valor.

DISCUSSÃO

Os principais resultados deste estudo apontam que as barreiras intrapessoais interpessoais, e ambientais podem influenciar os idosos a desistirem de participar de programas de AF. Dentre os motivos mais prevalentes encontram-se às condições de saúde, os compromissos cotidianos, as atitudes perante a prática de AF e os aspectos ambientais. Encontramos na literatura barreiras semelhantes entre os idosos (Bethancourt et al., 2014), e reforçam que os fatores desencorajadores à participação em programas de AF não se restringem apenas as escolhas individuais, mas são determinados também por fatores externos que interagem entre si.

No presente estudo em relação às barreiras intrapessoais, observou-se que a presença de limitação física (barreira mais prevalente) dificulta ou impede os idosos de se engajarem em programas de AF. Resultado semelhante é reportado em estudo anterior (Gomes et al., 2019) e indica que as condições de saúde é um importante preditor para realização de AF. Fatores como a baixa autoeficácia (Nascimento et al., 2010), a incerteza sobre quais atividades físicas são seguras, e esforço excessivo durante a prática de AF (Bethancourt et al., 2014) podem contribuir para acentuar a percepção de barreira da limitação física.

Ainda neste contexto, observou-se também que o cansaço e a falta de vontade/prazer pela AF; não gostar de AF, preguiça, não gostar de sair de casa, o comodismo, a idade, a responsabilidade quanto à participação nos programas de AF, e viagens pessoais foram relatados como barreiras. Alguns autores defendem que as experiências vividas ao longo da vida, marcado muitas vezes pela ausência ou pela pouca informação sobre a relação entre a prática de AF e saúde, interferem na adoção de comportamento ativo pelo indivíduo quando idoso (Lopes et al., 2016). Além disso, as expectativas negativas como a dor, o medo de lesão ou quedas (Gomes et al., 2019), e a percepção de fragilidade (Franco et al., 2015) podem explicar em parte o fato dos idosos evitarem aumentar os níveis de AF quando a saúde já está comprometida. No entanto em razão dos benefícios da AF na saúde dos idosos, programas bem planejados podem auxiliar no gerenciamento de diversas condições clínicas, superando crenças limitantes sobre a prática de AF no processo de envelhecimento (Franco et al., 2015).

A falta de tempo, barreira observada também na literatura (Gomes et al., 2019) foi considerada pelos participantes do presente estudo. No entanto, observou-se que apenas 12,5% perceberam-na como fator desencorajador para participação em programas de AF. A baixa prevalência de falta de tempo embora esperada, em razão da interrupção dos compromissos relacionados ao trabalho com chegada da aposentadoria (Justine et al., 2013), se mostra inversamente associada com a prática de AF (Gobbi et al., 2012), e sugere que mais do que o envolvimento em novos compromissos, a falta de tempo pode esta relacionada também ao desinteresse pela AF (Justine et al.,2013). Lidar com esse desafio requer cautela por parte dos programas de AF, haja vista que os diferentes contextos da população-alvo, devem ser considerados para melhor estruturação das intervenções com práticas corporais. Para além das práticas corporais comumente ofertadas (Amorim et al., 2013), a utilização de atividades cognitivas e multissensoriais no contexto da AF na Atenção Básica merecem ser consideradas, tendo em vista as repercussões positivas na saúde dos idosos (Dias & Lima, 2012), e a possibilidade de maior interesse por parte deste grupo.

Em relação às barreiras interpessoais, cuidar dos familiares e dos afazeres domésticos foram considerados motivos relevantes pelos idosos para desistirem de participar de um programa de AF. De acordo com estudo anterior (Krug et al., 2015), devido ao fato da maioria dos idosos não trabalharem fora de casa, às dinâmicas familiares por vezes colocam-nos numa posição de cuidador, sejam de seus cônjuges ou dos netos (Krug et al., 2015), levando-os a priorizar cada vez menos a prática de AF. Esse contexto ilustra a necessidade de maior acompanhamento dos idosos pelos profissionais de saúde da Atenção Básica, que por meio de estratégias como, por exemplo, o aconselhamento multiprofissional (Moraes et al., 2019), poderá auxiliar na mudança de comportamento para AF.

Outro fator relatado pelos idosos é a falta de companhia para realização da AF nos programas de AF. Esse motivo é frequentemente relatado em outros estudos (Gomes et al., 2019, 2019; Justine et al., 2013; Lopes et al., 2016), mesmo observando o caráter coletivo dos programas oferecidos (Amorim et al., 2013). Uma hipótese é que maior encorajamento para realização de AF é percebido quando os idosos estão juntos a pessoas próximas como os cônjuges e familiares (Sousa et al., 2019). Considerar a participação da família nos programas de AF pode favorecer melhor adesão por parte dos idosos.

A orientação médica também foi considerada como barreira pelos idosos, no entanto é sabido que a AF é considerada parte do tratamento para diversas condições crônicas. Estudos mostram que embora os profissionais médicos considerem essa premissa, muitos não estão familiarizados com as recomendações atuais de AF (Florindo et al., 2013). Portanto, além de capacitar os profissionais para aconselhar a AF, é importante que os centros de saúde disponham de programas de AF, tendo em vista que a orientação médica sobre AF é facilitada quando se percebe a existência de um fluxo de acompanhamento dos usuários neste contexto (Florindo et al., 2013).

Sobre as barreiras ambientais, observamos um conjunto de motivos, tais como o clima, o horário, à distância, local/ausência de local de funcionamento, a falta de equipamentos, o custo, e os tipos de AF ofertadas pelos programas foram relatados como barreiras. A barreira relacionada ao clima é reportada na literatura (Gomes et al., 2019), e também considerada pelos gestores dos Programas Academia da Saúde de Santa Catarina (Paiva Neto et al., 2019). Uma hipótese levantada pelos autores (Paiva Neto et al., 2019) refere-se às diferentes condições climáticas do estado marcadas pelo calor excessivo no verão e frio no inverno, impactando na adesão dos participantes aos programas. Devido também a esta questão, os horários de funcionamento dos programas devem levar em consideração o público que se deseja alcançar.

A distância reportada pelos idosos do presente estudo, e em estudo anterior (Gomes et al., 2019) pode estar sujeita a outros fatores como a insegurança do bairro, ausência/falta de manutenção das calçadas, tráfegos intensos, ou mesmo em razão da dificuldade de se locomover via transporte público (Macera et al., 2016). Essa barreira pode ser acentuada pelo local onde os programas são oferecidos, como a utilização de locais improvisados, por exemplo, em centros comunitários, salões paroquiais (Gomes et al., 2019), bem como as praças e parques, quadras esportivas, Unidades Básicas de Saúde com estruturas inadequadas, comumente utilizadas pelos programas de AF (Amorim et al., 2013).

A falta de equipamentos percebida pelos idosos como barreira se constitui um desafio principalmente para os programas públicos de saúde. A ausência de aparelhos de exercícios exige adaptação a partir de materiais alternativos como as faixas elásticas, caneleiras, steps (Salvador et al., 2015), "halter" de garrafa pet abastecido com areia/pedra e cabos de vassoura. Essa condição, porém não diminui a qualidade da intervenção com os idosos, no entanto, é preciso que o setor público de saúde disponha destes e de outros materiais para melhor planejamento das intervenções.

A barreira custo foi referida por alguns participantes, e embora não tenha sido investigado neste estudo, apresentar baixo nível socioeconômico contribui para percepção desta barreira (Cassou et al., 2008). Cassou et al. (2008) afirmaram que mesmo que o dinheiro não seja considerado uma variável ambiental, se configura como fator potencializador do acesso a

programas de AF privados. No entanto em relação aos programas públicos de AF, embora as pessoas de maior renda tenha mais conhecimento sobre a existência dos programas, em razão dos hábitos e clareza na interpretação das informações, são os usuários de menor renda quem mais participa (Ferreira et al., 2019). Expandir os canais de informações sobre dos programas de AF, poderá resultar em maior conhecimento pela população em geral, reduzindo a percepção da barreira do custo e garantindo benefícios a saúde pela prática de AF.

As intervenções realizadas pelos programas foram consideradas ainda que por uma pequena parcela dos participantes como motivo para não participar. Estudos mostram que de forma geral, a aulas de ginástica e a caminhada orientada são as mais frequentes (Bonfim et al., 2013), no entanto, a utilização das Práticas Integrativas e Complementares (PICs) como o Tai Chi, yoga, dança, e Qi Gong também tem se mostrado promissora, em razão dos benefícios alcançados pelos usuários, como a melhora da dor, redução dos sintomas depressivos e ansiedade (Galvanese et al., 2017). Em Florianópolis, as PICs têm sido utilizadas pelos profissionais da Atenção Básica, e tem impactado positivamente na saúde dos idosos (Silva, 2017).

De forma geral ao considerar o conjunto de motivos para a não participação dos idosos em programas de AF, notou-se que as barreiras intrapessoais, seguida das interpessoais e ambientais foram as mais prevalentes. A participação dos idosos em programas de AF é sustentada por uma série de influências determinadas socialmente, no entanto as crenças que os idosos têm a cerca de si mesmos parecem produzir um impacto maior na desistência dos programas de AF. Os problemas relacionados à saúde vistos também em outros estudos são os que mais contribuem com essa dimensão (Gomes et al., 2019; Lopes et al., 2016), e por isso sugere-se a realização de avaliação da autoeficácia em idosos iniciantes num programa de AF, a fim de planejar e sistematizar as intervenções com vistas na permanência dos idosos e a efetividade das intervenções.

Uma possível limitação pode ter influenciado a interpretação dos resultados e precisa ser considerada. As informações do estudo foram obtidas por meio de questionário, o qual pode apresentar viés de resposta mesmo considerando somente respostas fornecidas pelos idosos. Por outro lado, os resultados encontrados permitiu identificar as principais barreiras para participação de idosos em programas de AF, considerada fator importante para o planejamento e desenvolvimento de intervenções mais efetivas e duradouras (Bauman et al., 2012). Além disso, em razão da amostra ser representativa do município, permite extrapolar os resultados para a população em geral.

CONCLUSÕES

As barreiras percebidas pelos idosos para participar de programas de AF incluíram as condições de saúde, os compromissos cotidianos, as atitudes perante a prática de AF e os aspectos ambientais. Porém, ainda se observa que a maior parte das barreiras percebidas são da ordem intrapessoal. Considerar os idosos como protagonistas do cuidado, a partir de suas crenças, motivações e fatores externos, é indispensável para o fortalecimento de sua autonomia. Além disso, colabora para a melhor formulação das políticas e implementação das intervenções nos programas de AF pelos profissionais do serviço.

AGRADECIMENTOS

Gostaríamos de agradecer a Universidade Federal de Santa Catarina pelo suporte, e o apoio financeiro do Conselho Nacional de Desenvolvimento Científico e Tecnológico.

REFERÊNCIAS

Amorim, T. C., Knuth, A., Cruz, D., Malta, D., Reis. R., & Hallal, P. (2013). Descrição dos programas municipais de promoção da atividade física financiados pelo Ministério da Saúde. *Revista Brasileira de Atividade Física & Saúde, 18*(1), 63-74.

Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J. F, & Martin, B. W. (2012). Correlates of physical activity: why are some people physically active and others not? *The Lancet, 21*(9838), 258-271.

Benedetti, T. B., Mazo, G. Z., & Barros, M. V. G. (2004). Aplicação do Questionário Internacional de Atividades Físicas para avaliação do nível de atividades físicas de mulheres idosas: validade concorrente e reprodutibilidade teste-reteste. *Revista Brasileira de Ciência e Movimento,12*(1), 25-34.

Bethancourt, H. J., Rosenberg, D. E., Beatty, T., & Arterburn D. E. (2014). Barriers to and Facilitators of Physical Activity Program Use Among Older Adults. *Clinical Medicine* & Research, *12*(1-2), 10-20.

Bonfim, M. R., Costa, J. L. R., & Monteiro, H. L. (2013). Ações de educação física na saúde coletiva brasileira: expectativas versus evidências. *Revista Brasileira de Atividade Física & Saúde, 17*, 167-173.

Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde (2011). *Orientações para a coleta e análise de dados antropométricos em serviços de saúde: norma técnica do Sistema de Vigilância Alimentar e Nutricional - SISVAN*. Brasilia.

Brasil. Ministério da Saúde. Secretária de Vigilância em Saúde (2017). *Panorama nacional de implementação do Programa Academia da Saúde : monitoramento nacional da gestão do Programa Academia da Saúde: ciclo 2016*. Brasília.

Brasil. Ministério da Saúde. Secretária de Vigilância em Saúde (2018). *Vigitel Brasil 2018: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico : estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2018*. Brasilia.

Cassou, A. C. N., Fermino, R. C., Santos, M. S., Rodriguez-Añez, C. R., & Reis, R. S. (2008). Barreiras para a atividade física em idosos:uma análise por grupos focais. *Revista da Educação Física/UEM, 19*(3), 353-360.

Champion, V. L., & Skinner, C. S. (2008). The health belief model. Em K. Glanz, K. B. Rime, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (4th Ed., pp. 45–66). Jossey-Bass.

Dias, M. S., & Lima. R. M. (2012). Estimulação cognitiva por meio de atividades físicas em idosas: examinando uma proposta de intervenção. *Revista Brasileira de Geriatria e Gerontologia, 15*(2), 325-334.

Dunlop, D. D., Song, J., Arnston, E. K, Semanik, P. A., Lee, J., Chang R. W., &Hootman, J. M. (2015). Sedentary time in US older adults associated with disability in activities of daily living independent of physical activity. *Journal of physical activity & health, 12*(1), 93-101.

Eiras, S. B., Silva. W. H. A., Souza, D. L., & Vendruscolo, R. (2010). Fatores de adesão e manutenção da prática de atividade física por parte de idosos. *Revista Brasileira de Ciências do Esporte, 31*(2), 75-89.

Ferreira, R. W., Caputo, E. L., Hafele, C. A., Jeronimo, J. S., Florindo, A. A., Knut, A. G., & Silva, M. C. (2019). Acesso aos programas públicos de atividade física no Brasil: Pesquisa Nacional de Saúde, 2013. *Cadernos de Saúde Pública, 35*(2), e00008618.

Figueiro, T. H., Arins, G. C. B., Santos, C. E. S., Cembranel, F., Medeiros, P. A., d'Orsi, E., & Rech, C. R. (2019). Association of objectively measured sedentary behavior and physical activity with cardiometabolic risk markers in older adults. *PLoS One., 14*(1), e0210861.

Florindo, A. A., Mielke, G. I., Gomes, G. A., Ramos, L. R., Bracco, M. M., Parra, D. C., Simoes, E. J.,...& Hallal, P. C. (2013). Physical activity counseling in primary health care in Brazil: a national study on prevalence and associated factors. *BMC Public Health, 13*(31), 794.

Franco, M. R., Tong, A., Howard, K., Sherrington, C., Ferreira, P. H., Pinto, R. Z., & Ferreira, M. L. (2015). Older people's perspectives on participation in physical activity: a systematic review and thematic synthesis of qualitative literature. *The British Journal of Sports Medicine, 49*, 1268–1276.

Galvanese, A. T. C., Barros, N. F., & D'oliveira, A. F. P. L. (2017). Contribuições e desafios das práticas corporais e meditativas à promoção da saúde na rede pública de atenção primária do Município de São Paulo, Brasil. *Cadernos de Saúde Pública, 33*(12), e00122016.

Gobbi, S., Sebastião, E., Papini, C. B., Nakamura, P. M., Valdanha Netto, A., Gobbi, L. T. B., & Kokubun, E. (2012). Physical Inactivity and Related Barriers: A Study in a Community Dwelling of Older Brazilians. *Journal of Aging Research*, *2012*(Article ID 685190), e685190. https://doi.org/10.1155/2012/685190

Gomes, G. A. O., Papini, C. B., Nakamura, P. M., Teixeira, I. P., & Kokubun, E. (2019). Barreiras para prática de atividade física entre mulheres atendidas na Atenc¸ão Básica de Saúde. *Revista Brasileira de Ciências do Esporte, 41*(3), 263-270.

Hallal, P. C., Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., Ekelund, U., & Lancet Physical Activity Series Working Group (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet, 380*(9838), 247-257.

Justine, M., Azizan, A., Hassan, V., Salleh, Z, & Manaf, H. (2013). Barriers to participation in physical activity andexercise among middle-aged and elderly individuals. *Singapore medical journal, 54*(10), 581-586.

Krug, R. R., Lopes, M. A., & Mazo, G. Z. (2015). Barreiras e facilitadores para a prática da atividade física de longevas inativas fisicamente. *Revista Brasileira de Medicina do Esporte, 21*(1): 57-64.

Lopes, M. A., Krug, R. R., Bonetti, A., & Mazo, G. Z. (2016). Barreiras que influenciaram a não adocão deatividade física por longevas. *Revista Brasileira Ciências do Esporte, 38*(1):76-83.

Macera, C. A., Cavanaugh, A., & Bellettiere, J. (2016). State of the Art Review: Physical Activity and Older Adults. *American Journal of Lifestyle Medicine, 11*(1), 42–57.

Malta, D. C., Moraes Neto, O. L., Silva, M. M. A., Rocha, D., Castro, A. M., Reis, A. A. C., & Akerman, M. (2016). Política Nacional de Promoção da Saúde (PNPS): capítulos de uma caminhada ainda em construção. *Ciência & Saúde Coletiva, 21*(6), 1683-1694.

Moraes, S. Q., Souza, J. H., Araújo, P. A. B, & Rech, C. R. (2019). Prevalência de aconselhamento para atividade física na Atenção Básica à Saúde: uma revisão sistemática. *Revista Brasileira de Atividade Física & Saúde, 24*(e0073).

Nascimento, M. C., Silva, O. M. P., Saggioratto, C. M. L., Vargas, K. C. B., Schopf, K., & Klunk, J. (2010). O desafio da adesão aos exercícios físicos em grupos de idosos em Palmitos/sc: Motivos para a prática e para a desistência. *Revista Brasileira de Atividade Física & Saúde, 15*(3).

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judg, J. O., King, A. C.,...& Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Medicine & Science in Sports & Exercise, 39*(8), 1435-1445.

Almeida, O. P. (1998). Mini exame do estado mental e o diagnóstico de demência no Brasil. *Arquivos de Neuro-Psiquiatria, 56*, 605-612.

Paiva Neto, F. T., Mazo, G. Z., Sandreschi, P. F., Petreça, D. R., & Rech, C. R. (2019). Barriers to implementation of academia da saúde program in santa catarina. *Journal of Physical. Education, 30*(1), e3046.

Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Keer, J. (2006). An Ecological Approach to creating Active living communities. *The Annual Review of Public Health, 27*, 297–322.

Salvador, E., Ribeiro, E. H. C., Garcia, L., Silva, J. C. G., Santos, T. I., & Aoki, M. S. (2015). Intervenção de grupos de exercícios físicos supervisionados para a promoção da atividade física para usuários do Sistema Único de Saúde. In Sociedade Brasileira de Atividade Física e Saúde (Eds.), *Experiências de promoção da atividade física na estratégia de saúde da família* (pp.111). Florianopolis.

Santos, C. E. S., Manta, S. W., Maximiano, G. P., Confortim, S. C., Benedetti, T. R. B, D'Orsi, E., & Rech, C. R. (2018). Accelerometer-Measured Physical Activity and Sedentary Behavior: A Cross-Sectional Study of Brazilian Older Adults. *Journal of Physical Activity and Health, 15*(11), 811-818.

Schneider, I. J. C., Confortim, S. C., Bernardo, C. O., Bolsoni, C. C., Antes, D. L., Pereira, K. G., Ono, L. M.,...& D'Orsi, E. (2017). EpiFloripaAging cohort study: methods, operational aspects, and follow-up strategies. *Revista de Saude Publica, 51*(104).

Silva, K. (2017). *A dança circular no quotidiano da promoção da saúde da pessoa idosa* [Tese de doutorado]. Universidade Federal de Santa Catarina.

Sousa, B. A., Lemes, I. R., Verardi, C. E. L., Luza, L. P., Silva, F. C., & Silva, R. (2019). Apoio social e atividade física de idosos: revisão sistemática de estudos observacionais. *Revista Brasileira em Promoção da Saúde, 32*(:8635).

Valdés-Badilla, P. A., Gutiérrez-García, C., Pérez-Gutiérrez, M., Vargas-Vitoria, R., López-Fuenzalida, A. A. (2019). Effects of Physical Activity Governmental Programs on Health Status in Independent Older Adults: A Systematic Review. *Journal of Aging and Physical Activity, 27*(2), 265-275.

World Health Organization (2018). *Global action plan on physical activity 2018–2030: more active people for a healthier world.* Geneva, Switzerland. Retrieved from https://www.who.int/ncds/prevention/physical-activity/global-action-plan-2018-2030/en/.xx

World Health Organization (2013). *Global action plan for the prevention and control active of noncommunicable diseases 2013-2020.* Geneva, Switzerland.

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.20225

Analysis of the behavior of volleyball coaches of youth female categories

Jéssica Santos Ferreira Prazeres[1], Luísa Helena Silva[1], Leandro Vinhas de Paula [1], Juliana Otoni Parma[2], Mateus Graçano Hamdan[3], Renato Melo Ferreira[1]*

ABSTRACT

In this study, we aimed to analyze the behavioral profile of volleyball coaches of youth categories from both the athletes' and the coaches' perspectives. One hundred ten athletes and 18 head coaches and assistant coaches who participated in the 2018 clubs' Brazilian volleyball championship (Campeonato Brasileiro Interclubes de Voleibol) filled the athlete and coach version, respectively, of the Brazilian version of the Coach Behavior Scale for Sport. The reporting of the goal-setting dimension was not aligned between coaches and athletes ($z = 17$, $p = 0.012$, $d = 0.78$), while no differences were found for the other dimensions (physical training and planning, technical skills, mental preparation, personal rapport, and negative rapport). The mismatch between the perceptions of coaches and athletes for the goal-setting dimension may be related to an underestimation or overestimation by coaches or athletes of the team's potential and inadequate coach-athlete communication. Coaches should manage their behavior to clearly state for the athletes their personal and collective goals, avoiding frustration, and promoting more commitment with the set goals, increasing the team's chances of success.

KEYWORDS: Coach behavior, Leadership, Volleyball.

INTRODUCTION

In modern volleyball, the role of each player in the game system is specialized. Each player position (setter, outside hitter, middle hitter, opposite hitter, and libero) demands a specific training program that matches the players' characteristics and the tasks performed during the game (Marques Junior, 2013). For instance, the setter stands out as a cognitive player, with technical, tactical, and psychological skills that usually outperform those of other positions, linking the coach's instructions to the plays executed during the game (Matias & Greco, 2016). Considering these particularities, the coach's role lays in planning teaching/learning situations according to the needs of her/his players, setting team and individual goals, and providing meaningful feedback during the game and the practice contexts (Cheuczuk et al., 2016).

Recently, federations and confederations have focused on promoting high-level coaching qualifications, given the coach's relevance to athletes' expertise and development (Salmela & Moraes, 2003; Vieira et al., 2015). The coach's role is not restricted to teaching and improving motor skills, and it also includes educating and developing athletes in the social and personal spheres since they directly influence those who are led by them (Salmela & Moraes, 2003). In the present study, we consider the Coaching Model (Côté et al., 1995), which highlights the relation between the central (organization, training, and competition) and peripheric (athlete's and coach's personal characteristics, and contextual factors) components of sports performance. In this framework, the coach's characteristics, the focus of this study, are defined by her/his sources of satisfaction, personal approach to coaching, and evolution of knowledge (Côté et al., 1995). In the swimming context, Ferreira et al. (2012) showed that coaches with more sports success better motivate their teams and provide feedback. To maximize collective performance,

[1]Escola de Educação Física, Universidade Federal de Ouro Preto, EEF-UFOP, Ouro Preto, Brasil
[2]Performance and Exercise Psychophysiology Lab, School of Kinesiology, Auburn University, Auburn, AL
[3]Olympico Club, Belo Horizonte, Brasil
*Corresponding author: Laboratório de Atividades Aquáticas – LAQUA, Escola de Educação Física, Universidade Federal de Ouro Preto, EEF-UFOP, Rua Dois, 110, Ouro Preto – MG, CEP 35400-000, Brasil E-mail: renato.mf@hotmail.com

Conflict of interests: nothing to declare. Funding: nothing to declare.
Manuscript received at 06 04, 2020; Accepted at 07 21, 2020

coaches identify individual or group weaknesses to improve upon them in an orderly manner, optimizing both team's performance and personal skills (Chelladurai, 1990).

In team sports, similar coach characteristics, such as outstanding technical and tactical knowledge, recurrent motivation, and leadership, maximize the chance of achieving a successful coaching career (Hampson & Jowet, 2012). In volleyball, specifically, Zanetti et al. (2008) identified paramount coach characteristics, such as being patient, motivator, persistent, and experienced. Furthermore, Nascimento Junior et al. (2019) show that an optimal coach-athlete relationship enables the athlete to have better focus and individual development, leading to improved team's focus and performance. These results highlight the great role of the coach-athlete relationship for the athlete's development, affecting the multi-annual development of her/his sports career (Ferreira et al., 2012).

Leadership is the ability to influence people to work together to reach common goals and objectives, which is affected by various factors related to the characteristics of the leaders and the ones of those led by them, and to the situational context (Brandão & Valdés, 2005). These factors determine the leadership style to be adopted, whether democratic or autocratic. While the democratic style is people-oriented and encourages others' actions and ideas, the autocratic style is task-oriented and centers power around the leader (Weinberg & Gould, 2017). Effective leadership may impact team members, both positively and negatively. The former is related to providing feedback in the appropriate moments, motivating team members, and setting real and achievable goals. The negative impact, by its turn, is related to making the athletes overly activated before a match, providing improper feedback, and dismissing an athlete from the team after an unplanned outcome, harming the cooperative behavior of the athletes and affecting their sports performance (Brandão & Carchan, 2010; Lameiras et al., 2017).

Assessing the alignment between the self-perception of the coach and the athletes' perception of the coach behavior is of great importance, especially in youth categories, considering that performance on games and championships are partially dependent on this synergy, as suggested by Brandão and Carchan (2010). By analyzing professional adult players, they showed that, for 75% of the athletes, exerting the proper leadership type influences positively and directly their game performance. Also, Nascimento Junior et al. (2019) assessed state-level young volleyball players and suggested that the optimal coach-athlete relationship promotes better development of skills crucial to sports performance. After an extensive bibliographic review, we could not find any articles with the same thematic of coaching behavior on top-level female youth volleyball players, which justified the study's realization (theory and practice).

Given that the coach behavior and the perception of the athletes of this behavior likely interfere with the team's performance, in this study, we aimed to analyze the behavioral profile of volleyball coaches of female youth categories, comparing it to the perception of athletes of different playing positions. This type of information may underly the improvement of factors (e.g., coping), that influence the development of a multi-annual sports career (Pires et al., 2016). Besides, identifying coaches' behavioral profiles and their influences on their athletes can help coaches adopt optimal behavior, promoting their maximal performance. We hypothesize that the coach behavior is perceived similarly by coaches and athletes, regardless of the athlete's playing position.

METHOD

This is a quantitative, exploratory and cross-sectional study.

Participants

We assessed 11 teams, with 110 female volleyball players of youth categories [mean (M) age = 16.27, standard deviation (SD) = 0.77]: 30 middle hitters, 21 setters, 13 liberos, 21 opposite hitters, and 25 outside hitters, with experience [(mean exp = 5,18, SD = 2,11)], and a minimum of 6 months training with the same coach and team, and 18 head coaches and assistant coaches [(M age = 44.33, SD = 9.46)] of teams that participated in the 2018 clubs' Brazilian volleyball championship U18 (Campeonato Brasileiro Interclubes de Voleibol Sub-18).

With a mean sports experience of 20.38 years (SD = 9.33) and a mean of 20.05 years (SD = 9.28) of work in the area of volleyball, the majority (17) of the coaches and assistants hold an undergraduate degree in physical education/sports science, with 5 of those holding a graduate degree. They coach teams of different age categories and report a mismatch between the actual number of hours per week of training (M = 16.70, SD = 8.83) and the number of hours per week that they would like to spend with their teams (M = 20.05, SD = 5.70). All head coaches and assistant coaches have state- or national-level success experiences, with about one-third of them holding an international title. Almost all of them consider their successes in championships as the main accomplishments of their careers.

All coaches and athletes were informed about the objectives, relevance, and methodological procedures adopted in this study. The consent form was signed, and all data were

collected in the championship's host club or at the hotel. The performance in the games could interfere in the study; therefore, all data collection happened before the first round of the championship. Instructions were given individually for each coach and athlete at the moment of data collection; anyone was able to quit the research at any time, without any penalty, and, if they wished, they could also leave any of the questions blank.

This study was approved by the ethics committee from Universidade Federal de Ouro Preto (protocol number: 2.966.208).

Procedures

The coach version (ECT-T) and athlete version (ECT-A) of the Brazilian version of the Coach Behavior Scale for Sport (CBS-S) were used (Silveira, 2005; Moraes et al., 2010; Lobo et al., 2005). The instruments are composed of two parts: anamnesis (age, sex, team, player position, years of experience in this sport) and evaluation of the coach's behavior according to the coach's or athlete's perspective. The latter part is composed of 6 dimensions, distributed in 40 questions each, wherein the frequency of specific behaviors is assessed with a 7-points Likert scale, in which 1 represents "never", and 7 represents "always" (Table 1).

Statistical analysis

The descriptive statistics of each dimension (PT, TS, MP, GS, PR, NR) for each instrument (ECT-T and ECT-A) and for each playing position are described in Tables 2 and 3, respectively. Normality and homogeneity were tested using Shapiro-Wilk (PT, w=0.771, p<0.001; TS, w=0.705, p<0.001; MP, w=0.932, p<0.001; GS, w=0.795, p<0.001; PR,

Table 1. ECT-A and ECT-T dimensions, definitions, and items composing the instruments.

Dimension	Definition	Items
Physical Training and Planning (PT)	Physical training and planning provided by the coach for practice and competition contexts;	1 – 7
Technical Skills (TS)	Feedback, demonstration and instructions, and advice given by the coach;	8 – 15
Mental Preparation (MP)	Coach involvement in helping the athletes become tougher, more focused, and confident;	16 – 20
Goal Setting (GS)	Coaching involvement in the identification, development, and monitoring of athletes' goals;	21 – 26
Personal Rapport (PR)	Coach is approachable, available, and understanding;	27 – 32
Negative Rapport (NR)	Coach's behavior, such as yelling when in rage, instilling of fear, disregarding of athletes' opinions.	33 – 40

Table 2. Descriptive analysis of the coach behavior scale from the perspectives of the athletes (ECT-A) and coaches (ECT-T) who participated in the 2018 clubs' Brazilian volleyball championship.

Scale		Dimensions					
		PT	TS	MP	GS	PR	NR
[ECT-A]	[$\dot{x} \pm sd$]	5.67±0.75	5.85±0.42	5.25±0.90	5.06±0.57	5.31±0.67	2.94±0.55
	[*CV*%]	12.75%	6.62%	11.26%	9.82%	12.81%	19.58%
	[*Md*]	5.96	6.00	5.49	5.06	5.21	2.88
	[Variance]	0,54	0,15	0,38	0,26	0,45	0,32
	[Skewness]	-0,35	1,39	0,63	3,14	1,06	3,33
	[Kurtosis]	-0,82	-0,88	0,15	0,97	0,00	0,78
	[*Min; Max*]	4,38;6,54	5,07;6,48	4,40;6,62	4,30;6,29	3,98;6,43	1,90;4,18
[ECT-T]	[$\dot{x} \pm sd$]	5.31±2.02	5.99±0.75	5.49±1.07	5.74±0.66	5.48±0.79	2.58±0.92
	[*CV*%]	40.02%	12.77%	16.99%	10.68%	12.75%	36.24%
	[*Md*]	6.21	6.12	5.90	5.91*	5.33	2.31
	[Variance]	4.52	0.57	0.92	0.39	0.47	0.81
	[Skewness]	0.26	0.26	2.83	1.41	-0.74	1.97
	[Kurtosis]	-1.13	-0.91	-1.62	-1.05	-0.40	1.21
	[*Min;Max*]	1.00;7.00	4.38;6.71	3.40;6.60	2.17;4.50	4.17;6.17	1.50;4.50

*represents a significant difference between coaches` and athletes` perspectives ($p < 0.05$).

w=0.797, p<0.001; NR, w= 0.801, p<0.001) and Bartlett's tests (PT, χ^2=117.35, p<0.001; TS, χ^2=135.81, p<0.001; MP, χ^2=6.654, p=0.24; GS, χ^2=137.74, p<0.001; PR, χ^2=137.18, p <0.001; NR, χ^2=123.53, p<0.001), respectively.

Association and agreement were assessed with Spearman and Kendall tests, respectively. To test the alignment of perceptions reported in each instrument we used the Wilcoxon signed-rank test. To compare medians in each dimension among playing positions, we used the Kruskal-Wallis non-parametric test. We used r and ε^2 scores as the effect-size for Wilcoxon signed-rank test (small, 0.10 < r < 0.30; medium, 0.30 < r < 0.50; large, $r \geq 0.50$; range, 0 to 1) and

Table 3. Descriptive analysis of the coach behavior scale, athlete's version (ECT-A) for each playing position (libero, setter, opposite hitter, outside hitter, and middle hitter).

Playingpositions		Dimensions					
		PT	TS	MP	GS	PR	NR
Libero	[$\dot{x}$±sd]	5.72±0.83	5.86±0.76	5.37±1.30	5.12±1.00	5.07±1.34	3.19±1.09
	[CV%]	14.51%	12.96%	24.20%	19.53%	26.42%	34.16%
	[Md]	6.14	5.75	5.6	5.00	6.00	2.62
	[Variance]	1.19	1.31	1.51	1.97	1.61	0.51
	[Skewness]	-0.48	-0.18	-0.78	0.63	0.07	1.08
	[Kurtosis]	-0.31	0.01	0.39	0.08	-0.39	1.31
	[$Min;Max$]	4.29;7.00	3.75;7.00	4.20;7.00	2.50;7.00	3.33;7.00	2.00;4.38
Setter	[$\dot{x}$±sd]	5.61±1.13	5.62±1.10	5.15±1.82	4.84±1.16	5.10±1.48	2.82±0.98
	[CV%]	20.14%	19.57%	35.33%	23.96%	29.01%	34.75%
	[Md]	5.85	5.87	5.6	4.83	5.33	2.63
	[Variance]	1.29	1.21	3.32	1.35	2.19	0.96
	[Skewness]	0.89	0.14	0.52	-0.33	-0.71	-0.29
	[Kurtosis]	-1.08	-0.80	-1.01	0.08	-0.50	0.43
	[$Min;Max$]	3.00;7.00	2.88;7.00	1.20;7.00	2.50;6.83	2.17;7.00	1.25;4.75
Oppositehitter	[$\dot{x}$±sd]	6.16±1.09	5.93±1.15	5.71±1.23	5.28±1.40	5.86±1.27	2.79±0.71
	[CV%]	17.69%	19.39%	21.54%	26.51%	21.67%	25.44%
	[Md]	5.84	6.13	5.4	5.33	5.55	2.37
	[Variance]	1.28	0.91	1.94	1.63	1.87	1.62
	[Skewness]	1.00	0.60	-0.79	-0.60	-0.32	1.60
	[Kurtosis]	-1.09	-0.88	-0.34	-0.35	-0.70	1.33
	[$Min;Max$]	2.71;7.00	3.38;7.00	2.60;7.00	2.50;7.00	2.50;7.00	1.25;6.25
Outsidehitter	[$\dot{x}$±sd]	5.61±1.13	5.88±0.95	5.13±1.39	4.97±1.28	5.27±1.37	2.74±1.27
	[CV%]	20.14%	16.15%	27.09%	25.75%	25.99%	46.35%
	[Md]	6.13	6.12	5.6	5.16	6.00	2.87
	[Variance]	1.48	1.01	2.67	1.67	1.44	0.63
	[Skewness]	2.99	0.51	0.04	-0.43	-0.14	-0.93
	[Kurtosis]	-1.75	-1.09	-0.93	-0.42	-0.73	0.02
	[$Min;Max$]	2.14;7.00	3.50;7.00	1.60;7.00	2.17;7.00	2.67;7.00	1.38;4.25
Middle hitter	[$\dot{x}$±sd]	5.77±1.22	5.85±1.00	5.18±1.64	5.18±1.29	5.75±1.20	2.80±0.79
	[CV%]	21.14%	17.09%	31.66%	24.90%	20.86%	28.21%
	[Md]	5.78	5.88	5.4	5.08	5.41	3.12
	[Variance]	0.69	0.58	1.69	0.99	1.80	1.19
	[Skewness]	-0.38	0.38	-0.29	0.11	-0.52	-0.98
	[Kurtosis]	-0.44	-0.58	-0.62	-0.15	-0.61	-0.04
	[$Min;Max$]	3.71;7.00	4.00;7.00	2.20;7.00	2.83;7.00	2.00;6.83	1.13;4.88

Kruskal-Wallis non-parametric test (small, 0.10 < ε^2< 0.30; medium, 0.30 < ε^2 < 0.50; large, $\varepsilon^2 \geq 0.50$; range, 0 to 1), respectively (Tomczak & Tomczak, 2014). We set the α level at .05 for all analyses. All analyses were conducted in the R software, version 3.3.0 (cran.r-project.org).

RESULTS

A large difference between coach`s and the athletes` perspectives was found for the goal setting dimension (GS, z = 17, p = 0.01, r = 0.78), while no differences were found for the other CBS-S dimensions (PT, z = 44, p = 0.64, r = 0.14; TS, z= 44, p = 0.65, r = 0.14; MP, z = 37, p = 0.32, r = 0.31; PR, z = 46, p = 0.76, r = 0.09; NR, z = 70, p = 0.13, r = 0.48). In general, a low to moderate relative instability in ECT-A and low for ECT-T (CV% = 0 - 10% low; 10 to 20% moderate; and 20 to 30% high relative instability of the response) was verified in the different dimensions for the observed responses. Additionally, in both instruments, there was an asymmetry of the probability distribution curve on the left and right when examining the responses obtained (Skewness> 0, so the distribution has a heavier right tail; Skewness <0, so the distribution has a heavier left tail, both denote an asymmetric curve, on the other hand Skewness = 0, so the distribution is approximately symmetric). The descriptive statistics for each of the 6 dimensions from the coaches` and athletes` perspectives (ECT-T and ECT-A, respectively) are shown in Table 2 and Figure 1.

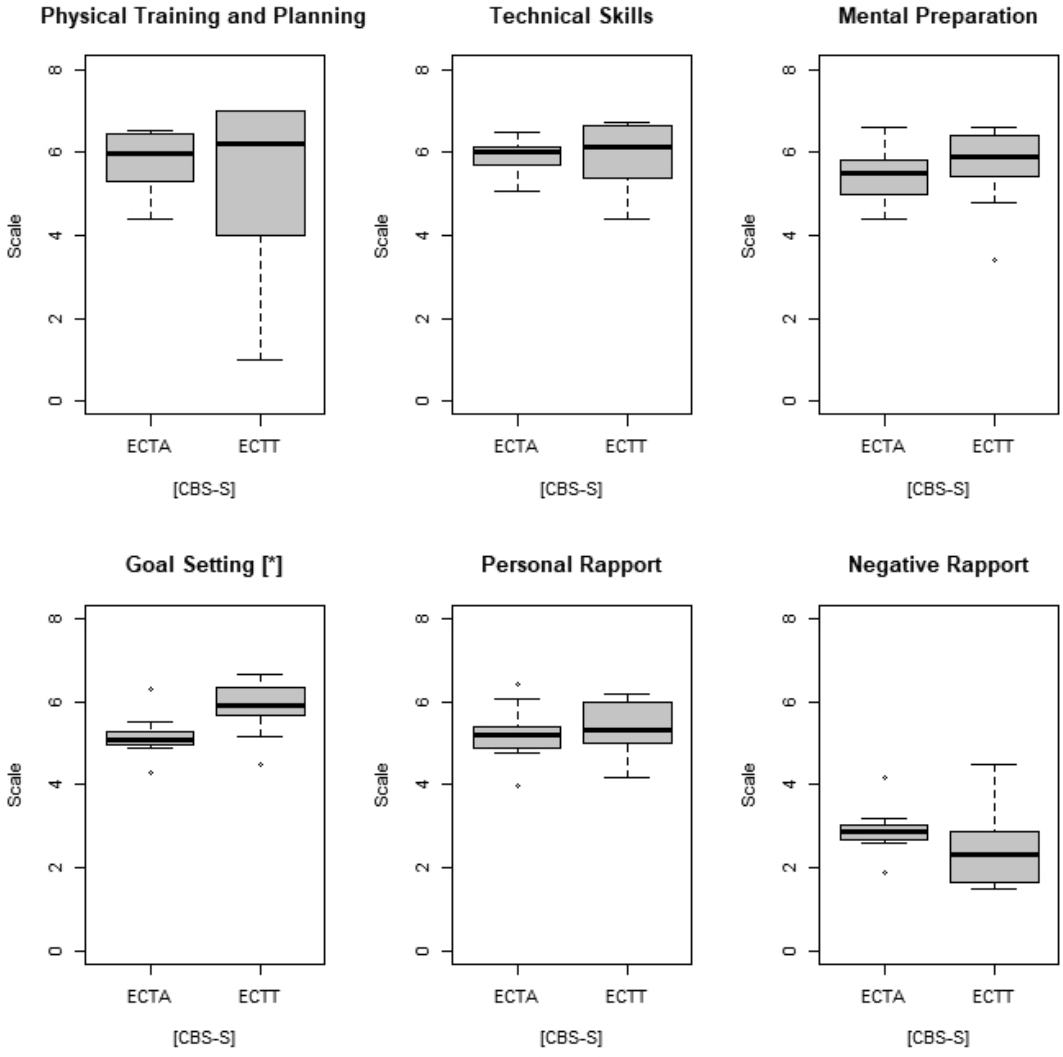

Figure 1. Median values of the dimensions physical training and planning, technical skills, mental preparation, goal setting, personal rapport, and negative rapport from the coaches` (ECT-T) and athletes (ECT-A) perspectives. *represents a significant difference between coaches` and athletes` perspectives (p < 0.05).

Regarding the perspectives of athletes of different playing positions, no differences among them were found for any CBS-S dimension (PT, $\chi^2_{4,0.05} = 3.20$, $p = 0.52$, $\varepsilon^2=0.02$; TS, $\chi^2_{4,0.05} = 0.91$, $p = 0.92$, $\varepsilon^2=0.01$; MP, $\chi^2_{4,0.05} = 1.13$, $p = 0.88$, $\varepsilon^2=0.01$; GS, $\chi^2_{4,0.05} = 1.49$, $p = 0.82$, $\varepsilon^2=0.01$; PR, $\chi^2_{4,0.05} = 6.08$, $p = 0.19$, $\varepsilon^2=0.05$; NR, $\chi^2_{4,0.05} = 4.19$, $p = 0.38$, $\varepsilon^2=0.04$). In summary, when examining the responses obtained in ECT-A, there was a relative variability from moderate to high and at least some degree of asymmetry in the distribution of data for each dimension by position. The descriptive statistics for each dimension according to each playing position are shown in Table 3.

The assessment of the degree of the association and agreement between the two instruments did not show any relation between the answers given by athletes and coaches in any of the CBS-S dimensions (association - PT, ρ =-0.01, p =0.97; TS, ρ =0.05, p = 0.89; MP, ρ = -0.40, p = 0.25; GS, ρ = 0.03, p = 0.93; PR, ρ = -0.15, p = 0.66; NR, ρ = -0.06, p = 0.85; agreement - PT, τ =-0.02, p =0.92; TS, τ =0.13, p = 0.59; MP, τ = -0.31, p = 0.20; GS, τ = 0.01, p = 0.99; PR, τ = -0.02, p = 0.42; NR, τ = -0.07, p = 0.78).

DISCUSSION

In this study, we aimed to analyze the behavioral profile of volleyball coaches of female youth categories, comparing the perspectives of coaches and athletes of different playing positions. The main results indicate a significant difference in the perceptions of the coach behavior between coaches and athletes in the goal-setting dimension.

The CBS-S scale has been widely used in other countries and contexts (Carlsson & Lundqvist, 2016; Jain et al., 2018), reflecting its value and effectiveness for behavioral evaluation of coaches. For instance, Jain et al. (2018) identified a synergy between the perception of coach and athletes of the coach behavior in several dimensions, including goal setting, highlighting the importance of synergy for sports performance. The results found by Rocchi and Pelleteir (2018) point in the same direction since they show that coaches who report their own behavior more positively than their athletes do lead to frustration and fewer experiences of success for the athletes. As shown in the current study, for volleyball athletes of female youth categories, except for the GS dimension, no significant differences between athletes' and coaches' perceptions of coach behavior were found for the PT, TS, MP, PR, and NR dimensions. These dimensions will be separately discussed for a deeper understanding of their effects on performance.

Physical Training and Planning (PT)

Although the coaches participating in this study do not interfere in this dimension very often, given the presence of athletic trainers in their staff, the athletes perceive this dimension similarly to their coaches. This is a positive result, considering that coach behavior can cause increased lesion rates if associated with elevated training loads (Ekstrand et al., 2018). Physical training is an important dimension of the Coaching Model (Côté et al., 1995) since the training organization aims to develop skills determinants of sports performance like strength and resistance. The training load is distinct among playing positions in volleyball, with the outside hitters having higher sprint and jump demands than players of other positions (Horta et al., 2019), for instance. No difference among playing positions was reported, suggesting an appropriate distribution of training load according to each player's specificities.

Technical Skills (TS)

The similar perception of coach behavior between coaches and athletes and among players of different positions found in this study for the TS dimension support the common role of volleyball coaches of youth categories of enhancing learning by developing coordination and technical and tactical skills through pedagogical methods (Lanes et al., 2018). As with Physical Training and Planning, the Coaching Model (Côté et al., 1995) shows that perfecting the technique, along with other dimensions, allows a complete development of the athlete. In youth categories, the better the general technical-tactical performance, the better their development, promoting success (Porath et al., 2016).

Mental preparation (MP)

During matches and championships, athletes face many stress sources, such as opponents and crowds (Weinberg & Gould, 2017). Thus, mental preparation is posed as an important tool for coaches since their emotional behavior significantly influences the match outcome (Donohue et al., 2018). Given that mentally strong athletes are more prone to succeed (Orlick, 2016), the alignment between coaches' and athletes' perceptions found in this study is desired. Coaches are usually in charge of promoting the team's mental preparation, even though it comes from their training pedagogy, rather than explicit and intentional work (Gilbert, 2017).

Goal setting (GS)

There is a significant difference between the coaches` perception of their own behavior and the perception of the athletes of the coach behavior in this dimension, albeit no

difference among playing positions was found. This result suggests a lack of alignment between coaches and athletes regarding the team's goals. Coaches may be overestimating or underestimating their athletes' potential, setting incompatible collective goals, which could encourage athletes to ditch team goals for personal goals.

The goal-setting dimension is related to the involvement of the coach in the identification, development, and monitoring of athletes' goals (Lobo et al., 2005). According to Weinberg and Gould (2017), GS may be divided into short- and long-term goals, for which the coach must establish the best plan of action to achieve them, assessing their development periodically. Bieleke et al. (2019) showed that coaches nurtured motivation in their athletes, improving their serving technic and efficiency by establishing individual and collective goals for their teams.

The theoretical implications are related to the difference between coach behavior perceived by coaches and perceived by athletes, interfering with communication and leadership skills (Noce et al., 2009). This can also negatively influence the practice organization of training and competitions (Côté et al., 1995). The level of the competition and the level of the athletes must be considered when setting team goals. A mismatch between the coach's expectations and athletes' expectations has practical implications since frustration and conflicts can be expected if the final outcome is worse than expected. Setting clear goals allow coaches to self-regulate and to regulate the expectations of their athletes (Gollwitzer & Sheeran, 2016) since it increases athletes' commitment to the goal set, facilitating adjustments of goals and plans of action throughout the process, and avoiding an early drop-out from the sport due to frustration (Nicholls et al., 2016).

Personal rapport (PR)

Coaches can provide feedback and information suitable to each athlete based on their interpersonal relationship, creating a positive practice environment, and establishing trust between coaches and athletes (Forlenza et l., 2018). For young athletes, trust and credibility optimize the coach-athlete relationship, making them better embrace individual and collective goals (Cheuczuk et al., 2016), leading to better sports development and a smoother transition to older categories. Therefore, coaches and athletes must share the same perception of coach behavior in the personal rapport domain.

Negative Rapport (NR)

The use of negative feedback, yelling, disregarding athletes' opinions, and instilling fear in athletes reflects an autocratic and transactional leadership style by the coach (Weinberg & Gould, 2017). This coaching style entails inappropriate behavior by the athletes during the game, resulting in adverse outcomes. Therefore, a similar perception of the coach behavior in this dimension by coaches and athletes is paramount for efficient regulation of the behavior of the coach, avoiding possible negative effects on the team's performance. Such as found in this study, there is a trend for an inverse relation between PR and NR, and for preference for a democratic coaching style, as well as for the use of a positive personal rapport (Misasi et al., 2016).

The ideal feedback (positive or negative) is one of the essential factors for success in sports affecting the multi-annual development of the athlete's career; according to Côtê et al. (1995), is the alignment between coach's and athletes personal characteristic (peripheral components of a model), which will impact positively in the organization of training and competition (central components).

Two possible limitations of this study are: 1) most of the teams have athletic trainers in their staff, which might have made the athletes direct their responses for the PT dimension to them, even though we instructed participants to direct all their answers to the head coach. We tried to mitigate this possibility by directly addressing this information in the instructions given to the athletes; 2) volleyball teams do not include an equal number of athletes of each playing position, which might have biased our results. It is possible that, if the same number of athletes of each playing position was included, we could have found a difference in the reporting of the PT and PR dimensions among playing positions since a marginal significance was found. Future studies should use samples with the same number of athletes for each playing position. Also, the coaches' behavioral profile should be associated with their coaching and leadership style.

CONCLUSION

Taken together, the results of this study suggest that the coaches' self-perception and the athletes' perception of the coach's behavior are not different from each other for all the dimensions assessed, except for the goal-setting dimension. The perception of coach behavior does not differ among playing position. The mismatch found for the goal-setting dimension might result in frustration, decreased performance, and suboptimal development of the athletes' potential. This study's results should assist volleyball coaches of youth categories to reflect on their behavior and be more assertive in the development of young athletes' sports career. Personal, achievable, and task-oriented goals should be developed for each athlete, avoiding an early drop out of the sport.

ACKNOWLEDGMENTS

The teams, coaches and athletes participating in this study

REFERENCES

Bieleke, M., Kriech, C., & Wolff, W. (2019). Served Well? A Pilot Field Study on the Effects of Conveying Self-control Strategies on Volleyball Service Performance. *Behavioral Sciences*, *9*(9), 93. https://doi.org/10.3390/bs9090093

Brandão, M. R. F., & Carchan, D. (2010). Comportamento preferido de liderança e sua influência no desempenho dos atletas. *Revista Motricidade, 6*(1), 53-69.

Brandão, M. R. F., & Valdés, H. (2005). La utilización de estratégias motivacionales por los entrenadores: Un aporte de la psicología del deporte. In: Roffé, M., & Ucha, F. G. (Eds), *Alto rendimiento, psicología y deporte: Tendencias actuales* (pp. 115-130). Buenos Aires, Argentina: Lugar Editorial.

Carlsson, A., & Lundqvist, C. (2016). The Coaching Behavior Scale for Sport (CBS-S): A psychometric evaluation of the Swedish version. *Scandinavian Journal of Medicine & Science in Sports, 26*(1), 116-123. https://doi.org/10.1111/sms.12359

Chelladurai, P. (1990). Leadership in sports: A review. *International Journal of Sport Psychology, 21*(4), 328-354.

Cheuczuk, F., Ferreira, L., Flores, P. P., Vieira, L. F., Vieira, J. L. L., & Nascimento Junior, J. R. A. (2016). Qualidade do relacionamento do treinador-atleta e orientação às metas como preditores de desempenho esportivo. *Psicologia: Teoria e Pesquisa*, *32*(2), 1-8. https://doi.org/10.15900102-3772e32229

Côté, J., Salmela, J. H., Trudel, P., Baria, A., & Russel, S. J. (1995). The coaching model: a grounded assessment of expert gymnastic coaches' knowledge. *Journal of Sport and Exercise Psychology, 17*(1), 1-17. https://doi.org/10.1123/jsep.17.1.1

Donohue, B., Gavrilova, W., Galante, M., Gavrilova, E., Loughran, T., Scott, J., … Allen, D. L. (2018). Controlled evaluation of an optimization approach to mental health and sport performance. *Journal of Clinical Sport Psychology, 12*(2), 234-267. https://doi.org/10.1123/jcsp.2017-0054

Ekstrand, J., Lundqvist, D., Lagerbäck, L., Vouillamoz, M., Papadimitiou, N., & Karlsson, J. (2018). Is there a correlation between coaches' leadership styles and injuries in elite football teams? A study of 36 elite teams in 17 countries. *British Journal of Sports Medicine*, *52*(8), 527-531. https://doi.org/10.1136/bjsports-2017-098001

Ferreira, R. M., Penna, E. M., Costa, V. T., & Moraes, L. C. C. A. (2012). Nadadores medalhistas olímpicos: contexto do desenvolvimento brasileiro. *Motriz: Journal of Physical Education, 18*(1), 130-142.

Forlenza, S. T., Pierce, S., Vealey, R. S., & Mackenzie, J. (2018). Coaching Behaviors that Enhance Confidence in Athletes and Teams. *International Sport Coach Journal*, *5*(3), 205-212.

Gilbert, J. N. (2017). Sport psychology teaching approaches for high school coaches and their student-athletes. *Journal of Physical Education, Recreation & Dance*, *88*(2), 52-58. https://doi.org/10.1080/07303084.2016.1260076

Gollwitzer, P. M., & Sheeran, P. (2016). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, *38*(6), 69-119. https://doi.org/10.1016/S0065-2601(06)38002-1

Hampson, R., & Jowet, S. (2012). Effects of coach leadership and coach-athlete relationship on collective efficacy. *Scandinavian Journal of Medicine & Science in Sports, 24*(2), 454-460. https://doi.org/10.1111/j.1600-0838.2012.01527.x

Horta, T. A. G., Bara Filho, M., Coimbra, D. R., Werneck, F. Z., & Miranda, R. (2019). Perfil da carga de treinamento no voleibol de alto rendimento: um estudo de caso. *Revista Brasileira de Ciências no Esporte*, *41*(4), 419-426. https://doi.org/10.1016/j.rbce.2018.06.008

Jain, T., Sharma, R., Singh, A., & Mehta, K. (2018). The Coaching Behavior Scale for Sport (CBS-S): Factor structure examination for elite Indian sportsperson. *Indian Journal of Positive Psychology, 9*(1), 1-8.

Lameiras, J., Martins, B., Lopes-de-Almeida, P., & García-Mas, A. (2017). Athletes Perception of Coaches' Leadership Style and Tendency to Cooperate among Competitive Teams. *Acción Psicológica*, *14*(1), 79-92. https://doi.org/10.5944/ap.14.1.19264

Lanes, B. M., Marques Filho, C. V., Oliveira, R. V., & Ribas, J. F. M. (2018). Praxiologia motriz: novas proposições para o treinamento dos jogos esportivos coletivos. *Revista Motrivivência*, *30*(54), 308-325. https://doi.org/10.5007/2175-8042.2018v30n54p308

Lôbo, I. L. B., Moraes, L. C. C. A., & Nascimento, E. (2005). Processo de validação da escala de comportamento de treinadores: versão atleta (ECT-A). *Revista Brasileira de Educação Física e Esporte*, *19*(3), 255-65. https://doi.org/10.1590/S1807-55092005000300008

Marques Junior, N. K. (2013). Evidências científicas sobre os fundamentos do voleibol: importância desse conteúdo para prescrever o treino. *Revista Brasileira de Prescrição e Fisiologia do Exercício*, *7*(37), 78-97.

Matias, C. J. A. S., & Greco, P. J. (2016). Atribuição dada pelo levantador em sua organização ofensiva ao papel do treinador: da base ao alto nível do voleibol. *Revista Brasileira de Ciências do Esporte*, *38*(4), 392-399. https://doi.org/10.1016/j.rbce.2016.02.010

Misasi, S. P., Morin, G., & Kwasnowski, L. (2016). Leadership: Athletes and coaches in sport. *The Sport Journal, 19*(July, 1st).

Moraes, L. C. C. A., Medeiros Filho, E. S., Lobo, I. L. B., & Silveira, D. R. (2010). Escala do comportamento do treinador: versão treinador (ECT-T) e versão atleta (ECT-A): o que o treinador diz é confirmado pelos seus atletas? *Revista Brasileira de Educação Física e Esporte*, *24*(1), 37-47. https://doi.org/10.1590/S1807-55092010000100004

Nascimento Junior, J. R. A., Fiorese, L., Vieira, J. L. L., Ferreira, L., Cheuczuk, F., Jowett, S., Fortes, L. de S., & Vissoci, J. R. N. (2019). Coach-athlete relationship and collective efficacy in volleyball: Is the association explained by athletes' goal orientations? *Motricidade*, *15*(2–3), 1–11. https://doi.org/10.6063/motricidade.14147

Nicholls, A. R., Levy, A. R., Carson, F., Thompson, M. A., & Perry, J. L. (2016). The applicability of self-regulation theories in sport: Goal adjustment capacities, stress appraisals, coping, and well-being among athletes. *Psychology of Sport Exercise, 27*(1), 47-55. https://doi.org/10.1016/j.psychsport.2016.07.011

Noce, F., Costa, T., & Lopes, M. (2009). Liderança. In: Samulski, D. (Org.). *Psicologia do esporte: conceitos e novas perspectivas* (pp. 295-334). Barueri: Manole.

Orlick, T. (2016). *In pursuit of excellence* (5ª ed.). Champaign, IL: Human Kinetics.

Pires, D. A., Bara Filho, M. G., Debien, P. B., Coimbra, D. R., & Ugrinowitsch, H. (2016). Burnout e coping em atletas de voleibol: uma análise longitudinal. *Revista Brasileira de Ciências no Esporte, 22*(4), 277-281. https://doi.org/10.1590/1517-869220162204158756

Porath, M., Nascimento, J. V. D., Milistetd, M., Collet, C., & Oliveira, C. C. D. (2016). Nível de desempenho técnico-tático e a classificação final das equipes catarinenses de voleibol das categorias de formação. *Revista Brasileira de Ciências do Esporte, 38*(1), 84-92. https://doi.org/10.1016/j.rbce.2015.10.012

Rocchi, M., & Pelletier, L. (2018). How does coaches' reported interpersonal behavior align with athletes' perceptions? Consequences for female athletes' psychological needs in sport. *Sport, Exercise, and Perform Psychology*, *7*(2), 141-154. https://doi.org/10.1037/spy0000116

Salmela, J. H., & Moraes, L. C. C. A. (2003). Development of expertise: The role of coaching, families, and cultural contexts. In: Strakes, J.

L., Ericsson, A. K. (Eds), *Expert performance in sports: Advances in research on sport expertise* (pp. 275-293). Champaign, IL: Human Kinetics.

Silveira, D, R. (2005). *Processo de Validação da Escala de Comportamento de Treinadores-Visão Treinadores (ECT-T)* [Dissertação de Mestrado em Ciências do Esporte]. Escola de Educação Física, Fisioterapia e Terapia Ocupacional da Universidade Federal de Minas Gerais, Belo Horizonte.

Tomczak, M., & Tomczak, E. (2014). The need to report effect size estimates revisited: An overview of some recommended measures of effect size. *Trends in Sport Sciences, 21*(1), 19-25.

Vieira, J. L. L., Ferreira, L., Cheuczuk, F., Flores, P. P., Vissoci, J. R. N., Rocha, F. F., ... Vieira, L. F. (2015). Impact of coach-athlete relationship on the collective efficacy of young volleyball players. *Revista Brasileira de Cineantropometria & Desempenho Humano*, *17*(6), 650-660. https://doi.org/10.5007/1980-0037.2015v17n6p650

Weinberg, R. S., & Gould, D. (2017). *Fundamentos da psicologia do esporte e do exercício* (6ª ed). Porto Alegre: Artmed.

Zanetti, M., Lavoura, T., Botura, H., & Machado, A. (2008) O Técnico ideal sob o olhar de atletas de voleibol infanto-juvenis. *Coleção Pesquisa em Educação Física, 7*(1), 363-368.

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.20242

Design and Validation of a Scale to Measure Fear of the Aquatic Environment in children

Juan Antonio Moreno Murcia[1]*, Elisa Huéscar Hernández[1], Luciane de Paula Borges[2], Neus Gómez Vera[1]

ABSTRACT

Although fear in early childhood is an emotion that permits survival of danger, fear of water can block and limit children's adaptive development towards this very fear. Aquatic competence is an important milestone in the improvement of general health in childhood, but there are no scales that measure how fear of water can hinder a child's development in the aquatic environment. This study aimed to design and analyze the validity of a Scale to Measure Fear of the Aquatic Environment (SFAE) to evaluate the perceived fear of the aquatic environment in three- to six-year-old children. Construct validity was also evaluated by verifying its relation to aquatic competence. The exploratory and confirmatory factor analyses support the use of five dimensions of influence on the perception of fear of the aquatic environment: social context, equipment/installations, attitude, experiences, and competence. The correlation pattern also supports construct validity showing negative and significant relations between fear and aquatic competence. The SFAE shows a promising initial validity for its use in the aquatic environment during early childhood.

KEYWORDS: aquatic activities, adaptive development, measure, early childhood, evaluation instrument.

INTRODUCTION

From a neurocognitive point of view, fear could be defined as an evolutionary emotion triggered when a person perceives a stimulus as dangerous and/or unknown (Silveira & Moreno-Murcia, 2015). Although its origins can be found in both phylogenetic and ontogenetic contexts, it is the latter that helps us understand how it could unfold during some evolutionary stages. Thus, the development of fear during early childhood constitutes a primitive alarm of an adaptive nature that allows a child to avoid situations that could become potentially dangerous (Martínez, 2014). Later, a child's evolutionary development itself progressively facilitates their ability to modulate the types and intensity of fear they perceive, gradually adjusting it to the new demands of the environment (Méndez et al., 2012). However, because each individual may perceive, interpret and act on the same experience differently, the feeling of anguish and lack of control that can cause fear does not always correspond to real and objective situations, so professional help is required. In this sense, research into fear should take into account the great complexity of this variable.

With respect to fear triggers, even today, the classification by Miller et al. (1972) is useful. It has three categories: 1) fears related to physical integrity (fear of suffering physical injury, dying, drowning, etc.), 2) fears related to social threats (fear related to personal worth), and 3) fears related to natural or supernatural dangers (fear of thunder, fear of monsters, etc.). For its part, fear of the aquatic environment is usually experienced by a child as a strong dread of drowning, so it can be incorporated within the category of fear of suffering physical harm. According to the American Psychiatric Association (APA, 2000), fear of water is considered a "specific phobia", which manifests itself as "a marked and persistent fear of clearly discernible, circumscribed objects or situations". The prevalence rate for fear of the aquatic environment in the general population is situated between 2 and 3% (Stinson et al., 2007), and although it is more common during early childhood, it intensifies throughout adulthood (Becker et al., 2007).

Although there are individual differences in how fear of the aquatic environment is experienced and interpreted, like any other fear, it manifests itself on three levels: motor, a child

[1]Universidad Miguel Hernández, Elche, Spain
[2]Centro de Enseñanza Samaniego, Alcantarilla, Spain
*Corresponding autor: Universidad Miguel Hernández de Elche, Centro de Investigación del Deporte, Avenida de la Universidad, s/n., 03202, Elche (Alicante); E-mail: j.moreno@umh.es

Conflict of Interest: Nothing to declare. Funding: To complete or nothing to declare
Manuscript received at 06 08, 2020; Accepted at 09 29, 2020.

shows a desire to avoid contact with actions leading to it; cognitive, a child understands that this medium represents a physical threat and they could drown; and physiological, corporal changes which are typical when a child is in situations that are either threatening or upsetting (Abadía et al., 1998; Méndez, 1999; Pharr et al., 2018). As the aquatic medium is an environment that is different from the one a child usually develops in, their first experiences with this medium can be decisive in causing this fear to appear. In this sense, previous research corroborates that among the reasons self-reported by children about their perception of fear of the aquatic environment, fear of drowning is a very common factor (Berukoff & Hill, 2010; Shank, 1987; Pharr et al., 2018; Whiting & Stembridge, 1965). Other causes indicated in the scientific literature for the origin of the fear of the aquatic environment correspond to stressful situations like ducking and fear of doing a task wrongly, or fears related to installation resources, such as personal fear (of the instructor) or physical fear (of equipment or characteristics of the installations like the depth of the swimming pool.) (Grenfell, 2004; Moreno et al., 1992; Salguero et al., 2004; Valiente et al., 2002). To be exact, it is during the first stages of exploration, discovery, and adaptation to the aquatic environment that some behaviors rejecting the aquatic environment can appear.

However, although scientific literature about fear recognizes that some of these evolutionary fears usually disappear over time, there is a variety of learned or conditioned behaviors whereby a fear can be maintained for many years (Méndez, 1999), as it is linked to unease generated during a previous experience (Shank, 1987; Whiting & Stembridge, 1965). Specifically, some studies have reported that while learning swimming techniques during infancy and childhood, fear of the aquatic environment constitutes the strongest predictive factor of the low ability to learn to swim (Irwin et al., 2010; Ziara, 2005). To address this need, advances in comprehending the reasons that cause fear of the aquatic environment could help designing educational aquatic programs that would be able to achieve a positive adaptation to swimming lessons.

The techniques used to analyze generalized responses about fear in children (Moreno et al., 1992) are centered on interviews, self-reports, inventories, observation and rating scales, self-observation, observation and direct recording, and psychophysiological techniques. However, for the evaluation of fear in the aquatic environment, there are no instruments to date that focus on measuring fear of the aquatic environment in early childhood.

Based on the above arguments, and taking into account the need to design validated instruments that measure fear of the aquatic environment in the child population, this paper establishes two objectives. The first objective was to design and validate an instrument for evaluating fear of the aquatic environment in 3- to 6-year-olds (studies 1 and 2) and analyze its psychometric properties. The second objective was to verify the relation of fear of the aquatic environment with aquatic competence in early childhood to establish the construct validity of the instrument (study 3). This scale would therefore contribute to mitigating the difficulties that this emotion can generate in a child (Irwin et al., 2015) in a learning environment, where their aquatic competence is hindered (Milosevic & McCabe, 2015), and also from a psychological point of view, where there is an increase in their unease towards this medium.

STUDY 1

The objective in this first phase was to create a scale to measure fear of the aquatic environment (SFAE) and also to obtain content validity.

Participants

The Delphi method was used as a strategy to evaluate the instrument to measure fear of the aquatic environment. The validation of the designed instrument would be performed by two groups of humans, established as a coordinating group and an expert group. The coordinating group had a good knowledge of the Delphi Method and comprised academic researchers who were familiar with the subject being studied and were able to intercommunicate easily (Mira et al., 2010). The group of selected experts, who were closely involved and had a wide experience in dealing with this problem, were university lecturers and researchers of renowned prestige in teaching aquatic activities and psychology. Finally, 12 experts were selected, the number indicated by Landeta (2002). The methodological sequence was set out in three phases: initial, exploratory and final.

Initial Phase

The coordinating group was responsible for: defining the research problem; selecting the group of experts and obtaining their commitment to collaborate; interpreting the partial and final research results; and supervising progress, being able to make adjustments and corrections.

Exploratory Phase

Here, the questionnaire was designed in its experimental version for the final version to then be determined (Annex 1). To do this, the first version underwent a first round of analysis and discussion by the members of the Coordinating Group, and certain corrections and adjustments were made

according to the qualitative criteria that had obtained a majority consensus. The agreed version was validated in a second round by the expert group in order to gather information on the most stable quantitative and qualitative criteria. The phases covered by the Delphi method are outlined as follows: 1) selection of experts whose contribution to the study is considered invaluable; 2) Invitation to participate in the process by email; 3) sending and receiving the questionnaire by electronic mail in an attached file, consisting of a first page with a brief introduction and explanation of the research subject, a page for the respondent to fill out with their personal details, a clear description of the study objective and the instructions for completing the questionnaire, followed by the corresponding instrument for validation; 4) validation instrument: Likert type scale with four categories according to adequacy, clarity, coherence and relevance or pertinence of the item to the dimension to be researched, as well as an open question to obtain qualitative valuations about the items or the introduction of any new ones, with a maximum deadline of 30 days; 5) follow-up by email of the selected people; 6) collection of the completed scales; and 7) analysis of information contained in the Delphi scale. The results of this consultation were analyzed by the coordinating group from a quantitative and qualitative point of view, drawing on the opinions expressed by the experts in response to the open question included in the validation instrument.

Final Phase

In the last phase, the results from the whole validation process of the final version of the questionnaire were synthesized.

Procedure

Construction of the instrument

Once the limitations of the instruments available were analyzed, the pictorial SFAE was drawn up to measure fear of the aquatic environment in early childhood (3-6 years old). The content was determined through bibliographical review and with reference to expert opinion (Crocker & Algina, 1986), establishing five dimensions that potentially generate fear of the aquatic environment: influence of social context, influence of experiences, influence of attitude, influence of equipment or installations, and influence of competence. Based on these, an initial bank of items was generated from different questionnaires and scales for evaluating fear of the aquatic environment as well as other instruments and/or constructs for measuring fear during early childhood. A first experimental version was constructed dividing responses to each question into two levels of difficulty.

The coordinating group read and classified each item according to the dimensions: influence of social context, influence of experiences, influence of attitude, influence of equipment or installations, and influence of competence. The choice was made according to the adequacy, rational criterion, and ages of the target sample, resulting in a bank of 25 items. Some of the items included in this version were either taken literally from the original questionnaire, some were reformulated, and the others, the vast majority, were written especially for the occasion. Afterward, it was decided that the questionnaire should appear by alternating the dimensions for the girls and boys. Illustrations were drawn to complement the written information and facilitate understanding; so, text and image complemented one another to make a whole. These illustrations were inspired by didactic materials and children's stories selected by the boys and girls according to their tastes and preferences. The illustrations were later scanned and transformed into an application to be used on a tactile computer. There were two closed response options for each item, where a child could either identify with an adaptative image in relation to the aquatic environment, reflecting well-being, or identify with a non-adaptative behavior, reflecting anxiety.

To reach optimum levels of content validity, the expert technique was used, and a pilot study was carried out to verify its comprehension validity from the perspective of the children as subjects of the study. The experts were asked to value different aspects of the initial information, the questionnaire, the items, and the global valuation of each one (Wieserma, 2001), taking into account the degree of comprehension and the value of the image, among others.

With respect to the items, the degree of pertinence to the subject of the study and to what extent each of them should be included was recorded on a scale from 1 to 4. It was decided that Items with mean values close to 2 should be omitted, items with values around 3 should be modified, and items with values close to 4 should be included. Once these calculations were made, 22 items were decided on for selection.

To verify the comprehension validity of the instrument, a pilot study was carried out. Three experts had administered the questionnaire to a total sample of 122 boys and girls (lasting between 8 and 10 minutes). The protocol for answering the questionnaire consisted of the investigator being placed on a table with the printed images and the child sitting on a chair next to it. When faced with the investigator's questions on each item, the child was asked to indicate with his or her finger which of the two images most closely resembled his or her case, and the image was recorded. The degree of comprehension was analyzed from a qualitative point of

view, recording the participants' questions, doubts, and suggestions (teachers and students).

Data analysis

Qualitative data were analyzed through content analysis. With respect to quantitative data, the preparatory data analysis and the calculation of descriptive statistics were performed using SPSS 25.0 software.

RESULTS

Qualitative techniques were used to obtain evidence about the conceptual, social, and cognitive validity of the instrument and thereby analyze the content of the measures. The qualitative contribution provided was completed with the quantitative contribution of the mean scores that the experts gave for each item. The results were analyzed including the valuations by the coordinating group and the expert group, constituting two independent sources that guaranteed the adequacy of the instrument. Out of the 22 items that were initially included in the questionnaire, twelve did not undergo any modification, since they obtained values close to 4 and the experts did not suggest another version. Two items with values around 2 were eliminated and substituted by new ones following the recommendation from the expert group; and four items, with values close to 3 were modified in accordance with the experts' opinion, and the coordinating group agreed on their final formulation.

STUDY 2

The aim of this second phase was to analyze the exploratory factor structure of the SFAE.

Participants

The sample comprised 384 children, 195 boys and 189 girls. Their ages ranged between 3 and 5 years old, with a mean age of 4.02 (*SD* = .82). Distribution by age was as follows (3, *n* = 126; 4, *n* = 123; 5, *n* = 135). With respect to aquatic experience, the 3-year-olds had none, the 4-year-olds had spent a year doing aquatic activities (one day a week throughout the school year), and the 5-year-olds had had two years' experience (one day a week during two school years)

Measures

Fear of the aquatic environment.

We used the *Scale to measure Fear of the Aquatic Environment* (SFAE) described in study 1. It contains 22 items grouped into five dimensions: influence of social context, influence of experiences, influence of attitude, influence of equipment or installations, and influence of competence. The children answered on a two-option Likert scale: one reflected an adaptative response to the medium and the other a non-adaptative response. Each alternative was presented individually to the child using a comic image to facilitate their understanding of the question. The child had to point to the image that was most similar to themselves. To control possible error sources, the items were presented in random order to each participant, and the intra-element (response option) was also varied per item.

Procedure

The people responsible for the sports installations that had accepted to participate in the study and the swimming instructors were contacted to inform them about the objective of the research and the activities to be evaluated. One researcher from the coordinating group personally evaluated each of the children, going through the different items of the questionnaire while observing the classes, without influencing class dynamics or development. Participation was voluntary, and participants' anonymity was preserved by allocating each child a numerical code and geographical area. Parents were previously informed about the nature of the study and signed a consent form. The study was supervised by the Project Evaluating Body of the institution corresponding to the lead researcher with the reference number DPS.JMM.01.19 and registry number 2019.286.E.OEP. The observation time for each child was approximately 15 minutes.

Data analysis

An exploratory factor analysis (EFA) was performed in order to establish the instrument's factor structure, and the internal consistency of the instrument was analyzed using Cronbach's alpha. Data analysis was carried out with the statistical software SPSS 25.0.

RESULTS

Exploratory factor analysis

An exploratory factor analysis of the main components was performed with oblimin rotation. After a first analysis, four of the items did not reach the established minimum saturation (.30), and they were eliminated. Another analysis was made, where the items were grouped into five areas (Table 1): influence of social context (five items), influence of experiences (three items), influence of attitude (four

items), influence of equipment or installations (four items) and influence of competence (three items). These five factors obtained eigenvalues of 1.00 (9.34, 3.45, 1.78, 1,23 and 1.19, respectively), explaining a total variance of 81.51% (31.11%, 20.14%, 10.15%, 10.10% and 10.01%, respectively).

Analysis of internal consistency

Cronbach's alpha obtained for each of the dimensions was .92 for influence of social context, .87 for influence of experiences, .83 for influence of attitude, .78 for influence of equipment and installations, and .85 for influence of competence.

STUDY 3

The objective of this third phase was to carry out a confirmatory factor analysis with the SFAE and to show how it related to aquatic competence.

Method

Participants

The sample comprised 444 children, 235 boys, and 208 girls. Their ages ranged between 3 and 5, with a mean age of 4.45 (*SD* = .84). Distribution by age was as follows (3, *n* = 134; 4, *n* = 149; 5, *n* = 161). With respect to aquatic experience, 3-year-olds had had experience from that school year, the 4-year-olds had spent two years doing aquatic activities (one day a week throughout the school year) and the 5-year-olds had had three years' experience (one day a week for two school years).

Measures

Fear of the aquatic environment

We used the final *Scale to measure Fear of the Aquatic Environment* (SFAE), obtained in study 2. It finally consisted of 18 items grouped into five dimensions: influence of social context (4 items), influence of experiences (4 items), influence of attitude (4 items), influence of equipment or installations (3 items), and influence of competence (3 items). The response procedure was the same as the one described in study 2.

Aquatic competence

We used the *Instrument to measure Aquatic Competence in Children* (IACC) by Moreno-Murcia et al. (2020). It contains 22 items grouped into three dimensions: socio-affective,

Table 1. Exploratory factor analysis SFAE

	ICS	IE	IA	IMI	IC
If your parents are happy when you go swimming	.95	-	-	-	-
When your parents leave you alone in the changing room	.68	-	-	-	-
When you arrive at the pool and see your classmates	.48	-	-	-	-
When you arrive and your instructor comes over	.96	-	-	-	-
When you're in the pool and you can't touch the bottom	-	.88	-	-	-
When you're in the pool	-	.63	-	-	-
When you're at the pool and they throw you in the water	-	.54	-	-	-
When you're in the water	-	.65	-	-	-
When you arrive at the pool	-	-	.41	-	-
When you have to go in the water	-	-	.41	-	-
When you go to the pool	-	-	.40	-	-
You like swimming	-	-	.44	-	-
When the pool is deep	-	-	-	-.32	-
If the pool is big	-	-	-	-.34	-
When the instructor gets out a floating mat to walk over	-	-	-	-.43	-
When have to jump in the water	-	-	-	-	.37
When you have to swim a long way	-	-	-	-	.43
When you're in the water	-	-	-	-	.37

Note: ISC = influence of social context; IE = influence of experiences; IA = influence of attitude; IEI = influence of equipment or installations; IC = influence of competence.

consisting of seven items; cognitive, with six items; and motricity, consisting of nine items. The child's behavior was evaluated using a five-point rubric score. For example, the item that corresponds to breathing (When the children in the shallow end were asked to make bubbles under the water by releasing air through the mouth and nose…): 1 corresponds to "*Blows without touching the water with their face.*"; 2 "*Blows by only putting the mouth at the level of the water*"; 3 "*Doesn't blow in the water, but puts their face completely on the water*", 4 "*Blows through the mouse and nose, putting their face completely in the water*", and 5 "*Is able to coordinate breathing (takes in air and releases it continuously several times)*". Internal consistency obtained was .84, .79 and .90, respectively, and globally it was .88.

Procedure

The same procedure as the one described in study 2 was used.

Data analysis

A confirmatory factor analysis was carried out to confirm the factor structure of the instrument (CFA). Similarly, the internal consistency of the instrument was measured by Cronbach's alpha, and the descriptive statistics were obtained (mean and standard deviations) as well as the bivariate correlations of all the variables. Also, the predictive power of the dimensions of the scale of fear of the aquatic environment on aquatic competence was verified through a stepwise multiple linear regression analysis. Data analysis was carried out using the statistical software SPSS 25.0 and AMOS 25.0.

RESULTS

Confirmatory factor analysis

The factor structure was measured using confirmatory factor analysis with the 18 items included in the five-factor model. The maximum verisimilitude estimation method was used together with the bootstrapping procedure since the result of the Mardia multivariate coefficient was 786.94, which indicated a lack of multivariate normality of the data. The result showed an adequate fit of the model: ((χ^2 (46, N = 444) = 761.80, p = .000; χ^2/d.f. = 6.09; CFI = .92; TLI = .90; IFI = .92; SRMR = .05). The model proposed presented a reasonable approximation to the data and contributed to supporting the hypothesis of the multidimensionality of the construct. The estimations of the factor saturations for each of the items in their respective factors are illustrated in Figure 1.

Descriptive analysis and bivariate correlations

The dimension of influence of competence had the highest value out of the scale's five dimensions, followed by influence of experiences, influence of equipment/installations, influence of attitude, and influence of the social context. Aquatic competence showed a mean of 4.5 out of 5. All the dimensions correlated positively with each other (Table 2), except for the aquatic competence dimension, which correlated negatively with all the fear dimensions.

Linear regression model

A stepwise linear regression was performed to verify the predictive value of the dimensions of fear of the aquatic environment on aquatic competence (Table 3). According to the fifth step in the linear regression analysis, all the dimensions negatively explained aquatic competence, with an explained variance of 22%, except for influence of attitude. The dimension with the most weight was influence of competence, followed by influence of experiences, influence of equipment/installation, and influence of social context.

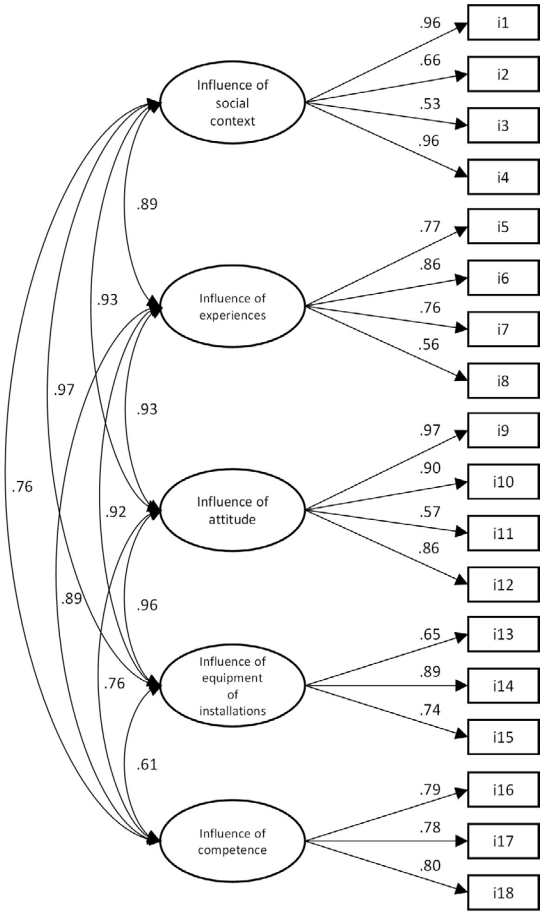

Figure 1. Confirmatory factor analysis SFAE

Table 2. Descriptive Statistics and Correlations for all the Variables

Variables	M	DT	1	2	3	4	5	6
ISC	1.05	.11	-	.77**	.88**	.75**	.63**	-.22**
IE	1.12	.18	-	-	.80**	.79**	.74**	-.37**
IA	1.01	.08	-	-	-	.84**	.68**	-.14**
IEI	1.07	.20	-	-	-	-	.74**	-.16**
IC	1.15	.28	-	-	-	-	-	-.42**
AC	4.15	.65	-	-	-	-	-	-

Note: ** p < .001; ISC = influence of social context; IE = influence of experiences; IA = influence of attitude; IEI = influence of equipment or installations; IC = influence of competence; AC = aquatic competence.

Table 3. Linear Regression analysis for the prediction of aquatic competence through the dimensions of fear of the aquatic environment

	B	SEB	β	ΔR^2
First step	5.47	.30		.04**
Influence of experiences	-1.25	.28	-.21**	
Second step	6.34	.31		.11**
Influence of experiences	-.79	.27	-.13*	
Influence of attitude	-1.21	.16	-.34**	
Third step	6.57	.43		.01**
Influence of experiences	-.77	.27	-.13*	
Influence of attitude	-1.17	.17	-.33**	
Influence of equipment or installations	-.27	.36	-.03	
Fourth step	6.63	.44		.01**
Influence of social context	-.78	.28	-.13*	
Influence of experiences	-1.23	.18	-.35**	
Influence of attitude	-.42	.41	-.05	
Influence of equipment or installations	.14	.19	.04	
Fifth step	6.88	.42		.09**
Influence of social context	-.81	.26	-.14*	
Influence of experiences	-.77	.19	-.22**	
Influence of attitude	-.65	.39	-.08	
Influence of equipment or installations	.59	.19	.18*	
Influence of competence	-.84	.12	-.36**	

Note: *p < .05; **p < .01

DISCUSSION

In the search for information that could diagnose an initial situation with respect to the factors involved in fear of the aquatic environment in children, the main purpose of this study was to develop and validate a pictorial measure instrument (SFAE) to evaluate fear of water in a sample of 3- to 6-year-old Spanish children. The psychometric properties of the design support the version of SFAE with good internal consistency reliability and the five factors that represent different aspects related to the experience of fear of the aquatic environment in children.

Therefore, based on these results, it can be concluded that the initial five-factor structure (influence of social context, influence of experiences, influence of attitude, influence of equipment or installations, and influence of competence) is replicated, showing an adequate fit for factor structure and internal consistency, and complementing aspects of content validity. Thus, by contemplating these five dimensions, the same instrument can be used to value the different triggers that can generate a child's fear of the aquatic environment.

The instrument was composed of the following dimensions. The dimension called influence of social context contained

four items, evaluating the potential influence that family, teacher, instructor, and peers had on children. Another factor was the influence of experiences, which consisted of four items that explore the consequences of being exposed to different situations that can cause fear in a child. Influence of attitude had four items, assessing a child's emotional disposition towards the aquatic environment. The factor called influence of equipment or installations comprised three items related to experiences where a child was able to discover their relationship with equipment resources. Finally, the dimension of influence of competence consisted of three items that gather information about how a child's problem-solving ability contributed to solving different situations in the aquatic environment.

The correlation analysis provided evidence of additional validity relating all the dimensions of the SFAE with one another significantly, and in the expected direction, specifically, the strongest relation was observed for influence of attitude with social context and equipment. This result is in line with studies that come within the Self-determination Theory framework and indicate the importance of social triggers in generating well-being in students (Ryan & Deci, 2017). It would therefore be useful, for example, to choose adequate recreational material that can be adjusted to a child's needs, and in this way help to generate a balanced and confident attitude towards the medium and steer them away from possible stimuli that can generate unease.

The results of this study with respect to the relation between the dimensions of fear of the aquatic environment and competence were in line with previous research, which recommends encouraging aquatic competence to reduce the fear of the aquatic environment (Brenner et al., 2009). To be exact, it was the dimensions of fear of the aquatic environment related to influence of competence and experiences which most robustly related to aquatic competence in children. This finding suggests that to minimize fear of the aquatic environment during childhood, it would be useful for children to acquire swimming competence and positive experiences at an early age, which would provide them with an emotional state of well-being.

Nevertheless, the promising result regarding the validity of the SFAE does not mean it is exempt from a series of limitations that should be taken into account. Firstly, although some works indicate that there may be gender differences in relation to fear (Méndez, 1999; Valdivia, 2000), in this study, an invariance analysis across sex was not considered. It would also be interesting if future research could verify the role of parents' educational styles with the dimensions of SFAE, and also the motivational style of the swimming instructor. Another fundamental aspect would be to verify the evolution of the scores obtained in the SFAE through a longitudinal study. Also, it would be necessary to check the possible differences by age and aquatic experience to avoid a possible bias.

Finally, this study reveals that if children's fear of the aquatic environment is minimized, it is important to further understand the variables that generate their unease towards this medium. The validity of the SFAE helps create new study perspectives that focus on the dimensions of fear of the aquatic environment, which had not received enough attention in this evolutionary stage. Consequently, this could lead to more effective educational decisions towards the integral development of childhood. Likewise, by using a pictorial valuation system, it is possible to make an evaluation that suits early childhood characteristics.

The analysis of the psychometric properties of the SFAE shows that it can be recommended and used in the child population to find out about the triggers of fear of the aquatic environment. Its use can lead to the development of a useful and simple applied tool as a starting point for future interventions that seek to gain further knowledge about the variables involved in a child's evolution towards the aquatic environment.

ACKNOWLEDGMENTS

Nothing to declare.

REFERENCES

Abadía, O., Aumente, M., Salguero, A., & Tuero, C. (1998). La hidrofobia: una experiencia práctica. *Lecturas: Educación Física y Deporte. Revista Digital, (3)*11.

Arnsten, A. F. (2009). Stress signalling pathways that impair prefrontal cortex structure and funtion. *Nature Reviews Neuroscience, 10*(6), 410-422.

Becker, E. S., Rinck, M., Türke, V., Kause, P., Goodwin, R., Neumer, S., & Margraf, J. (2007). Epidemiology of specific phobia subtypes: Findings from the Dresden Mental Health Study. *European Psychiatry, 22*, 69-74.

Berukoff, K. D., & Hill, G. M. (2010). A study of factors that influence the swimming performance of hispanic high school students. *International Journal of Aquatic Research and Education, 4*, 409-421.

Cody, B., Quraishi, A., Dastur, M., & Mickalide, D. (2004). *A national study of childhood drowning and related attitudes and behaviors.* The National SAFE KIDS Campaign.

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. New York, NY: Holt, Rinehart and Winston.

Franco, N., Pérez, M. A., & de Dios, M. J. (2014). *Relación entre los estilos de crianza parental y el desarrollo de ansiedad y conductas disruptivas en niños de 3 a 6 años. Revista de Psicología Clínica con Niños y Adolescentes, 1*(2), 149-156.

Graham, J., & Gaffan, E. A. (1997). Fear of water in children and adults: Etiology and familial effects. *Behaviour Research and Therapy, 35*, 91-108.

Grenfell, R. (2004). Drowning management and prevention. *Australian Family Physician, 32*, 990-993.

Irwin, C., Irwin, R., Martin, N., & Ross, S. (2010). Constraints Impacting Minority Swimming Participation PHASE II. The University of Memphis. Available from URL: http://img3.wikia.nocookie.net/__cb20090217163129/aforathlete/images/1/11/Minority_Drowning_Study.pdf

Irwin, C., Pharr, J., & Irwin, R. (2015). Understanding factors that influence fear of drowning in children and adolescents. *International Journal of Aquatic Research and Education, 9*, 136-148.

Jack, R. E., Garrod, O. G, & Schyns, P. G. (2014). Dynamic facial expressions of emotion transmit an evolving hierarchy of signals over time. *Current Biology, 24*(2), 187-192.

Kim, C. M., & Pekrun, R. (2014). Emotions and motivation in learning and performance. En J. Spector, M. Merril, J. Elen y M. Bishop (Eds.), *Hanbook of research on educational communications and technology* (pp. 65-75). Suiza: Springer.

Landeta, J. (2002). *El método Delphi: una técnica de previsión del futuro*. Barcelona: Ariel.

Leavy, J. E., Jancey, J., Hall, C., Nimmo, L., & Crawford, G. (2020). A content analysis of news media coverage of drowning events in Western Australia over two summers, 2014-2016. *Health Promotion Journal of Australia*, *31*(2), 192–198. https://doi.org/10.1002/hpja.267

Ma, W. J., Nie, S. P., Xu, H. F., Xu, Y. J., Song, X. L., Guo, Q. Z., & Zhang, Y. R. (2010). An analysis of risk factors of non-fatal drowning among children in rural areas of Guangdong Province, China: A case-control study. *BMC Public Health, 10*, 156.

Martínez, S. B. (2014). Los miedos en la preadolescencia y adolescencia y su relación con la autoestima. Un análisis por edad y sexo. *Revista de Psicología Clínica con Niños y Adolescentes,1*(1), 27-36.

Méndez, F. X. (1999). *Miedos y temores en la infancia. Ayudar a los niños a superarlos*. Madrid: Pirámide.

Méndez, X., Orgilés, M., & Espada, J. P. (2012). Terapia de Conducta en los miedos y fobias infantiles. En M. I. Comeche y M. A. Vallejo (eds.), *Manual de Terapia de Conducta en la infancia* (pp. 117-150). Madrid: Dykinson.

Menzies, R. G., & Clarke, J. C. (1993). The etiology of childhood water phobia. *Behaviour Research and Therapy, 31*(5), 499-501.

Milosevic, I., & McCabe, E. R. (2015). *Phobias. The Psychology of Irrational Fear*. Greenwood: ABC-CLIO.

Mira, J. E. B., Padrón, A. L., & Andrés, S. M. (2010). Validación mediante el método Delphi de un cuestionario para conocer las experiencias e interés hacia las actividades acuáticas con especial atención al Winsurf. *Ágora para la Educación Física y el Deporte, 12*(1), 75-94.

Miller, L. C., Barrett, C. L., Hampe, E., & Noble, H. (1972). Revised anxiety scales for the Louisville Behavior Checklist. *Psychological Reports, 29*, 503-511.

Moreno, I., Blanco, A., & Rodríguez, J. M. (1992). Instrumentos psicométricos de evaluación de los miedos infantiles. *Psicothema, 4*(2), 385-396.

Moreno, J. A., & Ruiz, L. M. (2008). Aquatic perceived competence in children: Development and preliminary validation of a pictorical scale. *International Journal of Aquatic Research and Education, 2*, 313-329.

Moreno-Murcia, J. A., de Paula Borges, L., y Huéscar Hernández, E. (2020). Design and Validation of the Scale to Measure Aquatic Competence in Children (SMACC). International Journal of Environmental Research and Public Health, 17(17), 6188. https://doi.org/10.3390/ijerph17176188

Mowrer, O. H. (1939). A stimulus-response analysis of anxiety and its role as a reinforcing agent. *Psychological Review, 46*(6), 553-565.

Mowrer, O. H. (1954). The psychologist looks at language. *American Psychologist, 9*(11), 660-694.

Pérez, M. D. (2000). El miedo y sus trastornos en la infancia. Prevención e intervención educativa. *Aula, 12*, 123-144.

Pharr, J., Irwin, C., Layne, T., & Irwin, R. (2018). Predictors of swimming ability among children and adolescents in the United States. *Sports, 6*, 1-11.

Poulton, R., Davies, S., Menzies, R. G., Langley, J. D., & Silva, P. A. (1998). Evidence for a non-associative model of the acquisition of a fear of heights. *Behaviour Research and Therapy, 36*, 537-544.

Pulido, F., & Herrera, F. (2015). Miedo e inteligencia emocional en el contexto pluricultural de Ceuta. *Anuario de Psicología, 45(2),* 249-263.

Salguero, A., Tuero, C., & González, R. (2004). *El miedo al agua: Estrategias y recursos metodológicos para superarlo* [Comunicación oral]. III Congreso de la asociación española de ciencias del deporte, Organizado por la Facultad de Ciencias de la Actividad Física y el Deporte, Universidad de Valencia, Fundación Deportiva Municipal Valencia, Valencia.

Shank, C. B. (1987). A child's fear of the water environment. *Children's Environments Quarterly, 4*, 33-37.

Silveira, Y., & Moreno-Murcia, J. A. (2015). Miedo a equivocarse y motivación autodeterminada en estudiantes adolescentes. *Cuadernos de Psicología del Deporte, 15(3),* 65-74.

Smith, G. S. (1995). Drowning prevention in children: The need for new strategies. *Injury Prevention, 1*, 216-217.

Stinson, F. S., Dawson, D. A., Patricia Chou, S., Smith, S., Goldstein, R. B., June Ruan, W. & Grant, B. F. (2007), The epidemiology of DSM-IV specific phobia in the USA: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychological Medicine, 37*, 1047-1059.

Valdivia, Z. (2000). *Educación no sexista en niños y niñas*. La Paz: UMSA.

Valiente, R. M., Sandín, B., & Chorot, P. (2002). Miedos comunes en niños y adolescentes: Relación con la sensibilidad a la ansiedad, el rasgo de ansiedad, la afectividad negativa y la depresión. *Revista de Psicopatología y Psicología Clínica*, *7*(1), 61-70.

Whiting, H. T., & Stembridge, D. E. (1965). Personality and the persistent nonswimmer. *Research Quarterly, 36*, 348-356.

Wieserma, L. D. (2001). Conceptualization and development of the sources of enjoyment in youth sport questionnaire. *Measurement in Physical Education and Exercise Science, 5*(3), 153-157.

Ziara, W. (2005). Relationships between progress in acquisition of swimming skills and anxiety level in ten-year-old children. *Human Movement, 6*, 93-97.DOI: http://dx.doi.org/10.6018/rie.33.1.182391

ARTIGO ORIGINAL

https://doi.org/10.6063/motricidade.20377

Voleibol de Praia: Análise Temporal e Respostas Endócrinas de Atletas de Nível Nacional

Beach Volleyball: Temporal Analysis and Endocrine Responses of National Athletes

Yago Pessoa Costa[1]*, Fabricio Boscolo Del Vecchio[2], Jefferson Muniz de Lima[1], Lúcio Roberto Cançado Castellano[1], Gilmário Ricarte Batista[1]

RESUMO

Objetivou-se caracterizar os aspectos temporais e verificar o efeito agudo de um jogo de voleibol de praia na testosterona, cortisol e razão T:C de jovens atletas. Adicionalmente, verificou-se se as respostas hormonais eram diferentes entre bloqueadores e defensores. Participaram 16 atletas masculinos de nível nacional (idade 17±2,44 anos). Cada atleta realizou um jogo com regras oficiais, sendo filmado para análise subsequente. Utilizou-se saliva para medir os níveis de testosterona e cortisol, e calcular a razão testosterona/cortisol (razão T:C), utilizando o método ELISA. Assim, comparou-se a concentração desses hormônios no tempo (início do jogo, final do 1° set e final do jogo) e entre as funções. Em média o tempo total de jogo foi 30min e 49s (± 0,01s), com *rallies* de 6 s (± 01s) e tempo entre *rallies* de 20s (±02s). O cortisol apresentou tendência linear, aumentando ao longo do tempo e a razão T:C demonstrou tendência quadrática, reduzindo ao final do primeiro set e restabelecendo-se ao final da partida. A razão T:C de bloqueadores pré-pos jogo teve efeito trivial, porém negativo (d= -0,198). Aproximadamente 30 minutos de voleibol de praia tem efeito na concentração de testosterona, cortisol e razão T:C. Além disso, bloqueadores parecem levemente mais exigidos fisicamente.
PALAVRAS-CHAVE: Atletas, Marcadores biológicos, Biomarcadores, Desempenho atlético.

ABSTRACT

This study aimed to characterize temporal aspects and verify the acute effect of a beach volleyball game on testosterone, cortisol, and T: C ratio of young athletes. Also, to verify whether the hormonal responses were different between blockers and defenders. Sixteen male athletes of national-level participated (age 17±2.44 years). Each athlete played a game with official rules, being filmed for subsequent analysis. Saliva was used to measure testosterone and cortisol levels and calculate testosterone/cortisol ratio (T: C ratio) using ELISA method. The concentration of these hormones was compared over time (beginning, end of first set, and end of the match) and between functions. Usually, the total match duration was 30min and 49s (± 0.01s), with rallies of 6 seconds (± 01s) and time between rallies of 20 seconds (± 02s). Cortisol showed a linear trend, increasing over time, and T: C ratio showed a quadratic trend, decreasing at the end of the first set and reestablishing at the end of the match. Blockers T: C ratio of pre-post match had a trivial but negative effect (d= -0.198). Approximately 30 minutes of beach volleyball affects the concentration of testosterone, cortisol, and T: C ratio. Besides, blockers seem slightly more physically demanding.
KEYWORDS: Athletes, Biological markers, Biomarkers, Athletic performance.

INTRODUÇÃO

O voleibol de praia se caracteriza como uma modalidade coletiva intermitente, já que intercala esforços de alta e baixa intensidade (Medeiros et al., 2014). Previamente, investigações acerca da modalidade exploraram indicadores temporais (quantidade de *rallies*, tempo do *rally*, tempo entre *rallies*,

[1]Universidade Federal da Paraíba, João Pessoa, Brasil.
[2]Universidade Federal de Pelotas, Pelotas, Brasil.
*Autor Correspondente: Campus I – Departamento de Educação Física - Lot. Cidade Universitaria, João Pessoa – PB - Brasil, 58051-900; E-mail: yago_pessoa@hotmail.com

Conflitos de interesse: Nada a declarar. Fonte de financiamento: O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de Financiamento 001
Artigo recebido em 06 16, 2020; aceite em 11 02, 2020

tempo total de trabalho e descanso, tempo total do set e do jogo) para descrever a densidade e demanda física exigida pelo jogo (Medeiros et al., 2014). Em comparação ao voleibol *indoor*, ressalta-se que o número reduzido de jogadores e a superfície em areia tornam a execução dos movimentos mais difíceis, trazendo maior complexidade ao jogo (Giatsis et al., 2017).

Do ponto de vista fisiológico, há uma certa escassez na literatura de informações. Previamente, identificou-se que a média da frequência cardíaca durante o jogo foi de 146 bpm (75% da frequência cardíaca máxima) e o lactato aumentou do repouso para o final do primeiro set (~ 0,95 mM para 2,30 mM), mas não houve diferença entre os sets (Magalhães et al., 2011). Posteriormente, os dados relacionados a frequência cardíaca foram corroborados (Jimenez-Olmedo et al., 2017). Isoladamente, tais informações caracterizam a modalidade como predominantemente aeróbia, e de moderada intensidade. Além disso, ao observar a métrica do jogo associando à frequência cardíaca, concluiu-se que bloqueadores tem uma demanda física maior (Nunes et al., 2020).

Embora os parâmetros relacionados a temporalidade, frequência cardíaca, lactato e métrica do jogo sejam importantes, a prática esportiva promove respostas endócrinas (Casto & Edwards, 2016), que é um fator determinante das adaptações relacionadas ao exercício e desempenho esportivo (Sgrò et al., 2014), sendo tais aspectos pouco conhecidos no voleibol de praia. Dentre os biomarcadores dessa natureza, a testosterona é um hormônio sexual secretado pelas células intersticiais dos testículos (Células de Leydig) controladas pelo eixo hipotálamo-hipófise-gonadal (Oyola & Handa, 2017), com bastante destaque no esporte pela característica anabólica (Vingren et al., 2010) e influência na produção de potência (Cardinale & Stone, 2006; Crewther et al., 2012).

Complementarmente, o cortisol também é investigado, já que é um glicocorticoide secretado pelo córtex supra renal controlado pelo eixo hipotálamo-hipófise-adrenal (Oyola & Handa, 2017), com característica catabólica (Lee et al., 2017). Ademais, as concentrações de testosterona e cortisol influenciam diretamente o sistema nervoso central e periférico contribuindo para o desempenho neuromuscular (Crewther et al., 2011). Por conseguinte, a razão testosterona/cortisol (T:C) expressa o equilíbrio anabólico/catabólico, ou seja, redução desse marcador parece caracterizar aumento da proteólise ou redução da síntese proteica (Lee et al., 2017), se constituindo como um marcador da carga de treino (Slimani et al., 2018). No voleibol *indoor*, por exemplo, observou-se efeito positivo na testosterona, cortisol e razão T:C associada a organização das cargas de treinamento que enfatizavam a especificidade da modalidade (Mazon et al., 2013).

De modo amplo, a realização de uma partida de três sets de voleibol *indoor* promoveu aumento dos níveis de testosterona e cortisol em jovens atletas do sexo feminino (Edwards & Kurlander, 2010). No entanto, atletas profissionais masculinos não modificaram os níveis pré-pós de testosterona e só aumentaram a concentração de cortisol em jogo com 5 sets (Peñailillo et al., 2018). Além disso, jovens atletas masculinos apenas aumentaram a concentração de cortisol em jogo com alto estresse contextual [i.e., final de campeonato (Moreira et al., 2013)]. Ainda que sejam modalidades semelhantes, o voleibol de praia tem características especificas (e.g. quantidade de jogadores, duração do jogo, superfície da quadra, esforço cognitivo) que dificultam a extrapolação dos dados. Adicionalmente, a razão T:C reduziu ~45% dos níveis de base para competição (análise aguda) com atletas de golfe e 30% entre o início e fim da temporada (análise crônica) de atletas de futebol (Handziski et al., 2006). Resultado semelhante foi observado com atletas femininas de voleibol *indoor,* permitindo aos autores concluir a aplicabilidade da razão T:C como marcador de *overtraining* (Roli et al., 2018).

Considerando que cada modalidade apresenta características particulares, e o conhecimento da dinâmica de jogo e do perfil hormonal podem contribuir, respectivamente, na prescrição de treinos e monitoramento da carga de treino. Assim, o objetivo do presente estudo foi caracterizar os aspectos temporais e verificar o efeito agudo de um jogo de voleibol de praia na testosterona, cortisol e razão T:C de jovens atletas. Adicionalmente, foi observado se havia diferença para esses biomarcadores entre jogadores bloqueadores e defensores. Nossa hipótese é que apenas um jogo é suficiente para aumentar os níveis de testosterona e cortisol. Junto a isto, esperávamos que bloqueadores tivessem maior desgaste, refletindo em menor razão T:C.

MÉTODO

Participantes

Foram recrutados 16 atletas masculinos (idade 17 ±2,44 anos; estatura 1,84 ±0,06m; massa corporal 76,23 ±9,54kg; IMC 22,35 ±1,92 kg/m^2; quantidade de treinos semanal 4 ±1,20 dias) pertencentes a dois centros de treinamento da cidade João Pessoa - PB, todos com experiência em competições nacionais e quatro destes também em competições internacionais. Destaca-se que cinco participantes obtiveram, pelo menos, terceiro lugar em etapas do circuito Nacional, e três eram campeões mundiais. Utilizou-se como critério de inclusão: a) competir no circuito nacional; b) estar entre os

16 melhores no ranking estadual. Os atletas eram excluídos se não conseguissem completar o jogo, no entanto, não foi necessário utilizar esse critério. O poder da amostra (-1) foi calculado *a posteriori* para α= 0,05, identificando-se para análise de testosterona poder= 0,965; cortisol poder= 0,999 e razão T:C poder= 0,475.

Ao total foram observados 4 jogos (1 por equipe), sendo 8 sets, totalizando 284 *rallies*. Além disso, as funções de jogo foram divididas em bloqueador e defensor. Desta forma, o atleta que realizava ≥80% das ações de bloqueio era classificado como bloqueador (Giatsis et al., 2011). Todas as equipes utilizaram uma formação especializada (i.e., função fixa), assim não havia equipes com formação universal (i.e., revezamento entre as funções de bloqueador/defensor).

Todos que aceitaram participar voluntariamente assinaram o Termo de Consentimento Livre e Esclarecido e, em caso de o participante ter idade inferior a 18 anos, a autorização foi realizada pelo responsável legal, além da assinatura do Termo de Assentimento pelo menor. Todos os termos utilizados foram elaborados em acordo com a declaração de Helsinki. Previamente os protocolos dessa pesquisa foram autorizados pelo Comitê de Ética em Pesquisa com Seres Humanos – Centro de Ciências Médica, da Universidade Federal da Paraíba (CCM - UFPB), protocolo nº 2.251.594.

Procedimentos

Formato da competição

Com duplas previamente estruturadas e habituadas a competirem juntas, os atletas foram expostos a um jogo simulado seguindo as regras de competição adotadas pela Federação Internacional de Voleibol (FIVB, 2016). Os jogos foram realizados em quadras à beira mar, com tamanho oficial (Lat= -7.116650, Long= -34.822635; Lat= -7.127300, Long= -34.822818) utilizando três bolas Mikasa® VLS 300. Além disso, um árbitro com experiência em competições nacionais foi recrutado para arbitrar a partida. Todos os confrontos foram sorteados e realizados no mesmo horário em dias distintos (15h da tarde), sendo realizado apenas um jogo por dupla. As condições climáticas eram semelhantes (temperatura de ~30ºC - https://weather.com/). Antes do início dos jogos, as duplas tinham 10 minutos de aquecimento. Para garantir empenho dos atletas, a dupla vencedora recebia uma premiação pela vitória (material esportivo). Adicionalmente, o placar final de todos os jogos foram 2x0.

Análise temporal

Todos os jogos foram gravados utilizando uma filmadora (Sony® DSC-SX21. Manaus, Brasil, 2011), apoiada em tripé para análise temporal posterior. Desta forma, as análises foram feitas utilizando um notebook (Samsung, NP270E4E, Brasil), por meio do *Software* Lince®, com o cronômetro digital do próprio *software*. As análises temporais foram conduzidas por dois investigadores que avaliaram todos os jogos e, após 15 dias, os mesmos jogos foram reavaliados. Para garantir a fidedignidade das observações foi verificada o coeficiente de correlação intraclasse e a diferença média intra e entre avaliadores, admitindo-se ICC ≥ 0,90 e diferenças inferiores a 5%, respectivamente, como utilizado por Medeiros et al. (2014), previamente. Caso a diferença fosse superior, os jogos seriam reavaliados. No total foram observados 284 *rallies*.

Os indicadores utilizados para análise temporal foram: tempo de *rally* (do saque até a bola sair de jogo), tempo entre *rallies* (intervalo entre um *rally* e outro), tempo total de trabalho (soma dos *rallies*), tempo total em descanso (soma dos tempos entre *rallies*) e tempo total do *set* (soma do tempo total de trabalho e descanso), tempo total de jogo (soma do tempo total dos *sets*), diferença entre tempo total de descanso e trabalho (razão TD/TT= tempo total de descanso/tempo total de trabalho) e quantidade de *rallies* (Medeiros et al., 2014).

Biomarcadores

Previamente à análise dos biomarcadores, todos os participantes foram instruídos a não escovar os dentes, não se alimentarem e nem consumirem bebidas energéticas 30 minutos antes do início das coletas. Amostras de 3 ml de saliva foram coletadas sem qualquer estímulo para salivação antes do início do jogo (antes do aquecimento), após o 1º *set* e 10 minutos ao final do jogo, em tubos plásticos, acondicionados imediatamente em compartimento resfriado e congelado a -20ºC.

A análise das amostras de saliva foi realizada em duplicata, por ensaio de imunoabsorção enzimática (Elisa), utilizando uma leitora de placa GloMax®-Multi (Promega, Califórnia, Estados Unidos, Ref. E7061). Os procedimentos utilizados foram os recomendados pelos manuais dos kits comerciais DRG® International (Frauenbergstr, Alemanhã. Ref. SLV-3013) e Diametra® (Via Pozzuolo, Itália. Ref. DKO020), para testosterona e cortisol, respectivamente. Além disso, o coeficiente de variação intra observações e lotes foi <5%. Posteriormente, a concentração de testosterona e cortisol foi utilizado para calcular a razão testosterona:cortisol (razão T:C) e o percentual de variação de acordo com a equação 1:

$$\frac{\text{Concentração Final - Concentração Inicial}}{\text{Concentração Inicial}} \times 100 \qquad (1)$$

Análise estatística

Os dados referentes à análise temporal e biomarcadores foram apresentados por meio de média e desvio padrão, já que se mostraram normais (testado por Shapiro-Wilk). Adicionalmente, calculou-se o percentual de variação para os níveis dos biomarcadores ao longo do tempo. Para comparar e investigar tendências temporais conduziu-se análise de variâncias de medidas repetidas (Anova *one-way* medidas repetidas), segundo momento (Pré, Pós 1º set e Pós-jogo). Ainda se comparou o efeito do jogo (Pré jogo Vs. Pós jogo) entre as funções de jogo por meio da Anova *two-way* medidas repetidas. Mediante a diferença estatisticamente significante, o *post hoc* Bonferroni era utilizado.

A complementar a análise, calculou-se o tamanho de efeito utilizando o *partial eta squared* (η_p^2), e em pares por meio do "d" de Cohen (Cohen, 1988), adotando a magnitude de < 0,2 (trivial), 0,2 à 0,6 (pequeno), >0,6 à 1,2 (moderado), >1,2 à 2 (grande), e > 2 à 4 (muito grande) (Hopkins et al., 2009). Todos os procedimentos foram realizados no software IBM SPSS Estatísticas para Windows, Versão 20.0. (Armonk, Nova York: IBM Corp), com significância de p≤ 0.05.

RESULTADOS

Dados derivados de 8 *sets* indicam que a duração média total do jogo foi de 30min e 49s (± 01min 54s), com tempo total dos *sets* de 15min e 24s (± 01min 14s). De modo geral, o tempo médio de trabalho foi de 3min e 42s (± 41s) e o tempo total em descanso foi de 11min e 42s (± 46s). O *rally* teve duração média de 6s (± 01s) e o tempo entre *rallies* foi de 20s (± 02s). Neste sentido, a razão média TD/TT foi 3,31(± 0,48), ou seja, representa uma relação de esforço:pausa de 1:3. Por fim, ocorreram em média 35,63 (± 3,38) *rallies* por *set*.

A Figura 1 reporta o efeito do jogo de voleibol de praia ao longo do tempo (início do jogo, final do 1º set e final do jogo) para testosterona (0,066 ± 0,045 ng/ml; 0,081 ± 0,060 ng/ml; 0,135 ± 0,154 ng/ml), cortisol (1,60 ± 0,752 ng/ml; 2,06 ± 0,92 ng/ml; 2,26 ± 1,14 ng/ml) e razão T:C (0,076 ± 0,17; 0,044 ± 0,045; 0,067 ± 0,078). A testosterona demonstrou proximidade à diferença significante entre momentos [$F_{(2,30)}$= 2,899; p= 0,071; η_p^2= 0,162; poder= 0,504], bem como proximidade à significância na análise da tendência linear (F=3,620; p= 0,076; η^2_p= 0,19). Além disso, os tamanhos de efeito entre o início do jogo e final do 1º set, e final do 1º set e final do jogo foram pequenos (d= 0,283 e 0,462, respectivamente). Todavia, a magnitude do tamanho de efeito do início para o final do jogo foi moderada (d= 0,608).

Em relação ao cortisol, houve diferença entre os pontos analisados [$F_{(2,24.803)}$= 5,792; p= 0,012; η_p^2 = 0,279; poder= 0,833], com diferença significante entre o início do jogo e final do 1º set (p= 0,025; d= 0,549; efeito pequeno) e final do jogo (p= 0,018; d= 0,681; efeito moderado). Não foi identificada diferença entre o final do 1º set e final do jogo (p= 1,0; d= 0,193; efeito trivial). Além disso, identificou-se tendência linear estatisticamente significante ao longo das medidas (F=10,22; p= 0,006; η^2_p= 0,40).

Em relação à razão T:C não se observou diferença significante [$F_{(2,30)}$= 0,804; p= 0,457; η_p^2= 0,051; poder: 0,175]. Entretanto, constatou-se tendência quadrática (F=4,570; p= 0,04; η^2_p= 0,23), ou seja, após diminuição ao final do 1º *set*, observa-se aumento ao final do jogo. Conectado a isso, o tamanho de efeito entre o início do jogo e final do 1º set foi pequeno (d= 0,314), assim como o valor do final do 1º set e final do jogo (d= 0,361). Já a comparação entre início do jogo e final do jogo apresentou efeito trivial (d= 0,081) para T:C.

A Tabela 1 apresenta o percentual de variação dos níveis de cortisol, testosterona e razão T:C. O cortisol sofreu aumento de 41,13% dos níveis iniciais para o final do jogo e

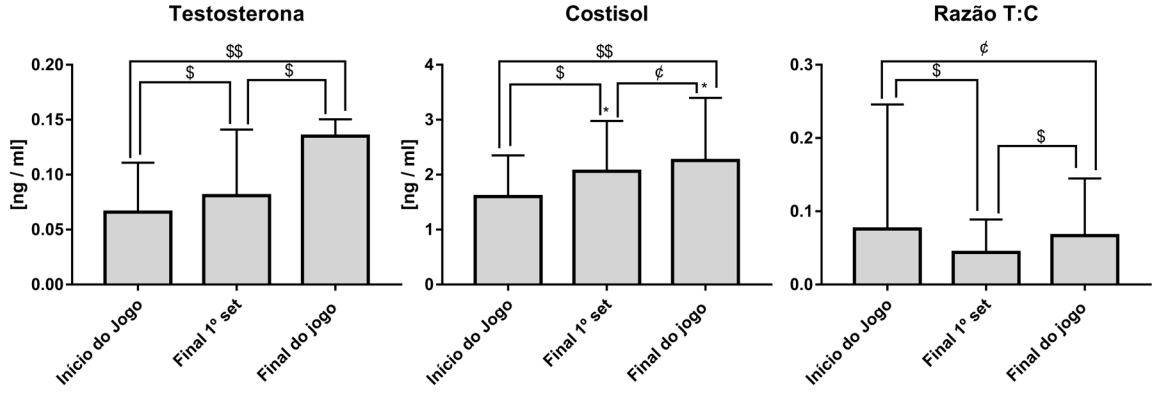

Figura 1. Efeito do jogo de voleibol nos níveis de cortisol, testosterona e razão T:C. (Nota: *p≤ 0,05 para Início do jogo Vs. Final do 1º set e Final do Jogo; ¢= efeito trivial; $= efeito pequeno; $$= efeito moderado)

a testosterona aumentou 103,34%. A razão T:C apresentou redução de 42,04% ao final do 1º set e de 11,55% ao final de jogo quando comparados aos níveis iniciais.

Adicionalmente foi verificado se havia diferença na concentração de testosterona, cortisol e razão T:C entre bloqueadores e defensores [Pré jogo Vs. Pós jogo (Figura 2)]. A testosterona não apresentou diferença significante ao longo do tempo [$F_{(1,7)}$= 3,332; p= 0,111; η^2_p = 0,322; poder= 0,351], entre as funções [$F_{(1,7)}$= 0,191; p= 0,675; η^2_p = 0,027; poder= 0,067] e na interação tempo*função [$F_{(2,7)}$= 0,043; p= 0,842; η^2_p = 0,006; poder= 0,054]. Em relação ao cortisol houve diferença significante entre os tempos [$F_{(2,7)}$= 17,350; p= 0,004; η^2_p = 0,713; poder= 0,944], mas não entre as funções [$F_{(2,7)}$= 0,326; p= 0,586; η^2_p = 0,045; poder= 0,079] e interação tempo*função [$F_{(2,7)}$= 0,015; p= 0,907; poder= 0,051].

Por fim, não houve diferença na razão T:C no tempo [$F_{(1,7)}$= 0,062; p= 0,811; η^2_p = 0,009; poder= 0,055], funções [$F_{(1,7)}$= 0,964; p= 0,359; η^2_p = 0,121; poder= 0,137] e interação tempo*função [$F_{(1,7)}$= 0,432; p= 0,532; η^2_p = 0,058; poder= 0,088]. Além disso, o tamanho do efeito Pré jogo Vs. Pós jogo foi d= 0,583 e d= 0,632 (testosterona); d= 1,018 e d= 0,598 (cortisol); d= -0,198 e 0,200 (razão T:C); para bloqueador e defensor, respectivamente.

Tabela 1. Percentual de variação dos níveis de cortisol, testosterona e razão T:C.

	Início do jogo * Final 1° set	Início do jogo * Final do jogo	Final 1° set * Final do jogo
Cortisol	28,25%	41,13%	10,03%
Testosterona	23,68%	103,34%	64,40%
Razão T:C	-42,04%	-11,55%	52,62%

DISCUSSÃO

O objetivo principal do presente estudo foi caracterizar os aspectos temporais e verificar o efeito agudo do jogo na testosterona e razão T:C em jovens atletas. Adicionalmente, também foi investigado se havia diferença entre os marcadores hormonais entre bloqueadores e defensores. Assim, observou-se que a modalidade apresenta relação de ~3 vezes mais tempo de bola fora de jogo do que em jogo, tendo os *rallies* durações bastante curtas, próximas a 6s. Além disso, o jogo (do início ao fim) teve efeito moderado na concentração de testosterona e cortisol. Para mais, o cortisol apresentou tendência linear, ou seja, aumento ao longo do tempo, e a razão T:C tendência quadrática, reduzindo ao final do 1ºset e retornando as condições iniciais ao final do jogo. Em relação as funções, bloqueadores parecem ser ligeiramente mais exigidos fisicamente, visto a resposta observada da razão T:C, corroborando com nossa hipótese inicial.

A análise temporal tem se mostrado como procedimento útil para entender a dinâmica competitiva (Palao et al., 2012), e pode contribuir substancialmente no desenvolvimento de modelos de treino que simulem as demandas fisiológicas específicas das modalidades esportivas (Jimenez-Olmedo et al., 2017; Magalhães et al., 2011). Os resultados obtidos no presente estudo indicam semelhança a jogos realizados em competições oficiais, garantindo boa reprodutibilidade dos jogos simulados. No estudo de Palao et al., (2012), o tempo total do jogo no masculino adulto foi em média de 44 minutos; porém, tal diferença frente à presente investigação (próximo a 30 min) pode decorrer de os autores terem considerado o intervalo entre os sets. Para duração, intervalos e quantidade dos *rallies*, os resultados são equivalentes aos de Medeiros et al. (2014), que observaram *rallies* com duração

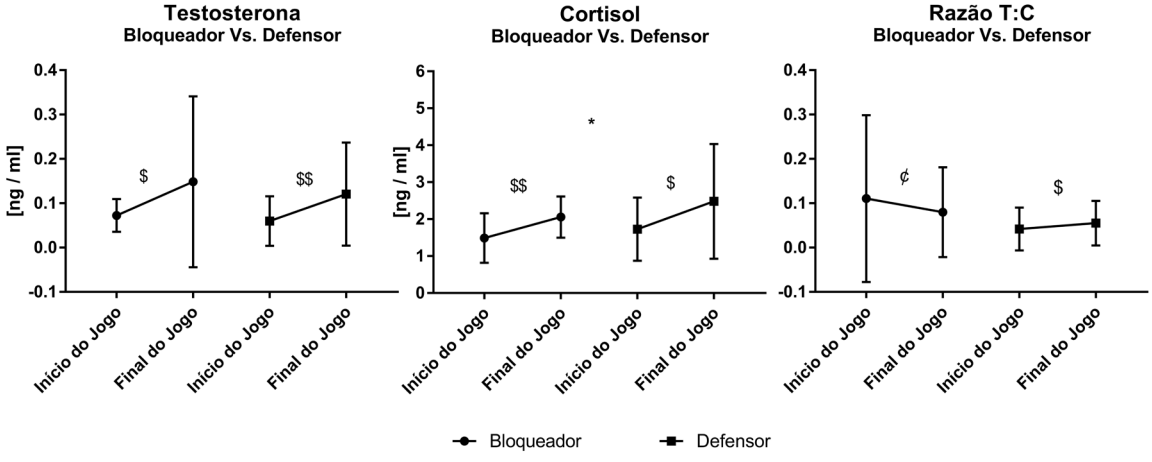

Figura 2. Comparação Início do jogo Vs. Final do jogo entre a função de bloqueador e defensor (Nota: *p≤ 0,05 para efeito do tempo; ¢= efeito trivial; $= efeito pequeno; $$= efeito moderado)

média de ~7 segundos, tempo entre *rallies* de ~21 segundos e ~37 rallies por set.

De modo amplo, ainda que os esforços sejam intermitentes por períodos ~3 vezes menor que o período de descanso, observou-se efeito moderado do jogo na testosterona e cortisol. Esses resultados foram observados em esporte com dinâmica semelhante (i.e., voleibol *indoor* e tênis) e outros esportes coletivos. Jovens atletas feminino de voleibol *indoor* e tênis aumentaram pré-pós jogo os níveis de testosterona e cortisol (Edwards & Kurlander, 2010) o mesmo foi observado com atletas de futsal (Carolina-Paludo et al., 2020).

Porém, com atletas de voleibol *indoor* masculino só observou-se efeito do jogo no cortisol e após 5 sets (Peñailillo et al., 2018). As respostas desses hormonios são em função principalmente da exigência física e pscicológica (Edwards & Kurlander, 2010), logo como os atletas realizam ao longo do set vários saltos e deslocamentos em intensidade máxima (Medeiros et al., 2014; Nunes et al., 2020), acrescentado a sobrecarga induzida pelo ambiente (i.e., piso em areia) e quantidade de atletas por time (maior responsabilidade no resultado), isso explica o aumento da testosterona e cortisol com apenas 2 sets jogados. Além disso, a razão T:C a tendência quadrática observada pode ser decorrente da responsividade tardia da testosterona aos estímulos associados ao esforço físico, bem como da rápida resposta do cortisol a essas condições (Viana Gomes et al., 2019).

Em relação as respostas hormonais de acordo com a função, observou-se semelhança do efeito do jogo entre bloqueadores e defensores para testosterona. No entanto, a exigência física parece ligeiramente maior nos bloqueadores, tendo o jogo um efeito moderado nos níveis de cortisol e trivial na razão T:C, porém negativo. Previamente, constatou-se que a maioria dos saltos são realizados em ações de ataque (44%) e bloqueio (39%) (Turpin et al., 2008). Além disso, bloqueadores jogam em uma faixa de intensidade levemente superior a defensores [77,71 - 89,13 %FCmáx Vs. 66,16% a 77,77 %FCmáx (Jimenez-Olmedo et al., 2017)]. Como a razão T:C é um marcador das cargas de treino e esforço, o resultado observado era esperado devido a maior exigência física desta função.

Como aplicação prática, os dados temporais podem ser utilizados para prescrição de treinamento intervalado, já que se associam a natureza da modalidade. Além disso, a utilização do jogo na semana de preparação para competições pode ser interessante, visto a especificidade do treinamento e equilíbrio entre marcadores endócrinos anabólicos e catabólicos. Ressalta-se, que os técnicos devem considerar a carga semanal principalmente na semana antecedente a competição, já que o tipo e intensidade do esforço determinam as repostas hormonais e desempenho subsequente (Gaviglio & Cook, 2014). Em competições oficiais é comum jogos sucessivos no mesmo dia. Desta forma, os atletas podem realizar imersões em água gelada (~ 14º C), que demonstrou efeito positivo pelo menos em marcadores hormonais (Freitas et al., 2019). Considerando apenas aspectos físicos, os times podem adotar como estratégia o direcionamento do saque para o atleta bloqueador, com o objetivo de obter vantagem ao final do jogo devido ao desgaste físico.

Esse estudo apresentou como limitação a realização de apenas um jogo por atleta dentro de uma competição simulada. Isso foi necessário para garantir a validade interna, e para assegurar que os resultados encontrados fossem devidos ao jogo e competição, evitando confusão em consequência do ritmo circadiano. Contudo, é comum atletas realizarem mais jogos durante o dia e em horários diferentes, o que deve ser considerado em pesquisas futuras, junto a atividades em competições oficiais. Além disso, apesar do reconhecido nível técnico dos atletas, que competiam em nível nacional e internacional, tal critério pode ter comprometido a ampliação da amostra. Por fim, esses dados devem ser extrapolados com cautela para atletas em diferentes níveis e gênero.

CONCLUSÕES

Em conclusão, os dados relacionados a temporalidade do jogo devem ser utilizados para prescrição do treinamento, aumentando a especificidade. Além disso, aproximadamente 30 minutos de voleibol de praia foi capaz de desencadear repostas na testosterona, cortisol e razão T:C em jovens atletas de nível nacional. De modo prático, jogos podem ser utilizados como treinamento. No entanto, ressalta-se que bloqueadores parecem sofrer maior desgaste físico, recomendando-se cautela no volume de sets jogados principalmente próximo a competições. Sugere-se que investigações futuras observem atletas feminino e competições oficiais.

ACKNOWLEDGMENTS

Centros de Treinamento Vôlei Vida e SE7

REFERÊNCIAS

Cardinale, M., & Stone, M. H. (2006). Is testosterone influencing explosive performance? *Journal of Strength and Conditioning Research / National Strength & Conditioning Association*, *20*(1), 103–107. https://doi.org/10.1519/R-16864.1

Carolina-Paludo, A., Nunes-Rabelo, F., Maciel-Batista, M., Rúbila-Maciel, I., Peikriszwili-Tartaruga, M., & Simões, A. C. (2020). Game location effect on pre-competition cortisol concentration and anxiety state: A case study in a futsal team. *Revista de Psicologia Del Deporte*, *29*(1), 105–112.

Casto, K. V., & Edwards, D. A. (2016). Testosterone, cortisol, and human competition. *Hormones and Behavior*, *82*(April), 21–37. https://doi.org/10.1016/j.yhbeh.2016.04.004

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Routledge.

Crewther, B. T., Kilduff, L. P., Cook, C. J., Cunningham, D. J., Bunce, P., Bracken, R. M., & Gaviglio, C. M. (2012). Relationships between salivary free testosterone and the expression of force and power in elite athletes. *Journal of Sports Medicine and Physical Fitness*, *52*(2), 221–227.

Crewther, Blair T., Cook, C., Cardinale, M., Weatherby, R. P., & Lowe, T. (2011). Two emerging concepts for elite athletes: The short-term effects of testosterone and cortisol on the neuromuscular system and the dose-response training role of these endogenous hormones. *Sports Medicine*, *41*(2), 103–123. https://doi.org/10.2165/11539170-000000000-00000

Edwards, D. A., & Kurlander, L. S. (2010). Women's intercollegiate volleyball and tennis: Effects of warm-up, competition, and practice on saliva levels of cortisol and testosterone. *Hormones and Behavior*, *58*(4), 606–613. https://doi.org/10.1016/j.yhbeh.2010.06.015

FIVB. (2016). Official beach volleyball rules 2017-2020. Auto-edição.

Freitas, V. H., Ramos, S. P., Bara-Filho, M. G., Freitas, D. G. S., Coimbra, D. R., Cecchini, R., Guarnier, F. A., & Nakamura, F. Y. (2019). Effect of cold water immersion performed on successive days on physical performance, muscle damage, and inflammatory, hormonal, and oxidative stress markers in volleyball players. *Journal of Strength and Conditioning Research*, *33*(2), 502–513. https://doi.org/10.1519/JSC.0000000000001884

Gaviglio, C. M., & Cook, C. J. (2014). Relationship between midweek training measures of testosterone and cortisol concentrations and game outcome in professional rugby union matches. *Journal OfStrength and Conditioning Research*, *28*(12), 3447–3452.

Giatsis, G., Panoutsakopoulos, V., & Kollias, I. A. (2017). Biomechanical differences of arm swing countermovement jumps on sand and rigid surface performed by elite beach volleyball players. *Journal of Sports Sciences*, *36*(9), 997–1008. https://doi.org/10.1080/02640414.2017.1348614

Giatsis, G., Tili, M., & Zetou, E. (2011). The height of the women's winners FIVB Beach Volleyball in relation to specialization and court dimensions. *Journal of Human Sport and Exercise*, *6*(3), 497–503. https://doi.org/10.4100/jhse.2011.63.03

Handziski, Z., Maleska, V., Petrovska, S., Nikolik, S., Mickoska, E., Dalip, M., & Kostova, E. (2006). The changes of ACTH, cortisol, testosterone and testosteroane/cortisol ratio in professional soccer players during a competition half-season. *Bratislavské Lekárske Listy*, *107*(6–7), 259–263.

Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009). Progressive statistics for studies in sports medicine and exercise science. *Medicine and Science in Sports and Exercise*, *41*(1), 3–12. https://doi.org/10.1249/MSS.0b013e31818cb278

Jimenez-Olmedo, J., Pueo, B., Penichet-Tomás, A., Chinchilla-Mira, J., & Perez-Turpin, J. (2017). Physiological work areas in professional beach volleyball: a case study. *Retos*, *31*(1), 94–97.

Lee, E. C., Fragala, M. S., Kavouras, S. A., Queen, R. M., Pryor, J. L., & Casa, D. J. (2017). Biomarkers in sports and exercise:tracking health,performance, and recovery in athletes. *Journal of Strength and Conditioning Research*, *31*(10), 2920–2937. https://doi.org/10.1016/j.soncn.2012.03.005

Magalhães, J., Inácio, M., Oliveira, E., Ribeiro, J. C., & Ascensão, A. (2011). Physiological and neuromuscular impact of beach-volleyball with reference to fatigue and recovery. *Journal of Sports Medicine and Physical Fitness*, *51*(1), 66–73.

Mazon, J., Gastaldi, A., Di Sacco, T., Cozza, I., Dutra, S., & Souza, H. (2013). Effects of training periodization on cardiac autonomic modulation and endogenous stress markers in volleyball players. *Scandinavian Journal of Medicine and Science in Sports*, *23*(1), 114–120. https://doi.org/10.1111/j.1600-0838.2011.01357.x

Medeiros, A., Marcelino, R., Mesquita, I., & Palao, J. M. (2014). Physical and temporal characteristics of Under 19, Under 21 and senior male beach volleyball players. *Journal of Sports Science and Medicine*, *13*(3), 658–665.

Moreira, A., Freitas, C. G., Nakamura, F. Y., Drago, G., Drago, M., & Aoki, M. S. (2013). Effect of match importance on salivary cortisol and immunoglobulin a responses in elite young volleyball players. *Journal of Strength and Conditioning Research*, *27*(1), 202–207. https://doi.org/10.1519/JSC.0b013e31825183d9

Nunes, R. F. H., Carvalho, R. R., Palermo, L., Souza, M. P., Char, M., & Nakamura, F. Y. (2020). Match analysis and heart rate of top-level female beach volleyball players during international and national competitions. *Journal of Sports Medicine and Physical Fitness*, *60*(2), 189–197. https://doi.org/10.23736/S0022-4707.19.10042-4

Oyola, M. G., & Handa, R. J. (2017). Hypothalamic–pituitary–adrenal and hypothalamic–pituitary–gonadal axes: sex differences in regulation of stress responsivity. *Stress*, *20*(5), 476–494. https://doi.org/10.1080/10253890.2017.1369523

Palao, J. M., Valades, D., & Ortega, E. (2012). Match duration and number of rallies in men's and women's 2000-2010 FIVB world tour beach volleyball. *Journal of Human Kinetics*, *34*(1), 99–104. https://doi.org/10.2478/v10078-012-0068-7

Peñailillo, L. E., Castro-Sepulveda, M. A., Jury, E. R., Escanilla, F. A., Deldicque, L., & Zbinden-Foncea, H. P. (2018). Differences in salivary hormones and perception of exertion in elite women and men volleyball players during tournament. *The Journal of Sports Medicine and Physical Fitness*, *58*(11), 1688–1694. https://doi.org/0.23736/S0022-4707.17.07681-2

Roli, L., De Vincentis, S., Rocchi, M. B. L., Trenti, T., De Santis, M. C., & Savino, G. (2018). Testosterone, cortisol, hGH, and IGF-1 levels in an Italian female elite volleyball team. *Health Science Reports*, *1*(4), e32. https://doi.org/10.1002/hsr2.32

Sgrò, P., Romanelli, F., Felici, F., Sansone, M., Bianchini, S., Buzzachera, C. F., Baldari, C., Guidetti, L., Pigozzi, F., Lenzi, A., & Di Luigi, L. (2014). Testosterone responses to standardized short-term sub-maximal and maximal endurance exercises: issues on the dynamic adaptive role of the hypothalamic-pituitary-testicular axis. *Journal of Endocrinological Investigation*, *37*(1), 13–24. https://doi.org/10.1007/s40618-013-0006-0

Slimani, M., Cheoura, F., Moalla, W., & Baker, J. S. (2018). Hormonal responses to a Rugby match: A brief review. *Journal of Sports Medicine and Physical Fitness*, *58*(5), 707–713. https://doi.org/10.23736/S0022-4707.17.07187-0

Turpin, J. P. A., Cortell, J. M., Chinchilla, J. J., Cejuela, R., & Suarez, C. (2008). Analysis of jump patterns in competition for elite male beach volleyball players. *International Journal of Performance Analysis in Sport*, *8*(2), 94–101. https://doi.org/10.1080/24748668.2008.11868439

Viana Gomes, D., Santos Vigário, P., Lima Piazera, B. K., Pereira Costa, F., Vaisman, M., & Salerno Pinto, V. (2019). Oxidative stress biomarkers after a single maximal test in blind and non-blind soccer players. *The Journal of Sports Medicine and Physical Fitness*, *59*(2), 267–273. https://doi.org/10.23736/S0022-4707.18.08030-1

Vingren, J. L., Kraemer, W. J., Ratamess, N. A., Anderson, J. M., Volek, J. S., & Maresh, C. M. (2010). Testosterone physiology in resistance exercise and training: The up-stream regulatory elements. *Sports Medicine*, *40*(12), 1037–1053. https://doi.org/10.2165/11536910-000000000-00000

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.20396

Adaptation of the Aquatic Functional Assessment Scale for Babies – AFAS-BABY©

Luize Bueno de Araujo[1]*, Tainá Ribas Mélo[1], Vera Lúcia Israel[1]

ABSTRACT

Despite the increasing use of the aquatic environment (AE) as a therapeutic option for activities with infants and toddlers and the increasing number of assessment instruments for land-based physical therapy, no instrument addresses the characteristics of the aquatic environment regarding babies. This study aimed to adapt the aquatic behaviors of the Aquatic Functional Assessment Scale (AFAS) for babies, encompassing infants and toddlers aged three to 24 months (AFAS-Baby). First, a child was observed in the AE by two experts, with adjustments being made by three professionals with experience in the scale. Second, 5 children were evaluated to verify both the scale's applicability and the need for adjustments in it. Lastly, 6 professionals/experts validated the content of the scale. Hence, the AFAS-Baby comprises 61 behaviors: 8 in the Adaptation (A) phase, 14 in Mastering of the water environment (D), 35 in Specialized Therapeutic Exercises (E), and 4 in Global fitness (Cd). The score remained unchanged, following the original scale. The AFAS-Baby enables the assessment of specific aquatic motor behaviors for infants and toddlers, as well as assists professionals in the aquatic stimulation of babies.

KEYWORDS: infant development, physical therapy, hydrotherapy, motor skill, evaluation.

INTRODUCTION

Aquatic physical therapy is widely used for pediatric interventions because, when immersed, the body is influenced by hydrostatic, hydrodynamic, and thermodynamic factors, with repercussions on the child's neuropsychomotor development (NPMD) (Becker, 2009; García et al., 2016).

Although the aquatic environment in all age groups is widely used, whether in health promotion (such as the stimulation of NPMD), rehabilitation, or performance, the functional motor behaviors in water-immersed bodies are scarcely described (Israel & Pardo, 2014; Santos et al., 2017). Several factors (such as the body's shape and density, the movement's intensity, rhythm, and speed) influence the body's behavior when immersed (Barbosa et al., 2006). Thus, it is important to understand how the immersed body behaves to better understand its aquatic activity.

A complete assessment leads to an adequate intervention with good results, justifying the need for a scientifically-based, systematic, and well-elaborated aquatic assessment (Barbosa et al., 2006). This environment has specific physical and thermal properties that act on the immersed body, and it is necessary to know them to improve the aquatic interventions and its benefits on land functions (Israel & Pardo, 2014). Moreover, there is a preference for the aquatic environment in some cases, which results in greater adherence (Güeita-Rodríguez et al., 2017; Muñoz-Blanco et al., 2020).

This is particularly the case of neuromotor potentials for children/babies who are in their full NPMD, who can benefit from playing and stimulating their aquatic skills in the heated pool, later transferring such learning to land-based activities (Muñoz-Blanco et al., 2020).

The literature is scarce regarding instruments that evaluate aquatic functional movements, especially in babies. Thus, the study of the movements of babies and preschoolers in the aquatic environment is an investigation field to be explored (Veloso et al., 2007; Santos et al., 2017) because it provides the basis for interventions in this age group, both for typical babies and those at risk and/or with developmental delays.

[1]Universidade Federal do Paraná, Curitiba, Brazil
*Autor Correspondente: Avenida Coronel Francisco H. dos Santos, 100, Caixa Postal: 19031, Centro Politécnico - Jardim das Américas, CEP: 81531-980 - Curitiba (PR), Brasil. E-mail: luizebueno@hotmail.com

Conflict of interests: nothing to declare. Funding: This study was financed in part by the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES) - Finance Code 001.
Manuscript received at 07 07, 2020; Accepted at 10 26, 2020.

Barbosa et al. (2006) developed a road map for physiotherapeutic assessment of water and land-based therapies, approaching adults with musculoskeletal disorders. Israel and Pardo (2014) described the application of the AFAS (Aquatic Functional Assessment Scale) for motor skills learning in adults with neurological sequelae.

Santos et al. (2017) developed a system for assessing the development of displacements in the aquatic environment for children, pointing out the need to expand to other behavioral dimensions in water immersion. Veloso et al. (2007) developed a system to categorize the baby's motor behavior for respiratory control and underwater orientation. Murcia and Pérez (2008) developed and validated a scale to measure four- to five-year-old children's perceived motor competence in aquatic environment.

As yet, no functional assessment instrument for the aquatic environment adapted for infants and toddlers has been found. The aquatic environment has been increasingly used as a therapeutic resource to stimulate the activities of typical, atypical, and/or at-risk babies for developmental delay. Despite the numerous assessment instruments for land-based physical therapy, there is a need to develop a scale that encompasses the aquatic environment's specific characteristics and its influences on the baby's water-immersed body.

To this end, it is necessary to investigate and systematize aquatic skills in babies in order to improve the underwater physical practice, aiming to improve the outcomes in the domains of activity and participation in children, as proposed by the International Classification of Functioning, Disability and Health (ICF) (Longo et al., 2018; Mélo et al., 2019; Novak et al., 2013).

This study aimed to adapt the aquatic behaviors of the Aquatic Functional Assessment Scale (AFAS) (Israel & Pardo, 2014) for babies from three to 24 months old (AFAS-Baby).

METHODS

This cross-sectional study was approved by the Research Ethics Committee of the Federal University of Paraná under CAAE: 57193516.6.0000.0102, nº 3.715.672.

The methodology consisted of two stages. In Stage I, the scale items were developed and adapted based on the motor behaviors described in the original AFAS (Israel & Pardo, 2014). This resulted in the first version of the scale for infants and toddlers up to 24 months old – considering the target population, the age range was standardized with the term "babies". Initially, two experts (one with 25 and the other 10 years of experience in the field) observed a baby 24 months old in the aquatic environment. Then, three professionals with six years of experience in applying the AFAS analyzed and discussed the original scale to determine its necessary adjustments for the adaptation of motor skills assessment for babies three to 24 months old. Also, five babies of different ages were assessed to verify the applicability of the whole scale, as well as the need for adjustments. The babies were selected by convenience, for the sample to be representative of each age group; therefore, one baby was selected out of each of the following age groups: three to six months, six to nine months, nine to 12 months, 12 to 18 months, and 18 to 24 months, with age the, 3, 7, 11, 16 and 23 months, respectively. Thereby, in this first Stage, the AFAS (Israel & Pardo, 2014) was adapted for babies, creating the Aquatic Functional Assessment Scale - Baby (AFAS-Baby). The parents and/or legal representatives interested in participating in the study signed an Informed Consent Form authorization.

Stage II consisted of the content assessment by experts/experienced researchers in the field, based on the degree of agreement (Alexandre & Coluci, 2011). The AFAS-Baby was submitted to evaluation by a committee of expert judges of Pediatric Neurofunctional Physical Therapy and/or Aquatic Physical Therapy for the analysis and assessment of the content. Fourteen experts who had not participated in Stage I were selected; however, only six of them accepted to participate in this study in Stage II and returned the material on time.

All the 6 experts who evaluated the scale were physical therapists, with an average of 8.83 years (±5,91) of clinical experience and 7.83 years (±1,94) of research in Neurofunctional Physical Therapy and/or Aquatic Physical Therapy, as well as familiarity with child assessment instruments and/or aquatic environment assessment.

These experts assessed the scope of the instrument, the characteristics of the target population, clarity and relevance of the items. After the analysis, they made suggestions for changes in the items, as well as inclusions or exclusions.

An email was sent to the selected experts inviting them to participate in the research, explaining the objectives of the study and the participation expected of each of them, as well as the deadlines for submission. A new email was sent to those who accepted the invitation, containing the Informed Consent Form for them to sign, a small questionnaire about their curriculum vitae, and a version of the AFAS-Baby. They were asked to analyze each item's semantics, content, comprehensiveness, scope, and relevance. The document described the objective of the study, the instrument, its score, and the interpretation of both the original and the adapted scales.

The questionnaire consisted of 49 items, each with the following four subitems: name of the motor behavior, its description, the scoring criteria, and the age range to which

each behavior apply. The questionnaire also had three items to evaluate the instructions, the required materials, and the general score. There were also general instructions for filling out the questionnaire, blank space for suggestions and observations, and two columns to indicate each subitem's relevance and understanding. Some examples of the questionnaire sent to the experts are presented in Table 1.

Based on the expert's assessments, a data-sheet with all the answer options was developed, scoring 1 for "in agreement" and 0 for "not in agreement". The degree of agreement between the judges was calculated based on its percentage – a 90% agreement rate between the judges was considered acceptable. The following formula was used (Alexandre & Coluci, 2011):

$$\%\ agreement = \frac{number\ of\ participants\ who\ agreed \times 100}{total\ participants}$$

Thus, behaviors with less than 90% of relevance were excluded, whereas adjustments were made to items with less than 90% of agreement.

After the analysis, adjustments were made to the AFAS-Baby, considering the results of the agreement percentage method, as well as the experts' suggestions and observations.

RESULTS

All experts reported they knew and/or to had used the original AFAS scale. They also reported they were unacquainted with any specific aquatic behavior assessment instrument for babies.

The percentage of agreement in the experts' evaluations of the general items of the scale (instructions, required materials, and general score) are shown in Table 2. Of the three items evaluated, some adjustments were made to the description of the instructions, as suggested by the evaluators, to make the information clearer.

In this first Stage of the experts' evaluation, only the understanding of the instructions had a percentage of agreement lower than 90%, which led to adjustments in its description.

In the second Stage of the evaluation, the 49 water environment behaviors approached in the scale were separately analyzed in the phases demonstrated in table 3. Regarding both the assessment of the scale and the understanding of the items, in most of them, the name of the behavior, its description, and score presented high relevance, as well as the procedures of the score.

In the adaptation (A) phase, of the nine initial behaviors, one was excluded, and two had their description adjusted,

Table 1. Example of the scale organization for expert evaluation

A1 = (a) enters the pool by the edge (b) on the lap (c) or walking	( ) Relevant ( ) Not relevant Justification / Suggestion: ( ) Understandable ( ) Not Understandable Justification / Suggestion:
Description: (a) places the child sitting on the edge of the pool, calls the baby to enter, observes the child's response; b) in the lap of the person in charge, enters by the horizontal ladder, physical therapist calls into the pool, observes the child's response; (c) a child enters the pool by walking down the ramp or stairs.	( ) Relevant ( ) Not relevant Justification / Suggestion: ( ) Understandable ( ) Not Understandable Justification / Suggestion: ( ) 0-3m ( ) 3-6m ( ) 6-9m ( ) 9-12m ( ) 12-18m ( ) 18-24 m Justification / Suggestion:
Score: 1 - does not perform; 2 - performs with full support, needs support in more than 2 parts of the body and/or goes in the lap and/or shows no interest in entering the pool and/or cries; 3 - performs with partial support, needs support in 1 or 2 parts of the body, 4 - performs without support, with motor domain and partial coordination; 5 - performs without support, with full motor domain and coordination, with interest and/or leads the upper limbs towards the water and/or smile.	( ) Relevant ( ) Not relevant Justification / Suggestion: ( ) Understandable ( ) Not Understandable Justification / Suggestion:

Table 2. Results of items evaluated by experts in the general items of the scale

	Evaluated items	Relevance	Understanding
		% agreement	
General items	Orientations	100%	83.33%
	Materials required	100%	100%
	General score	100%	100%

resulting in eight behaviors. Regarding the mastering of the water environment, there were initially eight behaviors. Two of them were excluded, and another eight were added to allow for separate scoring of right and left side performance (when the behavior had this peculiarity) or when the movement was fragmented. Hence, it totaled 14 behaviors. As for the 28 behaviors described in specialized therapeutic exercises, three were excluded, 14 had their description adjusted, nine underwent changes in their scoring, and another 10 were added to allow separate scoring in the right and left side performance and/or peculiarities suggested by the experts – it totaled 35 behaviors. The four behaviors were maintained in the global fitness phase, with only some adjustments to make their descriptions clearer.

There was no consensus between the experts when choosing the age group to which each behavior applies. Moreover, they suggested not to divide the behaviors by age group.

The scale scoring remained the same as that of the original scale, which ranges from 1 to 5 – the higher the score, the better the baby's motor skills and independence in the water.

As suggested by the experts, the behaviors were sequentially numbered to make them easier to be applied. Thus, the final version of the AFAS-Baby scale, available in Appendix 1, has 61 behaviors.

DISCUSSION

This study aimed to adapt the aquatic behaviors of the assessment AFAS for babies three to 24 months old (AFAS-Baby). The adjustments suggested by the experts were relevant not only to improve the understanding of the scale but also to allow a comprehensive approach to aquatic motor behaviors since the aquatic environment has been considered beneficial for the performance of exercises and stimulation of

Table 3. Results of the items evaluated by experts in the phases

Phases	Number of items	Name		Description		Score	
		% agreement					
		Relevance	Understanding	Relevance	Understanding	Relevance	Understanding
Adaptation (A)	6	100%	100%	100%	100%	100%	100%
	2	100%	83.33%	100%	100%	100%	100%
	1	83.33%	100%	100%	100%	100%	100%
Mastering of the water environment (D)	6	100%	100%	100%	100%	100%	100%
	1	83.33%	100%	100%	100%	100%	100%
	1	83.33%	100%	83.33%	100%	100%	83.33%
Specialized Therapeutic Exercises (E)	4	100%	100%	100%	100%	100%	100%
	5	100%	100%	83.33%	100%	100%	100%
	4	100%	100%	100%	83.33%	100%	100%
	4	100%	100%	100%	100%	100%	83.33%
	2	100%	100%	83.33%	100%	100%	83.33%
	1	66.66%	100%	100%	100%	100%	100%
	1	100%	100%	100%	66.66%	100%	100%
	1	100%	100%	100%	100%	100%	66.66%
	1	100%	83.33%	100%	83.33%	100%	100%
	1	100%	83.33%	100%	100%	100%	83.33%
	1	100%	100%	83.33%	83.33%	100%	100%
	1	83.33%	100%	83.33%	100%	100%	100%
	1	83.33%	66.66%	100%	83.33%	100%	100%
	1	100%	100%	100%	66.66%	100%	83.33%
Global fitness (Cd)	1	100%	100%	100%	100%	100%	100%
	3	100%	100%	100%	66.66%	100%	100%

different populations, including babies and children (García et al., 2016; Mcmanus & Kotelchuck, 2007).

The great number of recreational activities in the aquatic environment is beneficial due to the physical and thermal water properties (Becker, 2009). However, studies with aquatic interventions in babies and young children are scarce, and evaluations using specific instruments, as the scale proposed in this study, can assist in data collection to support more studies with these interventions.

In the literature, the outcomes in the available studies are related to land-based therapy and usually do not carry out standardized assessments in the aquatic environment (Araujo et al., 2020). This limits the possibility of extending the results, hampering the comparison between studies and narrowing, not only, the intervention strategies but also the results in the evaluated outcomes. There is a consensus on the need for standardized and systematic evaluations to measure results in order to establish the repercussions on intervention effectiveness (Barbosa et al., 2006), as well as the need for adequate instruments to plan specific actions and support public policies (Araujo et al., 2018). Despite the wide variety of evaluation instruments for land exercises, aquatic instruments are still scarce. Therefore, this study contributed to the development of an aquatic instrument, which was widely accepted by experts and minutely elaborated by different professionals with experience in this area.

The study by Yamaguchi et al. (2020) used the original AFAS (Israel & Pardo, 2014) to verify the effects of an aquatic physical therapy program on the acquisition of aquatic motor skills in adults with Parkinson's disease. The authors verified that training inside the pool improved the aquatic skills, as well as the land functional motor skills. The research by Israel (2018) used the same scale on muscular dystrophy, which enabled each participant's progress and performance in aquatic functional motor skills to be monitored. Hence, assessing the acquisitions made in the water and their transfer for use outside the aquatic environment allows for a greater understanding of the neuroplastic changes brought about by the aquatic exercise. Consequently, light is shed on how these modifications are transferred to a real environment and how the child participated in it.

Evaluations in the aquatic environment are necessary since it has specific characteristics, which makes different motor behaviors to be observed in it in comparison with those in land-based therapy (Becker, 2009; Iucksch et al., 2020). Instruments like the AFAS-Baby scale, proposed in this study, can improve the knowledge of the water-immersed body. They facilitate the development of more specific therapeutic strategies according to the needs and objectives established for the babies and provide a follow-up tool to observe the evolution in this environment, with repercussions that extend to daily life activities.

Each item's tiered score, as adopted in other studies with assessment instruments (Mancini et al., 2016; Russell et al., 2011), allows for a better acquaintance with the child's learning and motor gesture in the water, not limiting whether they performed the task or not. This scoring encompasses the independence in the behavior – with an analysis of the coordination and control, the need for supports, the number of supports they need, and the dependence or nonperformance. When the child does not perform the task, it is possible to define what were the reasons for it, whether the child refused to do it, or the professional did not manage to observe the item to be assessed. Furthermore, the total score of the phase and the scale makes it possible to quantify the child's progress. Therefore, it is a quantitative scale that allows for a qualitative analysis of the child's aquatic motor behavior.

Noticeably, for some children with neurodevelopmental delays and/or neuromotor impairments, water is an environment that makes it possible to perform motor skills (mobility) and learn behaviors, which are hampered or altogether impossible in land-based exercises (Araujo et al., 2020; Iucksch et al., 2020). Thus, the analysis and monitoring of motor behaviors in the aquatic environment are essential to evidence-based intervention protocols (Güeita-Rodríguez et al., 2019).

Through this research, various professionals who work with children in the aquatic environment will have access to an instrument that will aid in the systematic assessment, covering a wide age range and useful in different health conditions. The scale assesses the aquatic motor skills based on the child's/baby's development according to their neuromotor potential. Consequently, this will allow better oriented and more specific interventions according to the needs of each case.

The intervention program is part of following up on the progress process of the child's NPMD. Hence, based on the assessment, it is possible to know their history and health from the contextual/ecological BPS model's perspective and then establish an action plan with functional goals and objectives (Angeli et al., 2019). The aquatic assessment also makes it possible to develop and select the complexity of the tasks and aquatic exercises based on the child's potentials, allowing for repercussions in the participation of the child and relatives. Moreover, through a periodical assessment and reassessment process, it is possible to systematically control the child's progress with records, develop the aquatic stimulation program, and plan their discharge and/or referral for other activities (Yamaguchi et al., 2020).

The present research also provides a low-cost, easily accessible instrument. It is similar to the notes in the study by Mélo et al. (2019), which highlights that the use of low-cost evaluation scales, developed specifically for the child population and freely available in the literature, can assist professionals in the survey of more specific actions for the specificities of each child. Also, they provide the basis for early interventions to reverse or minimize damage to the neuropsychomotor development. This corroborates studies (Araujo et al., 2017; Araujo et al., 2019; Yamaguchi et al., 2019) that identified the need for programs to stimulate children with established developmental risks, especially under unfavorable conditions.

The assessment of learning and motor behaviors in the water can provide quantitative as well as qualitative data on the child's motor behavior with the scale's scoring system, which considers not only whether the child managed to execute the item or not but also how it was performed and what amount of support was needed. This allows the child's progress to be stratified within the same behavior, thus improving a specific item. This greater possibility of experiences provided by a stimuli-abundant environment (Morgan, Novak & Badawi, 2013) allows the child's maximum potential to be better explored, developing the baby's functioning, activity, and participation, as proposed in the biopsychosocial model (BPS) of the International Classification of Functioning (ICF) (Longo et al., 2018; Mélo et al., 2019; Novak et al., 2013; WHO, 2015;).

The limitation of this study is the scale not being validated. Hence, future studies are necessary to widen the scale's use and verify its validation with representative sample size, and stratify the expected score for each age group and/or health condition.

CONCLUSION

This study made it possible to consider specific aquatic motor behaviors for infants and toddlers aged three to 24 months, an age group not included in the original scale (AFAS) developed for adults.

The data presented in this paper can support the professional's activities in aquatic therapy with babies, both for clinical and research use. It can also support the assessment and identification of specific objectives and monitoring the progress with both qualitative and quantitative aspects in aquatic physical therapy.

ACKNOWLEDGMENTS

Gratitude is extended to CAPES for the grant. The authors would also like to thank the researchers who adopted the scale analysis phase, as well as the Academic Publishing Advisory Center (Centro de Assessoria de Publicação Acadêmica, CAPA www.capa.ufpr.br) of the Federal University of Paraná (UFPR) for their assistance with the English language translation and editing.

REFERENCES

Alexandre, N. M. C., & Coluci, M. Z. O. (2011). Validade de conteúdo nos processos de construção e adaptação de instrumentos de medidas. *Ciência & Saúde Coletiva*, *16*(7), 3061-3068. https://doi.org/10.1590/S1413-81232011000800006.

Angeli, J. M., Schwab, S. M., Huijs, L., Sheehan, A. & Harpster, K. (2019). ICF-inspired goal-setting in developmental rehabilitation: an innovative framework for pediatric therapists. *Physiotherapy Theory and Practice*, *26*, 1-10. ISSN 0959-3985. https://doi.org/10.1080/09593985.2019.1692392.

Araujo, L. B., Mélo, T. R., & Israel, V. L. (2017). Low birth weight, family income and paternal absence as risk factors in neuropsychomotor development. *Journal of Human Growth and Development*, *27*(3), 272-280. https://doi.org/10.7322/jhgd.124072.

Araujo, L. B., Mélo, T. R., & Israel, V. L. (2020). Kids Intervention Therapy - Aquatic Environment (KITE) for babies 4 to 18 months old, by following the International Classification of Functioning (ICF): clinical trial protocol. *Motriz*, *26*(1), e10200223. https://doi.org/10.1590/s1980-657420200001022.

Araujo, L. B., Novakoski, K. R. M., Bastos, M. S. C., Mélo, T. R., & Israel, V. L. (2018). Characterization of the neuropsychomotor development of children up to three years old: the ICF model in the context of the Family Health Support Center. *Cadernos Brasileiros de Terapia Ocupacional*, *26*(3), 538-557. https://doi.org/10.4322/2526-8910.ctoao1183.

Araujo, L. B., Quadros, D. A., Murata, M. P. F., & Israel, V. L. (2019). Neuropsychomotor development assessment of children aged 0 to 5 in early childhood public education centers. *Revista CEFAC*, *21*(3), e12918. https://doi.org/10.1590/1982-0216/201921312918.

Barbosa, A. D., Camargo, C. R., Arruda, E. S., & Israel, V. L. (2006). Avaliação fisioterapêutica aquática. *Fisioterapia em Movimento*, *19*(2), 135-147.

Becker, B. E. (2009). Aquatic therapy: scientific foundations and clinical rehabilitation applications. *American Academy of Physical Medicine and Rehabilitation*, *1*(9), 859-872. ISSN 1934-1482. https://doi.org/10.1016/j.pmrj.2009.05.017.

García, J. L., López, A. M. S., García, L. B., Segovia, J. P. N., & Cordero, M. J. A. (2016). Influencia de la actividad física acuática sobre el neurodesarrollo de los bebés: revisión sistemática. *Nutrición Hospitalaria*, *33*(5), 10-17. https://doi.org/10.20960/nh.515.

Güeita-Rodríguez, J., García-Muro, F., Rodríguez-Fernández, Á. L., Cano-Díez, B., Chávez-Santacruz, D., & Palacios-Ceña, D. (2019). Preliminary Aquatic Physical Therapy Core Sets for Children and Youth With Neurological Disorders: A Consensus Process. *Pediatric Physical Therapy, 31*(3), 272-278. https://doi.org/10.1097/PEP.0000000000000624.

Güeita-Rodríguez, J., García-Muro, F., Rodríguez-Fernández, Á. L., Lambeck, J., Fernández-De-Las-Peñas, C., & Palacios-Ceña, D. (2017). What areas of functioning are influenced by aquatic physiotherapy? Experiences of parents of children with cerebral palsy. *Developmental Neurorehabilitation*, *21*(8), 506-514. https://doi.org/10.1080/17518423.2017.1368728.

Israel, V. L., & Pardo, M. B. L. (2014). Hydrotherapy: Application of an Aquatic Functional Assessment Scale (AFAS) in Aquatic Motor

Skills Learning. *American International Journal of Contemporary Research*, *4*(2), 42-52.

Iucksch, D. D., Araujo, L. B., Novakoski, K. R. M., Yamaguchi, B., Carneiro, C. F., Mélo, T. R., & Israel, V. L. (2020). Decoding the aquatic motor behavior: description and reflection on the functional movement. *Acta Scientiarum. Health Sciences*, *42*, e47129. https://doi.org/10.4025/actascihealthsci.v42i1.47129.

Longo, E., Campos, A. C., & Palisano, R. J. (2019). Let's make pediatric physical therapy a true evidence-based field! Can we count on you? *Brazilian Journal of Physical Therapy*, *23*(3), 187-188. https://doi.org/10.1016/j.bjpt.2018.10.011.

Mancini, M. C., Coster, W. J., Amaral, M. F., Avelar, B. S., Freitas, R., & Sampaio, R. F. (2016). New version of the Pediatric Evaluation of Disability Inventory (PEDI-CAT): translation, cultural adaptation to Brazil and analyses of psychometric properties. *Brazilian Journal of Physical Therapy*, *20*(6), 561-570. https://doi.org/10.1590/bjpt-rbf.2014.0166.

Mcmanus, B. M., & Kotelchuck, M. (2007). El efecto de la terapia acuática sobre la movilidad funcional de los bebés y niños pequeños en Atención Temprana. *Pediatric Physical Therapy, 19*(4), 275-82. https://doi.org/10.1097/PEP.0b013e3181575190.

Mélo, T. R., Araujo, L. B., Novakoski, K. R. M., & Israel, V. L. (2019). Sistematização de instrumentos de avaliação para os dois primeiros anos de vida de bebês típicos ou em risco conforme o modelo da CIF. *Fisioterapia e Pesquisa*, *26*(4), 380-393. https://doi.org/10.1590/1809-2950/18026126042019.

Morgan, C., Novak, I., & Badawi, N. (2013). Enriched environments and motor outcomes in cerebral palsy: systematic review and meta-analysis. *Pediatrics*, *132*(3), e735-e46. https://doi.org/10.1542/peds.2012-3985.

Muñoz-Blanco, E., Merino-Andrés, J., Aguilar-Soto, B., García, Y. C., Puente-Villalba, M., Pérez-Corrales, J., & Güeita-Rodríguez, J. (2020). Influence of Aquatic Therapy in Children and Youth with Cerebral Palsy: A Qualitative Case Study in a Special Education School. *International journal of environmental research and public health*, *17*(10), 3690. https://doi.org/10.3390/ijerph17103690.

Murcia, J. A. M., & Pérez, L. M. R. (2008). Aquatic Perceived Competence Analysis in Children: Development and Preliminary Validation of a Pictorial Scale. *International Journal of Aquatic Research and Education*, *2*(4), 313-329. https://doi.org/10.25035/ijare.02.04.05.

Novak, I., Mcintyre, S., Morgan, C., Campbell, L., Dark, L., & Morton, N. et al. (2013). A systematic review of interventions for children with cerebral palsy: state of the evidence. *Developmental Medicine & Child Neurology*, *55*(10), 885-910. https://doi.org/10.1111/dmcn.12246.

Organização Mundial da Saúde (OMS). (2015). *Classificação Internacional de Funcionalidade, Incapacidade e Saúde (CIF)*. São Paulo: EDUSP.

Russell, D., Rosenbaum, P., Avery, L. & Lane, M. (2011). *Medida da função motora grossa [GMFM-66 & GMFM-88]: Manual do usuário*. São Paulo: Memnon.

Santos, C., Veloso, E., & Santos, J. (2017). Sistema de avaliação dos deslocamentos em meio aquático do bebé e criança em idade pré-escolar. Validação de um instrumento de avaliação. *Revista de Investigación en Actividades Acuáticas*, *1*(1), 3-6. https://doi.org/10.21134/riaa.v1i1.1103.

Veloso, E., Barreiros, J., & Santos, C. (2007). Respiração e orientação subaquática em piscina: Efeitos da idade, tempo de prática e duração do programa de estimulação aquática em bebés e crianças pequenas. *Brazilian Journal of Motor Behavior*, *2*(1), 11-21.

Yamaguchi, B., Ferreira, M. P. & Israel, V. L. (2020). Aquatic Physiotherapy and Parkinson's Disease: Effects on Functional Motor Skills. *Advances in Parkinson's Disease*, *9*, 1-12. https://doi.org/10.4236/apd.2020.91001.

Yamaguchi, B., Silva, A. Z., Araujo, L. B., Guimarães, A. T. B., & Israel, V. L. (2019). Psychomotor evaluation of children attending Child Education Centers in the south of Brazil. *Early Child Development and Care*, 2019, 1-8. https://doi.org/10.1080/03004430.2019.1672165.

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.20533

Comparison between Under-13 and Under-15 Soccer Players in Small-Sided and Conditioned Games

Davi Correia da Silva[1]*, Ítalo Bartole Resende[1], Fabrício Vasconcellos[2], Gibson Moreira Praça[3], Israel Teoldo[1]

ABSTRACT

The present study aims to compare players' tactical behavior and performance in Small-Sided and Conditioned Games when playing against opponents from different age levels (Under-13 and Under-15). Participated in this study 93 players from U-13 (n=42) and U-15 (n=51) teams, who performed 7,416 tactical actions. The instrument used was the System of Tactical Assessment in Soccer (FUT-SAT) to analyze players' tactical actions. Descriptive statistics and independent *t*-tests and Mann-Whitney were used considering the value of $p<0.05$. Results indicated that the players in the U-13 age level obtained a better percentage of success in the movements supporting the player in possession of the ball, and the U-15 players performed more movements that allow the team to defend in unity. In addition, players of both age levels performed similarly, although U-13 players suffered more fouls and won more throw-ins or corner kicks, whereas the U-15 age level was more effective in regaining possession of the ball but suffered fewer attacks to their goal. It was concluded that the players of the U-15 age are more compacted compared to the U-13 players. Besides, both age performances were similar even though the players of the U-15 age level were more effective.

KEYWORDS: Task Constraint, Sports Training, Tactical.

INTRODUCTION

The soccer game is characterized by a relation of cooperation and opposition between the players as actions are performed through the confrontation of the teams (Kannekens et al., 2009). During the game, teams seek to organize and balance in the playing field to generate disorganization and imbalance in the opponent's actions and consequently perform in the play (Silva et al., 2019). Thus, since this organization results from tactical actions through positioning and movements of the players (Teoldo et al., 2017), the tactical component is considered essential for sports performance (Serra-Olivares et al., 2016).

Given the importance of the tactical component in soccer and the relations of cooperation and opposition in the game, some scientific research has sought to investigate players' tactical behavior in the context of confrontations between different opponents (Gonçalves et al., 2016). The literature indicates that for a team to reach the top rank in a competition, players need to show regularity in their tactical actions in the games (Maleki et al., 2016). Therefore, when facing different opponents, players must adapt to new game contexts (Garganta & Gréhaigne, 1999). Correspondingly, the literature reports that champion teams in small-sided and conditioned games (SSCGs) tournaments have adapted better to the different opponents throughout the games (Silva et al., 2019). These authors reported that the players of the champion teams performed more tactical principles that help circulating the ball in width against the runner-up as well

[1]Núcleo de Pesquisa e Estudos em Futebol, Universidade Federal de Viçosa, Viçosa, Brazil
[2]Laboratório de Estudos em Futebol, Instituto de Educação Física e Desporto, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil
[3]Centro de Estudos em Cognição e Ação, Departamento de Esportes, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil.

*Autor Correspondente: Universidade Federal de Viçosa, CEP 36570-900, Viçosa, MG, Brazil. E-mail: davizirt@hotmail.com
Conflict of interests: Nothing to declare. Funding: This study was funded by the State Department of Sport and Youth of Minas Gerais (SEESP-MG) through the State Act of Incentive to Sports, by FAPEMIG, CNPQ, FUNARBE, the Dean's Office for Graduate and Research Studies and the Centre of Life and Health Sciences from the Universidad Federal de Viçosa, Brasil. This study was financed in part by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.
Manuscript received at 07 06, 2020; Accepted at 26 10, 2020

as more tactical principles that showed a more direct style of play against the third-placed teams. A direct style of play is an attacking style that drives players to attack the goal in a more direct fashion instead of a possession style of play.

Therefore, it is possible to observe changes in tactical actions depending on the opponent in competitions made of small-sided and condition games, usually performed in training sessions. In the context of player development, it is common to witness confrontations between teams or players of different age levels as training activities, which can lead to changes in tactical behavior mainly because of the typical characteristics of this behavior per age groups (Clemente et al., 2020; Fernández-Espínola et al., 2020; Teoldo et al., 2010).

According to Américo et al. (2016), who assessed players from U11 to U15 age levels, the effectiveness of tactical behavior tends to increase as players get older, except the U15 age level, which sharply dropped compared to other age levels. Some other studies showed that collective tactical behavior is also influenced by age (Olthof et al., 2015; Clemente et al., 2020). For example, Olthof et al. (2015) demonstrate that older players maintained a higher average distance and occupied a greater area on the field when compared to younger players in the small-sided games. More recently, Clemente et al. (2020) found that the area occupied by U15 players was greater than the one occupied by U13 players. However, the distance between the centroids of these players was similar, as there was no statistically significant difference.

However, Teoldo et al. (2010) compared the tactical behavior of soccer players and did not find significant differences between players of U13 and U15 age levels, which indicates that the behavior presented by the players of both age levels was similar. The authors also mentioned the older players obtained better performance related to offensive movements in support of the player with the ball.

Although these studies point out similarities and differences in the tactical behavior and performance of players from different age levels, all of the assessments were performed with teams composed of players of the same age level (e.g., U13 players vs. U13 players). Thus, there is a lack of information on the comparison between players of different age levels when they play against each other because there has been no study investigating the tactical behavior and performance of players from different age levels playing one against the other (U13 players vs. U15 players). It is then suggested to investigate confrontations between players of different age groups as it is an important methodological strategy that can enrich the teaching-learning process and training in soccer.

Hence, it is observed that the literature does not provide enough information for coaches to plan the use of oppositions between players of different age levels during the teaching-learning process and training activities, especially with respect to the ten core tactical principles of the game (Teoldo et al., 2009). These principles consist of standards of behavior that lead players to solve problems that emerge in the play, which the literature recommends initiating its teaching and learning from 12 years of age (Teoldo et al., 2017). The present study aims to compare the tactical behavior and performance of players in SSCGs when playing against opponents from different age levels (Under-13 and Under-15).

METHODS

This study was approved by the Human Research Ethics Committee under the protocol CAAE - 48139515.3.0000.5153. The ethical procedures followed the Helsinki declaration and Resolution norms nº. 466/2012 of the National Health Council (CNS). The study was conducted with the consent of the club legal officer and the player's guardian, who filled a free and informed consent form as well as an agreement form.

Participants

The participants consisted of 92 players of the Under 13 (n=42, M_{age} = 13.07 years, SD = 0.55) and Under 15 age levels (n=50, M_{age} = 14.76 years, SD = 0.60). The U15 players presented body mass and height values (54.27 ± 8.12 kg body weight, 1.66 ± 8.63 m height) significantly higher than U13 players (45.70 ± 8.73 kg of body mass, 1.58 ± 10.85 m of height), respectively, p <0.001; r =0.469 and p =0.003; r =0.308.

Players from both age levels performed 7416 tactical actions in 18 small-sided and conditioned games (SSCGs). They were selected amongst players from three different Brazilian clubs affiliated to the *Federação Mineira de Futebol,* which compete at the regional level. As a sample inclusion criterion, players should be participating in systematic training with a frequency of three times or more per week.

Data collection instrument

The instrument used to assess the players' behavior and tactical performance was the System of Tactical Assessment in Soccer (FUT-SAT), validated by Teoldo et al. (2011). The system consists of a field test, which is played with the following configuration: Goalkeeper + 3 vs. 3 + Goalkeeper, and is applied in a reduced playing field of 36 meters in length and 27 meters in width during four minutes. All games were filmed for further analysis.

After the field test, the instrument allows the assessment of players' tactical actions, with and without the ball.

This evaluation is based on the ten core tactical principles of the soccer game, which five of them are playing during the offensive phase (when the team has the ball): (i) penetration, progression movements of the ball carrier toward the goal and/or the opposing bottom line, (ii) offensive coverage, movements of support to the ball carrier, (iii) depth mobility, movements of players between the last defender and goal line, (iv) width and length, movements for use and expansion of the effective game space, and (v) offensive unity, movements that allow the teams to attack in unity. The five other principles are performance in the defensive phase (when the team does not have the ball): (i) delay, movements of direct opposition to the ball carrier, (ii) defensive coverage, movements of support of the player who directly opposes the ball carrier, (iii) balance, movements that ensure defensive stability in the area of the ball dispute (iv) concentration, movements that increase the goal protection and facilitate the recovery of the ball possession, and (v) defensive unity, movements that allow the team to defend in unity (Teoldo et al., 2009; Teoldo et al., 2017).

The system consists of two macro-categories (Observation and Outcome) and seven categories (Tactical Principles, Place of Action in the Game Field, Action Outcome, Tactical Performance Index, Tactical Actions, Percentage of Errors, and Place of Action Related to the Principles). The number of tactical actions and the quality of tactical principles achievement were considered to assess the tactical behavior. In turn, the values provided by the Tactical Performance Index (TPI) were considered to assess the tactical performance. The calculation of this index considers the performance of the principle (PP), quality of principle performance (QP), place of action in the game field (PA), the action-outcome (AO), and the number of tactical actions, below:

$$Tactical\ Performance\ Index\ (TPI) = \frac{\Sigma\ tactical\ actions\ (PP\ x\ QP\ x\ PA\ x\ AO)}{number\ of\ tactical\ actions}$$

Materials

A digital camera SONY® model HDR-XR100 was used to record the games. This camera was positioned in elevation and in the diagonal between a sideline and a goal line. After recording, the video material was digitally inserted into a portable computer (DELL® laptop model Inspiron® N4030 Intel Core ™ i5) via USB cable and converted into an "AVI" format using the Format Factory® software. The Soccer Analyser® software was used for image processing and game analysis. This software allows the insertion of dynamic and static spatial references that enable an objective analysis of the behavior and tactical performance of soccer players based on the realization of the core tactical principles of the soccer game.

Data collection procedure

For the FUT-SAT field test, the soccer players were divided into teams composed of one player from each positional role: defender, midfielder, and forward with the aim to balance the level of performance across the teams. Thus, players were only assigned a team regarding their level of performance and field position, disregarding the level of biological maturation or the experience (calculated in years of practice). A U13 team would only play a U15 team once. All games were played on natural grass fields. All players received numbered vests from one to six to facilitate the analysis. For the test application, the players were asked to play according to the official rules of the game (including the offside rule). Thirty seconds were granted before the assessment for the players to familiarize themselves with the test. The coaches did not provide any instruction or encouragement to the players during the test, and several size-five balls were placed next to the field to quickly replace a ball the moment another left the limits of the SSCGs.

Statistical analysis

Descriptive statistics (mean and standard deviation) were used to characterize the sample. The Kolmogorov-Smirnov tests (to assess the data distribution), the independent *t*-test (for the variables that presented normal distribution), and the Mann-Whitney test (for the variables that did not present normal distribution) were used. The software used for data analysis was SPSS version 22.0, and the significance level adopted was p <0.05. The Pearson's r effect was calculated and classified as low (<0.29), medium (0.30-0.49), and high (> 0.50) according to the calculation performed using the formulas for the independent *t*-test (a) and the Mann-Whitney test (b), respectively (Cohen, 1992):

$$r = \sqrt{\frac{t^2}{t^2 + df}} \quad (a)$$

$$r = \frac{Z}{\sqrt{n}} \quad (b)$$

Reliability

The equivalent of 10.68% of the total actions was reanalyzed for reliability, for a total of 792 tactical actions. The number of reanalyzed actions is higher than the reference number (10%) proposed in the literature (Tabachnick & Fidell, 2001).

A 21-day interval was observed before the intra and interobserver reliability analysis. Cohen's Kappa test was used to calculate reliability (Robinson & O'Donoghue, 2007). The results revealed an intraobserver reliability value of 0.813 (standard error= 0.059) and an interobserver value of 0.813 (standard error= 0.063), being classified as "near perfect" by the literature (Landis & Koch, 1977).

RESULTS

Table 1 shows that the behavior of players of the U13 age level has shown a better percentage of success in movements of support to the ball carrier (Offensive Coverage) compared to the players of the U15 age level. Players of the U15 age level have made more movements that allow the team to defend in unity (Defensive Unity) compared to the players of the U13 age level. However, these results present an effect size classified as low as specified in the statistical calculations.

Table 2 shows that players of the U13 age level obtained similar performance to their pairs of the U15 age level.

Table 3 indicates that the outcome of the actions performed by the U13 players resulted in more fouls, corners, or throw-ins in the offensive phase and suffered more strikes on goal from the opponents in the defensive phase, compared to players of the U15 age level. On the other hand, in the defensive phase, U15 players regained more ball possession compared to U13 players. However, these results present an effect size classified as low as specified in the statistical calculations.

DISCUSSION

This present study aimed to compare the tactical behavior and performance of players in Small-Sided and Conditioned Games when playing against opponents from different age levels (Under-13 and Under-15). The results showed that U13 players achieved the best percentage of success movements

Table 2. Mean and standard deviation of the Tactical Performance Index (TPI) in the confrontation between players of U13 and U15 age levels

TPI	U13	U15	p	r
Offensive				
Penetration	57.40 ± 21.22	52.54 ± 25.46	0.354	0.011
Offensive Coverage	52.12 ± 15.70	49.67 ± 16.85	0.266	0.115
Depth Mobility	46.23 ± 19.15	46.56 ± 21.25	0.820	0.023
Width and Length	41.88 ± 11.68	42.30 ± 8.53	0.841	0.002
Offensive Unity	54.77 ± 19.95	51.16 ± 17.56	0.366	0.010
Defensive				
Delay	29.89 ± 10.26	31.47 ± 12.26	0.485	0.072
Defensive Coverage	36.30 ± 15.74	37.39 ± 20.19	0.804	0.003
Balance	30.73 ± 11.03	31.30 ± 11.31	0.806	0.002
Concentration	28.62 ± 10.81	31.22 ± 15.60	0.795	0.026
Defensive Unity	33.27 ± 8.63	33.27 ± 8.23	0.997	0.000
Total				
Offensive TPI	48.21 ± 11.26	46.90 ± 9.16	0.682	0.042
Defensive TPI	31.50 ± 5.26	32.23 ± 4.63	0.475	0.007
Game TPI	38.18 ± 6.04	36.92 ± 4.81	0.267	0.012

Table 1. Mean and standard deviation of the number of actions and percentage of success in the confrontation between players of U13 and U15 age levels

	Number of Actions				Percentage of Success			
	U13	U15	p	r	U13	U15	p	r
Offensive								
Penetration	3.55 ± 2.70	3.02 ± 1.99	0.464	0.075	31.94 ± 27.92	25.36 ± 20.24	0.441	0.079
Offensive Coverage	8.72 ± 4.27	7.13 ± 3.95	0.065	0.192	41.97 ± 22.12	32.95 ± 18.90	0.031	0.223
Depth Mobility	2.20 ± 2.60	2.17 ± 2.19	0.587	0.056	23.33 ± 29.18	20.65 ± 20.84	0.818	0.023
Width and Length	12.22 ± 5.12	12.34 ± 6.42	0.923	0.001	41.70 ± 21.79	38.69 ± 20.22	0.658	0.045
Offensive Unity	5.45 ± 3.97	5.23 ± 3.60	0.903	0.012	34.28 ± 26.88	32.14 ± 23.31	0.931	0.009
Defensive								
Delay	7.17 ± 3.07	6.71 ± 3.00	0.619	0.051	39.79 ± 22.44	31.70 ± 19.37	0.108	0.166
Defensive Coverage	2.05 ± 1.78	1.67 ± 1.54	0.355	0.095	25.83 ± 24.15	22.46 ± 25.14	0.372	0.092
Balance	6.55 ± 4.06	6.39 ± 3.02	0.814	0.024	29.33 ± 22.88	28.69 ± 18.31	0.811	0.024
Concentrantion	4.55 ± 3.05	4.34 ± 2.86	0.920	0.010	33.12 ± 25.70	32.42 ± 22.09	0.831	0.022
Defensive Unity	12.10 ± 4.25	14.56 ± 5.67	0.027	0.025	40.65 ± 17.81	49.33 ± 26.20	0.080	0.020
Total								
Offensive	32.15 ± 8.87	29.91 ± 7.91	0.220	0.014	52.83 ± 20.57	46.07 ± 16.42	0.063	0.192
Defensive	32.42 ± 8.03	33.69 ± 8.33	0.690	0.041	54.65 ± 17.21	56.12 ± 19.11	0.711	0.004

to offensive supporting the player with the ball whilst U15 players performed more movements that allowed the team to defend in unity. Also, there was no difference in tactical performance during a confrontation of the U13 against U15. Otherwise, players of the U13 age level suffered more fouls, won more corners and throw-ins in the offensive phase, and suffered more shots at their own goal in the defensive phase compared to the players of the U15 age level. In the defensive phase, the U15 players regained more ball possession compared to U13. However, all results present an effect size classified as low as specified in the statistical calculations.

The U13 players were more likely to accomplish correct movements to support the player with the ball in the offensive phase, which facilitates the tactical-technical responses of the player with the ball and reduces the opponent's pressure on him (Teoldo et al., 2017). In turn, players of the U15 age level made more movements that allow the team to defend as a whole: these movements indicate that they were able to reduce the spaces between the lines during the defensive phase. These movements are characterized by the unitary concept of defense, which seeks to ensure an organization capable of coordinating defensive movements outside the center of play (Teoldo et al., 2017). These results do not corroborate the findings of Teoldo et al. (2010) since the authors do not report differences in the tactical behavior of players in U13 and U15 age levels. However, it is important to highlight the study by Teoldo et al. (2010) did not compare the tactical behavior of the players in confrontation, which can generate different motivations for playing.

Therefore, the factor that may explain the greater frequency in movements that allow the team to defend as a whole is the moment in which the U15 players are going through their teaching-learning and training process of the core tactical principles of the soccer game. According to the literature, it is recommended that core tactical principles should be incorporated in training from the U13 age level, which is the age associated with a greater capacity of abstraction, promoting the accomplishment of all the movements of the mentioned principles (Teoldo et al., 2017). Thus, U15 players have more experience in training that favors the accomplishment of more complex movements outside the center of play.

Additionally, Américo et al. (2016) recommend that the teaching of tactical principles should occur gradually. Therefore, players in the U13 age level must experience teaching principles that occur within the center of play and the principles of width and length, concentration, and balance (near the center of play). At the same time, players in the U15 age level must experience the principles of depth mobility, offensive unity, and defensive unity that are further from the center of play (in addition to principles in and near the center of play). In this regard, U15 players may have played more movements that allow the team to defend in unity due to the phase in the teaching-learning process and training and the consequent experience in specific soccer training, to the detriment of confronting with young players.

On the other hand, besides experience in training tactical principles, players in the U15 age level are more likely to have participated in competitions and/or matches considered relevant, as in rich in tactical content and competitive (Ford et al., 2012). According to Kannekens et al. (2009), participation in such relevant competitions and matches are factors that influence players' behavior. In addition to these experiences, another factor that may explain the capacity to compact shown by the U15 players matches the finding of Philippaerts et al. (2006), who demonstrated that older players tend to perform better in the defensive phase because the

Table 3. Mean and standard deviation of the action outcomes in the confrontation between players of U13 and U15 age levels

Action Outcomes	U13	U15	p	r
Offensive				
Shoot at goal	3.02 ± 2.57	2.80 ± 1.75	0.659	0.045
Keep possession of the ball	21.71 ± 8.48	20.37 ± 6.75	0.398	0.009
Earn a foul, win a corner or throw-in	2.00 ± 1.32	1.45 ± 1.20	0.023	0.235
Commit a foul, five away a corner or throw-in	1.90 ± 1.33	1.84 ± 1.17	0.821	0.023
Loss of ball possession	3.23 ± 1.75	3.19 ± 1.77	0.575	0.058
Defensive				
Regain the ball possession	3.02 ± 2.08	3.82 ± 1.92	0.025	0.232
Earn a foul, win a corner or throw-in	1.95 ± 1.20	2.29 ± 1.34	0.179	0.139
Commit a foul, five away a corner or throw-in	1.45 ± 1.27	1.78 ± 1.25	0.140	0.153
Ball possession of the opponent	22.90 ± 6.87	23.70 ± 8.09	0.957	0.005
Take a shot at own goal	3.42 ± 1.96	2.60 ± 2.23	0.008	0.273

physical component is more developed compared to their younger peers. In line with this, Andrade and Teoldo (2015) argue that older players tend to take advantage of defensive tactical performance because defensive movements require more of the physical component compared to offensive ones.

Specifically, in terms of performance, the fact that U13 players do not present differences in tactical performance compared to U15 players should be considered as a positive point for the teaching-learning process and training of players in this age group. Considering the direct confrontation between the age levels, players of the U13 age level may have maintained the performance due to the motivation in performing their actions in a context of greater difficulty. Therefore, this can be a substantial factor for younger players to be able to raise their performance levels throughout the training process since the literature indicates that motivation is a preponderant factor to raise sports performance (Forsman et al., 2015).

Furthermore, the fact that there are no harmful consequences to the performance of U13 players implies that they are able to play their older peers, and therefore coaches can submit them to direct confrontation games. This is justified because players could maintain performance similar to their older counterparts, resisting the constraints imposed by their opponents despite the physical disadvantages (Andrade & Teoldo, 2015), even if U15 players are taller and heavier than the U13's. Inversely, this confrontation may be interesting to provide new experiences to the U15's because they train with other players besides those who compose their team. This acquisition of experience can be beneficial for U15 players' performance (Ericsson, 2008).

In terms of action outcomes, the consequent compaction that U15 players presented through the movements that allow the team to defend in unity may have hindered the offensive actions performed by the U13 players, who lost more ball possession and suffered more shots at their own goal. This result is similar to findings in the literature that show that the reduction of spaces between defensive lines can cause a technical-tactical and psychological pressure on players who accomplish offensive actions and subsequently cause more losses of ball possession (Garganta et al., 2013). Besides, these results corroborate the findings in the literature, which indicate that compaction between the lines tends to contribute to the defensive organization because reducing the available space for the opponent increases the probability for them to commit errors and thus generates an increase in the defensive efficiency (Maleki et al., 2016, Teoldo et al., 2017).

Therefore, the fact that players in the U13 age level are lower and lighter than U15's may have been the reason why these players suffered more fouls or won more throw-in and corners. Thus, to use direct confrontation between age levels in the teaching-learning and training process, the coach can consider the following aspects. First, U15 players will be better able to perform their actions that require abstract thinking (outside the center of play) compared to U13 players (Teoldo et al., 2017), besides the physical advantages they have over their younger peers (Andrade & Teoldo, 2015). Therefore, the coach can use this training feature to provide U13 players with actions that require abstract thinking when confronting their older counterparts, or inversely, offer the U15 the opportunity to improve their effectiveness in terms of action outcome. Also, coaches could use direct confrontation between age levels to include and/or fix specific content in the teaching and learning process, such as rehearsed combinations of play or behavior patterns so that they can perform them in a more complex context. It is also worth noting the importance of the confrontation between age levels during the transition periods, such as when U13 graduates to the U15 age level the following year.

In terms of practical application, the use of confrontation between age levels may be relevant when the structural conditions available for training do not provide proper training for all players in the same age levels. In this case, this confrontation would facilitate the use of the space for activities involving two age levels simultaneously. Besides, as mentioned previously, such confrontation can be a useful tool in the process of transition between age levels and potentially lead to a significant improvement in the young soccer players' training due to the interaction of players with differences in performance levels (Machado et al., 2019).

The results of this research can contribute to coaches, researchers, and professionals involved in the soccer teaching-learning and training process in terms of understanding the use of confrontation between age levels. Although the results of this research contribute to the progress of the studies related to the tactical component and the constraints manipulation, some limitations must be observed. The contents taught were not investigated to verify if the teaching of tactical principles is being used according to what is recommended in the literature. Also, the players' practice time in systematized training and associated activities, as well as the players' motivation during the task, were not investigated. This information could explain better the results, but it is suggested that further research was conducted to investigate the comparison between age levels, using different age groups from those assessed in this study to understand how players and teams perform their actions in confrontation between different age levels.

CONCLUSIONS

It is concluded that direct confrontation games between the U13 and U15 age levels lead players to compress more the team compared to the players of the U13 age level. However, players performance in both age levels is similar despite the differences found in the outcomes of the tactical actions: U13's earned more fouls, won more throw-ins or corners in the offensive phase, and suffered more shots at their own goal in the defensive phase whereas U15's could regain more ball possession in the defensive phase.

Practically, controlling and assessing the tactical component in this type of confrontation may favor the players' training process regarding the use of this manipulation by technical staff members. Therefore, in situations of club's structural conditions limitations in which two age levels have to accomplish the training in the same space, or in situations of transition between the one age level to the next, the use of this confrontation can be a positive alternative.

REFERENCES

Américo, H., Cardoso, F., Machado, G., Andrade, M., Resende, E., & Teoldo, I. (2016). Analysis of the tactical behavior of youth academy soccer players. *Journal of Physical Education*, *27*(1), 2710–2719. http://dx.doi.org/10.4025/jphyseduc.v27i1.2710

Andrade, M., & Teoldo, I. (2015). Como a eficiência do comportamento tático e a data de nascimento condicionam o desempenho de jogadores de futebol? *Revista Brasileira de Educação Física e Esportes*, *29*(3), 465–473. http://dx.doi.org/10.1590/1807-55092015000300465

Clemente, F., Castillo, D., & Arcos, A. (2020). Tactical analysis according to age-level groups during a 4 vs. 4 plus goalkeepers small-sided game. *International Journal of Environmental Research and Public Health*, *17*, 1667. http://dx.doi.org/10.3390/ijerph17051667

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-9.

Ericsson, K. A. (2008). Deliberate practice and acquisition of expert performance: a general overview. *Academic emergency medicine*, *15*(11), 988-994. http://dx.doi.org/10.1111/j.1553-2712.2008.00227.x

Fernández-Espínola, C., Robles, M. T. A., Fuentes-Guerra, F. J. G. (2020). Small-sided games as a methodological resource for team sports teaching: a systematic review. *International Journal of Environmental Research and Public Health*, *17*(6),1884. http://dx.doi.org/10.3390/ijerph17061884

Ford, P. R., Carling, C., Garces, M., Marques, M., Miguel, C., Farrant, A., … Williams, M. (2012). The developmental activities of elite soccer players aged under-16 years from Brazil, England, France, Ghana, Mexico, Portugal and Sweden. *Journal of Sports Sciences*, *30*(1), 1–11. https://doi.org/10.1080/02640414.2012.701762

Forsman, H., Gråstén, A., Blomqvist, M., Davids, K., Liukkonen, J., & Konttinen, N. (2015). Development of perceived competence, tactical skills, motivation, technical skills, and speed and agility in young soccer players. *Journal of Sports Science*, *34*(14), 1-8. https://doi.org/10.1080/02640414.2015.1127401

Garganta, J., & Gréhaigne, J. (1999). Abordagem sistêmica do jogo de futebol: Moda ou necessidade? *Movimento*, *5*, 40-50.

Garganta, J., Guilherme, J., Barreira, D., Brito, J., & Rabelo, A. (2013). Fundamentos e prática para o ensino e treino do futebol. In F. Tavares (Ed.), *Jogos desportivos coletivos: ensinar a jogar* (pp. 199–263). Porto: Faculdade de Desporto da Universidade do Porto: Centro de Estudos dos Jogos Desportivos.

Gonçalves, B., Marcelino, R., Torres-Ronda, L., Torrents, C., & Sampaio, J. (2016). Effects of emphasising opposition and cooperation on collective movement behavior during football small-sided games. *Journal of Sports Sciences*, *34*, 1346–1354.

Kannekens, R., Elferink-Gemser, M. T., & Visscher, C. (2009). Tactical skills of world-class youth soccer teams. *Journal of Sports Sciences*, *27*(8), 807–812. https://doi.org/10.1080/02640410902894339

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159–174.

Machado, J. C., Barreira, D., Teoldo, I., Travassos, B., Júnior, J. B., Santos, J. O. L. D., & Scaglia, A. J. (2019). How does the adjustment of training task difficulty level influence tactical behavior in soccer?. *Research quarterly for exercise and sport*, *90*(3), 403-416. http://dx.doi.org/10.1080/02701367.2019.1612511

Maleki, M., Dadkhah, K., & Alahvisi, F. (2016). Ball Recovery Consistency as a Performance Indicator in Elite Soccer. *Revista Brasileira de Cineantropometria e Desempenho Humano*, *18*(1), 72–81. http://dx.doi.org/10.5007/1980-0037.2016v18n1p72

Olthof, S. B. H., Frencken, W. G. P., Lemmink, K. A. P. M. (2015). The older, the wider: on-field tactical behavior of elite-standard youth soccer players in small-sided games. *Human Movement Science*, *41*, 92–102.

Philippaerts, R., Vaeyens, R., Moreno, J., Van Renterghem, B., Matthys, D., Craen, R., … Malina, R. (2006). The relationship between peak height velocity and physical performance in youth soccer players. *Journal of Sports Sciences*, *24*(3), 221–230. https://doi.org/10.1080/02640410500189371

Robinson, G., & O'Donoghue, P. (2007). A weighted kappa statistic for reliability testing in performance analysis of sport. *International Journal of Performance Analysis in Sport*, *7*(1), 12–19. https://doi.org/10.1080/24748668.2007.11868383

Serra-Olivares, J., Clemente, F. M., & González-Víllora, S. (2016). Tactical expertise assessment in youth football using representative tasks. *SpringerPlus*, *5*, 1301. http://dx.doi.org/10.1186/s40064-016-2955-1

Silva, D. C., Costa, V. T., Casanova, F., Clemente, F. M., & Teoldo, I. (2019). Comparison between teams of different ranks in small-sided and conditioned games tournaments. *International Journal of Performance Analysis in Sport*, *19*(4), 608-623. http://dx.doi.org/10.1080/24748668.2019.1643598

Tabachnick, B., & Fidell, L. (2001). *Using multivariate statistics: International Edition*. London: Pearson Education.

Teoldo, I., Garganta, J., Greco, P., & Mesquita, I. (2009). Tactical Principles of Soccer: concepts and application. *Motriz*, *15*(3), 657-668.

Teoldo, I., Garganta, J., Greco, P., Mesquita, I., & Afonso, J. (2010). Assesment of tactical principles in youth soccer players of different age groups. *Revista Portuguesa de Ciência do Desporto*, *10*(1), 147–157. http://dx.doi.org/10.5628/rpcd.10.01.147

Teoldo, I., Garganta, J., Greco, P., Mesquita, I., & Maia, J. (2011). System of Tactical Assessment in Soccer (FUT-SAT): Development and preliminary validation. *Motricidade*, *7*(1), 69–83. https://doi.org/10.6063/motricidade.7(1).121

Teoldo, I., Guilherme, J., & Garganta, J. (2017). *Training football for smart playing: On tactical performance of teams and players*. Curitiba: Appris

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.20647

Influência do ambiente na motivação esportiva: comparação entre espaços sistematizados e não sistematizados de prática

Influence of the environment on sports motivation: comparison between systematized and non-systematized spaces for practice

Vinicius Machado de Oliveira[1]*, Marcos Roberto Brasil[1,2], Verônica Volski Mattes[1,3], Pedro Henrique Iglesiaz Menegaldo[1], Neidiana Braga da Silva Souza[1], Schelyne Ribas[4]

RESUMO

Este trabalho teve como objetivo comparar a motivação esportiva entre espaços sistematizados e não sistematizados de prática. Participaram do estudo 381 crianças e adolescentes, de ambos os sexos, com idades entre 10 e 18 anos. A amostra foi constituída de acordo com o local de prática relatado pelo participante, distribuída em três grupos: [1] Treinamento, [2] Escola e [3] Outros (praças, clubes, quadras públicas, casa, rua etc.). O instrumento utilizado para aferir a motivação esportiva foi o *Sport Motivation Scale* (SMS). Após as análises estatísticas, constatou-se que o treinamento é o local onde se verifica os maiores níveis motivacionais, sendo significativamente mais acentuado quando comparado com outros ambientes. Nessa direção, depreende-se que a Educação Física escolar não consegue fornecer níveis próximos de motivação ao treinamento, apresentando, inclusive climas motivacionais equivalentes a outros locais não sistematizados de prática.

PALAVRAS-CHAVE: Educação Física Escolar, Esporte Recreativo, Psicologia do Esporte Treinamento.

ABSTRACT

This study aimed to compare sports motivation between systematized and non-systematized spaces of practice. Three hundred eighty-one youths of both sexes, aged between 10 and 18, participated in this study. The sample was constituted according to the practice location reported by the participant, distributed in three groups: (1) Training, (2) School, and (3) Others (public parks, clubs, public sports courts, house, street, etc.). The instrument used to measure sports motivation was the Sport Motivation Scale (SMS). After statistical analysis, it was found that training is the place where there are the greatest motivational levels, being significantly more accentuated when compared to other environments. In this direction, it was found that school Physical Education cannot provide motivation levels close to training, presenting motivational climates equivalent to other non-systematic places of practice.

KEYWORDS: School Physical Education; Recreational Sport; Sport Psychology; Training.

INTRODUÇÃO

O esporte, como se sabe, é um dos fenômenos sociais que mais ganhou relevo na sociedade moderna (Bracht, 2005; Costa & Kunz, 2013). Se há alguma dúvida disso, basta visualizar a proporção que essa atividade biopsicossocial assumiu nas últimas décadas, alcançando os mais diferentes contextos do globo, bem como os diferentes estratos sociais da sociedade (Campos et al., 2011). Em linhas gerais, o esporte, como uma prática heterogênea e polissêmica (Marchi-Júnior et al., 2018), com o decorrer do tempo vem ganhado diferentes apropriações, extrapolando a própria dimensão da prática. Isto é, devido ao peso funcional que o campo esportivo

[1]Programa de Pós-Graduação Associado em Educação Física UEM/UEL, Universidade Estadual de Maringá - UEM, Maringá, Brasil.
[2]Departamento de Educação Física, Uniguairacá Centro Universitário, Guarapuava, Brasil.
[3]Departamento de Educação Física, Universidade Estadual do Centro-Oeste –UNICENTRO, Guarapuava, Brasil.
[4]Departamento de Eduicação Física, Universidade Federal de Mato Grosso – UFMT, Cuibá, Brasil.
*Autor Correspondente: Rua dos Abacateiros, 70 – Bairro Conradinho, CEP: 85060-450, Guarapuava, Paraná, Brasil; E-mail: oliveira_vm@hotmail.com

Conflito de interesses: Nada a declarar. Financiamento: Nada a declarar
Artigo recebido a 07 29, 2020; Aceite a 30.10.2020

conquistou no tecido social hodierno, outros campos acabaram também se vinculando a esse espaço, a exemplo, dos campos econômicos e da informação (Bourdieu, 1997). Em outros termos, com o processo de espetacularização e mercantilização, o esporte pôde ampliar ainda mais o seu raio de ação no tecido social, levando cada vez mais pessoas a envolverem-se de múltiplas formas com as manifestações proporcionadas por esse fenômeno.

Dentro desta atmosfera dinâmica e imersiva criada ao redor do esporte, seja por motivações intrínsecas ou extrínsecas, os indivíduos desde muito novos são atraídos por essa prática ludomotora. De acordo com Cagigal (1972) e Parlebas (1997), o esporte tem total relevância na vida das crianças e adolescentes, uma vez que essa prática permite que o indivíduo descubra, aprimore ou transforme a sua personalidade. No entanto, mais do que isso, através do esporte, como um ambiente de descontrole controlado das emoções (Elias & Dunning, 2019), as crianças podem ser estimuladas a colocar em exercício as suas relações de interdependência (Elias, 2011a), de modo a saber a gerenciar uma gama de sensações e sentimentos, que podem ser refletidos fora do campo esportivo, tal como frustração, raiva, tensão, medo, euforia e uma série de outras pulsões da intimidade humana (Oliveira & Souza, 2018).

Subjacente a esse argumento, chama-se atenção para o fato de que a escola, para muitos, é o primeiro local onde as crianças podem estabelecer vínculos iniciais com o esporte e, por isso, diante de todos os benefícios supracitados e já conhecidos dessa atividade motriz, é imprescindível que a prática seja articulada a um ambiente prazeroso, agradável e durável (Souza, 2019). Por sinal, é justamente nessa esteira que se circunscreve o papel da Educação Física, que, como uma ciência da motricidade (Sergio, 1994) ou do homem em movimento (Cagigal, 1972), tem por responsabilidade propiciar a construção de biografias de movimento (Souza, 2019). Nesse sentido, se o esporte é um dos principais conteúdos de intervenção da Educação Física, não haveria o porquê pintar um quadro de decadência ou pessimismo em relação ao desporto no ambiente escolar, tendo em vista o imaginário negativo em torno de sua espetacularização. Aliás, essa própria midiatização que se construiu sobre esporte serviu como um ingrediente extra para cooptar cada vez mais a atenção das crianças para o desporto (Parlebas, 1997).

Diante de todo o fascínio por essa expressão do movimentar-se, bem como das reconhecidas prerrogativas do "ser esportivo" (Bourdieu, 1983), é que o esporte, nas últimas décadas, virou escopo de inúmeros campos de investigação, desde as ciências *soft* até as *hard* (Costa & Kunz, 2013). E uma das áreas que ganhou proeminência nas últimas décadas, com efeito, foi a área da Psicologia do Esporte, que dentre os vários objetivos estabelecidos no âmbito dos estudos comportamentais, colocou como desafio procurar compreender as principais motivações que levam os agentes sociais a buscarem as práticas esportivas. Por seu turno, em face desse desiderato, a Psicologia do Esporte vem demonstrando que quanto mais motivador é o ambiente onde o indivíduo vivencia suas atividades motrizes, mais o sujeito se sente estimulado a continuar envolvido com as práticas de interesse (Bernardes et al., 2015; Coimbra et al., 2013; Vieira et al., 2011). Por isso, torna-se imprescindível o trabalho da Educação Física escolar.

No lastro desse raciocínio, pensando que o esporte é um dos conteúdos reconhecidamente obrigatórios das aulas de Educação Física, e que os indivíduos passam em média 12 anos de sua vida no contexto escolar (pelo menos no que concerne à realidade brasileira), logo torna-se um grande desafio para os professores manter os escolares aderentes ao esporte. Entretanto, mais do que isso, a Educação Física escolar carrega a missão de produzir ambientes de aprendizagem prazerosos e duradouros, de modo que o contato com o mover-se continue mesmo após o término da vida escolar (Souza, 2019). Dessa forma, tendo em vista que a escola é um ambiente sistematizado de prática, com a presença de um mediador do movimento, será que a escola consegue produzir climas motivacionais suficientemente imersivos quando comparada a outros locais de prática, como espaços sistematizados de treinamento ou não sistematizados como o caso de ambientes recreativos (praças, clubes, quadras recreativas, rua etc)? Em que pese a hipótese de que no treinamento, devido aos seus elementos constitutivos, possa possibilitar uma motivação mais preponderante, ainda sim crê-se que a Educação Física escolar não está tão distante neste requisito.

Em outras palavras, dada função da Educação Física nas escolas, é esperado que a disciplina consiga fornecer climas motivacionais satisfatórios, sobretudo quando confrontada com ambientes casuais de prática, que aqui chamamos de espaços não sistematizados que seriam aqueles locais em que os praticantes realizam suas atividades motrizes por conta própria, ou seja, sem a supervisão ou orientação de algum profissional da Educação Física. Assim sendo, é provável que o treinamento e a escola devido a figura do mediador do movimento reservariam alguma vantagem sobre os ambientes informais de prática, especialmente no que diz respeito ao aspecto motivacional.

Nesse sentido, diante da hipótese ventilada e mediante a necessidade de mais estudos acerca da motivação esportiva na esfera escolar (Caruzzo et al., 2017; Januário, et al., 2012; Zahariadis et al., 2005), o presente estudo teve como objetivo comparar a motivação esportiva entre espaços sistematizados (Treinamento/Escola) e não sistematizados de prática

(praças, clubes, quadras recreativas, rua), procurando verificar em que posição a Educação Física escolar se insere. Ademais, para além desse desiderato geral, o estudo procura também identificar as atividades esportivas realizadas nos ambientes perscrutados, os níveis e os tipos de motivação presentes em cada espaço, a associação entre a motivação e local de prática, bem como a influência do tempo de prática na motivação.

MÉTODO

Características do estudo e cuidados éticos

O empreendimento aqui proposto apresenta características de uma pesquisa assente no terreno das investigações transversais. Caracteriza-se também por sua abordagem descritiva com intervenções analíticas de gênero quantitativo e qualitativo (Thomas et al., 2007). É oportuno destacar que, como a pesquisa foi realizada com seres humanos, o estudo foi inicialmente submetido a análise de comité de ética e posteriormente aprovado pelo Parecer 487.685/2013 (CAAE: 23127713.8.0000.0106), estando em concordância com as regulamentações indicadas pelo Conselho Nacional de Saúde (CNS), bem como com os regimentos da Declaração de Helsínquia.

Participantes

Participaram neste estudo 381 escolares, de ambos os sexos e com idades compreendidas entre 10 a 18 anos. Os níveis de escolaridade variavam do 6º ano do ensino fundamental (a partir do 2º ciclo do ensino básico) até o último ano do nível médio (últimos anos do secundário). A coleta foi realizada em 7 escolas públicas brasileiras de um município do interior do estado do Paraná/Brasil. É oportuno ressaltar também que amostra foi composta por conveniência, em função da voluntariedade dos escolares e das escolas em participar do estudo.

Para a realização da pesquisa, os escolares foram estratificados quanto ao local de prática esportiva. Assim estabeleceu-se 3 grupos: "Treinamento" (locais sistematizados de prática com fins de performance); "Escola" (ambiente sistematizado via disciplina de Educação Física, com caráter educacional) e Outros (espaços não sistematizados como clubes, quadras públicas, praças, ruas, casas, dentre outros espaços, direcionados para fins recreativos). Cabe destacar que o número final de participantes (n: 381) foi estabelecido em função do grupo de treinamento. Isto é, num universo de 1280 alunos investigados, apenas 127 praticavam esportes no âmbito de treinamento. Dessa forma, objetivou-se estratificar os demais grupos de acordo com as características do grupo Treinamento, a fim de reduzir ao máximo possíveis fatores de interveniência nos resultados (Figura 1). Por conseguinte, aprouve respeitar os mesmos quantitativos de participantes, tanto no que concerne a faixa etária como o sexo dos escolares.

A estratificação da amostra de acordo com os grupos perscrutados é apresentada a seguir, através das frequências absolutas e relativas (Tabela 1).

Instrumentos e procedimentos de pesquisa

Como instrumento de análise da motivação esportiva mobilizou-se o questionário *Sport Motivation Scale* (SMS), elaborado por Pelletier et al. (1995), testado e validado para os falantes da língua portuguesa por Serpa et al. (2004) (Portugal) e Costa et al. (2011) (Brasil). De forma geral, o SMS trata-se de um instrumento composto por 28 itens/perguntas que permitem avaliar os níveis motivacionais para a prática desportiva em torno de 7 subescalas, que se subdividem em dimensões intrínsecas, extrínsecas e amotivação[1] (casos de desmotivação).

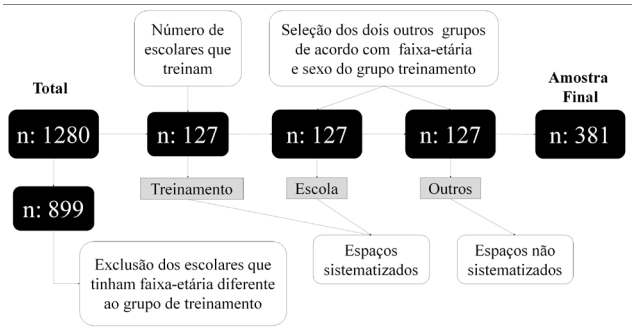

Figura 1. Critérios de seleção da amostra

Tabela 1. Número de participantes de acordo com a estratificação em faixa etária e sexo

Local	Idade		Sexo	
	10 a 14 anos	15 a 18 anos	Feminino	Masculino
	n(f)	*n(f)*	*n(f)*	*n(f)*
Escola	85 (66.93%)	42 (33.07%)	40 (31.50%)	87 (68.50%)
Treinamento	85 (66.93%)	42 (33.07%)	40 (31.50%)	87 (68.50%)
Outros	85 (66.93%)	42 (33.07%)	40 (31.50%)	87 (68.50%)
Total	381 (100,0%)		381 (100,0%)	

Nota: Estratificação dos grupos em relação ao local de prática.

[1]O mesmo que desmotivação. Em alguns estudos de validação do SMS, a dimensão desmotivação pode aparecer com a nomenclatura "amotivação", como no estudo de validação de Serpa e colaboradores. Ver: Serpa, S., Alves, P., Barreiros, A. (2004). *Versão portuguesa da Sport Motivational Scale (SMS) e da Sport Academic Scale (AMS): processos de tradução, adaptação e fiabilidade*. Tese de doutorado, Universidade Técnica de Lisboa, Lisboa, Portugal.

O SMS conta com as seguintes dimensões: (1) Motivação Intrínseca para Conhecer (MI-C): aspectos da motivação relacionados ao interesse pela busca de conhecimentos sobre o desporto praticado; (2) Motivação Intrínseca para Atingir Objetivos (MI-AO): essa dimensão está associada ao prazer que o indivíduo constrói ao dominar técnicas e habilidades da atividade motriz que pratica; (3) Motivação Intrínseca para Experiências Estimulantes (MI-EE): também de cunho intrínseco, essa dimensão motivacional está atrelada à busca por sensações prazerosas como divertimento, euforia, excitação; (4) Motivação Extrínseca de Regulação Externa (ME-RE): o indivíduo pratica o esporte, em alguma medida, preocupado com prerrogativas e recompensas exteriores a prática. (5) Motivação Extrínseca de Introjeção (ME-I): o sujeito coloca o esporte como uma obrigatoriedade em sua rotina por pressões incutidas por ele próprio, podendo se sentir mal por não praticar; (6) Motivação Extrínseca de Identificação (ME-ID): o agente crê que o esporte possa contribuir e agregar em outras áreas, como nas relações sociais por exemplo; (7) Desmotivação: na percepção dessa dimensão, o indivíduo não se sente mais seduzido pelo esporte, não havendo estímulos suficientes que o façam sentir esperança na prática.

Em termos de aplicação do questionário, em um primeiro momento, o respondente sinaliza o esporte praticado. Na sequência, ele deve ler cada item e assinalar o seu nível motivacional de acordo com a escala *likert* proposta pelo instrumento. A escala varia de 1 a 7 pontos, sendo distribuída dentro das seguintes categorias de respostas: (1) - não corresponde nada; (2 ou 3) - corresponde um pouco; (4) - corresponde moderadamente; (5 a 6) - corresponde muito; (7) - corresponde exatamente. Assim, face a essas opções, quanto mais alto o valor atribuído pelo agente, maior é a motivação para o desporto, com exceção dos itens desmotivacionais cuja cotação se dá de maneira inversa, ou seja, quanto menor o valor relatado pelo respondente, menos desmotivado o indivíduo se apresenta.

Para obtenção da motivação referente a cada subescala do instrumento, soma-se os valores atribuídos nos itens correspondentes à dimensão e depois divide pelo número de itens da escala, chegando, portanto, há um valor médio para a dimensão analisada. Com essa cotação é possível determinar a intensidade e as razões pelas quais os agentes se sentem mais motivados para a atividade esportiva.

Análise estatística

Para a análise dos dados, utilizou-se o software *Statistical Package for Social Science* (SPSS) versão 25.0. Com os dados cadastrados no programa, executou-se, primeiramente, o teste *Kolmogorov-Smirnov com o objetivo* de testar a simetria dos dados. Como o teste identificou assimetria, aprouve adotar a estatística inferencial não paramétrica. Com efeito, para as comparações entre grupos (Treinamento/Escola/Outros) realizou-se o teste de *Kruskal Wallis*, seguido de múltiplas comparações para encontrar onde localizavam-se as diferenças. Além disso, também foi realizado o teste de *Qui-Quadrado,* para identificar possíveis associações entre o local de prática e o desempenho motivacional. Cabe destacar que, para essa análise, a motivação esportiva dos participantes foi estratificada de acordo com uma classificação sugerida em função do próprio sistema de pontuação atribuído pelo instrumento. Assim, chegou-se a seguinte divisão: (escore entre 0 a 2,33) – motivação baixa; (escore entre 2,34 até 4,66) – motivação moderada; (escore entre 4,67 até 7,00) – motivação alta. Nessa esteira, com a verificação da motivação média encontrada entre os participantes, era possível determinar como se classificava a motivação.

Ademais, empregou-se o teste *Mann Whitney*, que foi utilizado para realizar uma comparação da motivação entre o tempo de prática para o grupo de "Treinamento", a fim de verificar se o tempo de contato com a atividade motriz interfere nos níveis motivacionais. Por fim, é importante mencionar que os resultados foram apresentados por via de gráficos e tabelas, sendo expressos em frequências absolutas e relativas; médias, medianas e intervalos interquartílicos. O valor de significância adotado para as análises foi de $p<0.05$.

RESULTADOS

Para o inquérito inicial da investigação, procurou-se em um primeiro momento identificar a modalidade esportiva praticada pelos escolares participantes da pesquisa. Uma vez indicado o esporte de interesse, foi possível visualizar o universo de atividades motrizes vivenciadas pelos estudantes. O resultado quanto a essa análise segue apresentado na figura abaixo, segmentado conforme o ambiente de prática (Figura 2).

Ao perscrutar as modalidades praticadas pelos estudantes, verificou-se que a variabilidade de atividades motrizes experienciadas no âmbito escolar é menor quando comparada com outros espaços de prática. Nota-se também que a maioria dos esportes relatados são os tradicionalmente praticados nas escolas públicas, a exemplo do futsal, vôlei, futebol, tênis de mesa, entre outros. Nessa esteira, enquanto percebe-se uma limitação nas práticas corporais da escola, fora dela, identifica-se um quadro mais diferenciado de modalidades, como pôde-se observar nos outros dois contextos analisados.

Em que pese em todos os espaços se observe uma maior ocorrência das práticas tradicionais, no âmbito de treinamento

destacam-se as modalidades de luta e nos locais não sistematizados de prática, os esportes praticados nas ruas ou parques, como o caso das modalidades de skate, ciclismo, patins e BMX.

Após os participantes relatarem a prática esportiva de maior interesse, na sequência, com base no instrumento SMS, eles indicaram a sua motivação para o desporto praticado. Por meio desses dados, pôde-se identificar as dimensões com maior nível motivacional entre os estudantes. O resultado dessa análise é apresentado na figura abaixo.

Analisando de forma geral as informações do gráfico em tela, verifica-se que todos os grupos investigados evidenciaram inclinação para as dimensões intrínsecas de motivação. Nesse espectro, destaca-se o grupo treinamento, que exibiu intensidades motivacionais mais elevadas, não só para as dimensões intrínsecas como também para as extrínsecas. Na sequência, com o objetivo de estabelecer comparações mais efetivas entre os grupos, aprouve realizar análise inferencial das variáveis. Para isso, aplicou-se o teste *Kruskal Wallis* cujos resultados são apresentados a seguir por meio de medianas e intervalos interquartílicos (Tabela 2).

Por meio da análise realizada, constatou-se que houve diferenças significativas entre os grupos, com exceção das variáveis "ME-I" e "ME-ID". À primeira vista, pode-se identificar que o grupo "Treinamento" se demonstrou estatisticamente menos desmotivado em relação aos outros espaços observados. Com efeito, em todas as outras dimensões perscrutadas, observou-se níveis motivacionais mais bem

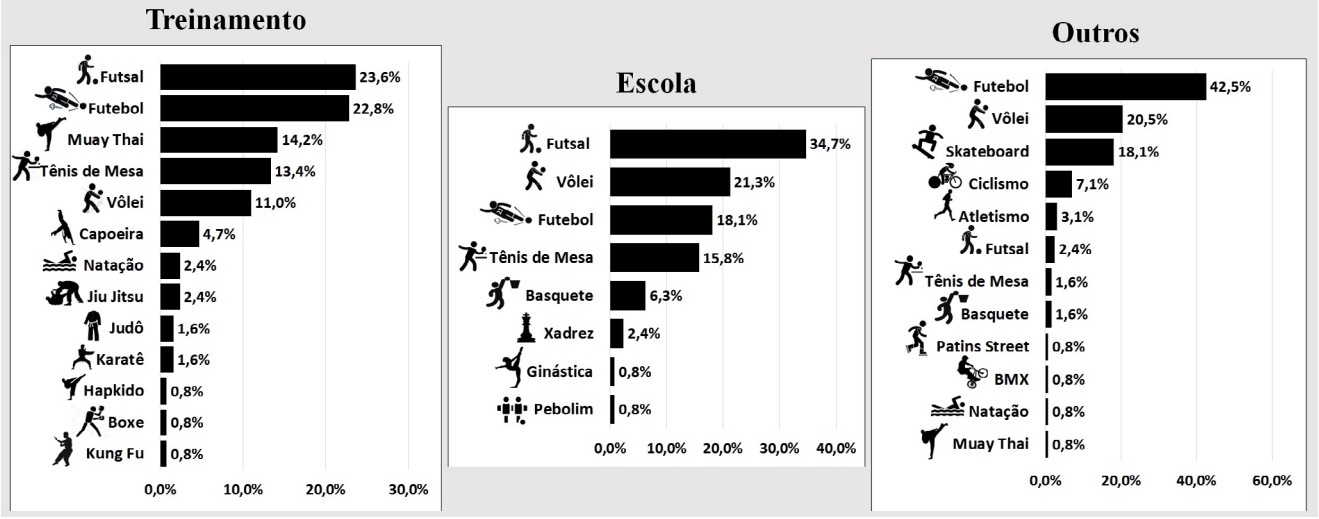

Figura 2. Modalidades esportivas indicadas pelos escolares de acordo com o local de prática

Tabela 2. Comparação da motivação esportiva em relação ao ambiente de prática

Dimensões	Escola	Treinamento	Outros	*p-valor*
	Mediana (Q1-Q3)	*Mediana (Q1-Q3)*	*Mediana (Q1-Q3)*	
DES	2.75 (1.75-3.75)	2.25 (1.25-3.50)	2.50 (1.50-3.75)	0.014*
ME-RE	3.00 (2.25-3.75)	4.00 (2.75-5.25)	3.25 (2.50-4.25)	0.010*
ME-I	4.00 (3.00-5.25)	4.50 (3.50-5.75)	4.25 (3.25-5.25)	0.080
ME-ID	4.25 (3.25-5.50)	4.25 (3.50-5.25)	4.00 (3.00-5.25)	0.208
MI-C	5.00 (4.00-6.00)	5.75 (4.75-6.25)	4.75 (3.50-6.25)	0.000*
MI-AO	5.00 (3.75-5.75)	5.50 (4.75-6.25)	4.50 (3.50-5.75)	0.000*
MI-EE	5.00 (4.00-6.00)	5.50 (4.50-6.25)	5.00 (4.25-6.00)	0.011*
MI	4.83 (4.08-5.75)	5.50 (4.75-6.08)	4.83 (3.92-5.75)	0.000*
ME	3.75 (2.92-5.00)	4.42 (3.42-5.17)	3.92 (3.00-4.75)	0.035*

Nota: DES: Desmotivação; ME-RE: Motivação Extrínseca de Regulação Externa; ME-I: Motivação Extrínseca de Introjeção; ME-ID: Motivação Extrínseca de Identificação; MI-C: Motivação Intrínseca para Conhecer; MI-AO: Motivação Intrínseca para Atingir Objetivos; MI-EE: Motivação Intrínseca para Experiências Estimulantes; MI: Motivação Intrínseca; ME: Motivação Extrínseca. Intervalo Interquartílico (25-75), (*) Diferenças estatisticamente significativas entre grupos (p≤ 0,05) para o teste *Kruskal Wallis*.

atribuídos para esse grupo, o que de certa maneira ratifica os dados da figura 3.

Ao explorar com mais rigor os dados por meio de múltiplas comparações em forma de pares, pôde-se verificar com mais clareza onde estavam alocadas as diferenças. De modo geral, o grupo "Treinamento" foi o que exibiu os maiores escores, distanciando-se significativamente da "Escola" e "Outros" locais de prática. Nessa esteira, não foram observadas diferenças entre esses dois últimos grupos, uma vez que os escores evidenciados não apresentaram oscilações tão distintas ao ponto de incidir estatisticamente nos dados como observado na figura 3 e tabela 2.

Ainda com o intuito de intensificar as análises, buscou-se identificar possíveis associações entre o desempenho motivacional e o tipo do local de prática. Assim, por via de classificação sugerida, pôde-se realizar tal análise que segue socializada na tabela 3.

Os dados da tabela 3 sinalizam que todos os grupos, em alguma medida, exibiram níveis motivacionais associados à classificação moderada e alta. Todavia, em que pese esse comportamento, verifica-se que o grupo de Treinamento se sobressaiu em relação à motivação alta, evidenciando mais sujeitos concentrados no interior dessa classificação (62,2%). Nesse contexto ainda, ressalta-se que além de esboçar melhor classificação, o grupo denotou também baixa prevalência de desmotivação uma vez que apenas 4 dos indivíduos sinalizaram motivações reduzidas.

Embora a "Escola" e os "Outros" locais não sistematizados de prática não tenham conseguido exibir níveis mais elevados de motivação em relação ao Treinamento, constata-se que, de alguma forma, a motivação se manteve em níveis moderados, mesmo na percepção de climas motivacionais que talvez não sejam tão intensos quando comparado com ambientes que visam performance. Diante disso, os dados sugerem que quanto mais imersivo é o contexto de prática, mais satisfatória e elevada pode ser a motivação do praticante. Por sinal, é o que justamente verificou-se quando levada a rigor uma

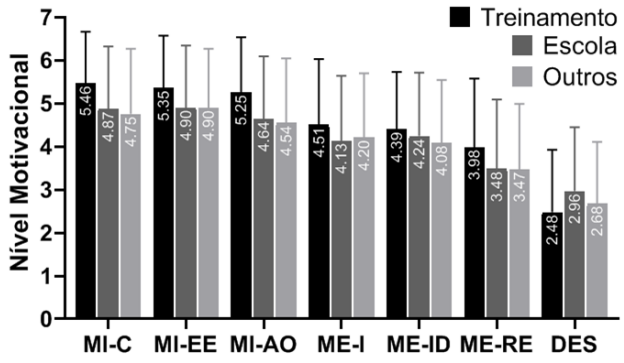

Figura 3. Nível motivacional em relação ao local de prática esportiva

Nota: MI-C: Motivação Intrínseca para Conhecer; MI-EE: Motivação Intrínseca para Experiências Estimulantes; MI-AO: Motivação Intrínseca para Atingir Objetivos; ME-I: Motivação Extrínseca de Introjeção; ME-ID: Motivação Extrínseca de Identificação; ME-RE: Motivação Extrínseca de Regulação Externa; DES: Desmotivação.

Tabela 4. Comparação da motivação esportiva em relação ao tempo de prática para o grupo treinamento

Dimensões	Até 12 meses	Mais de 12 meses	p-valor
	Mediana (Q1-Q3)	*Mediana (Q1-Q3)*	
DES	2.50 (1.25-3.75)	1.50 (1.06-3.00)	0.097
ME-RE	3.75 (2.25-4.75)	4.50 (3.00-5.50)	0.022*
ME-I	4.50 (3.50-5.75)	4.75 (3.56-5.75)	0.600
ME-ID	4.00 (3.25-5.00)	4.62 (3.81-5.44)	0.022*
MI-C	5.50 (4.75-6.00)	6.00 (4.75-6.50)	0.114
MI-AO	5.25 (4.25-6.00)	5.75 (5.00-6.25)	0.027*
MI-EE	5.25 (4.50-6.00)	5.87 (5.00-6.50)	0.010*
MI	5.33 (4.58-5.92)	5.75 (5.04-6.23)	0.023*
ME	4.17 (3.25-4.75)	4.62 (3.83-5.44)	0.052

Nota: DES: Desmotivação; ME-RE: Motivação Extrínseca de Regulação Externa; ME-I: Motivação Extrínseca de Introjeção; ME-ID: Motivação Extrínseca de Identificação; MI-C: Motivação Intrínseca para Conhecer; MI-AO: Motivação Intrínseca para Atingir Objetivos; MI-EE: Motivação Intrínseca para Experiências Estimulantes; MI: Motivação Intrínseca; ME: Motivação Extrínseca. Intervalo Interquartílico (25-75), (*) Diferenças estatisticamente significativas entre grupos (p≤ 0,05) para o teste *Mann Whitney.*

Tabela 3. Associação entre motivação esportiva e local de prática

Classificação	Escola		Treinamento		Outros		p-valor
	n	%	n	%	n	%	
Motivação Baixa	9	7.08%	4	3.15%	10	7.87%	0,006*
Motivação Moderada	63	49.61%	44	34.65%	65	51.18%	
Motivação Alta	55	43.31%	79	62.20%	52	40.95%	
Total	**127**	**100,0%**	**127**	**100,0%**	**127**	**100,0%**	

Nota: (*) Diferenças estatisticamente significativas entre grupos (p≤ 0,05) para o teste *Qui-Quadrado.*

comparação a respeito do tempo de prática do grupo treinamento (Tabela 4).

Posteriormente a análise, os resultados revelaram que os sujeitos com o tempo de prática maior do que 1 ano exibem níveis motivacionais sobressalentes em relação àqueles que estão, grosso modo, ingressando em suas atividades motrizes no esporte. Isto é, à medida que o tempo passa e o sujeito estabelece uma maior ligação com a modalidade, mais potencial pode ser sua motivação para com essa. Contudo, mesmo inserido em uma condição de aprendizagem embrionária no desporto, ainda assim o contexto de treinamento parece ofertar doses mais elevadas de motivação se estabelecido uma breve comparação com o ambiente escolar e outros espaços de prática. Isso fica perceptível se visualizado conjuntamente os dados da tabela 2 e 4.

DISCUSSÃO

A presente pesquisa, de um modo geral, objetivou comparar a motivação esportiva entre locais diferentes de prática, desde espaços sistematizados até os não sistematizados. Dessa forma, inicialmente, ao verificar os esportes praticados entre os grupos perscrutados neste estudo, constatou-se que no contexto de "Treinamento" e em "Outros" locais de prática existe uma pluralidade maior de modalidades esportivas quando contrastado com o ambiente escolar. Dito de outra forma, a escola pública não consegue fornecer uma quantidade ampla de práticas, por mais que os documentos normativos[2] da Educação Física brasileira sugiram o contato com o maior número de atividades motrizes possíveis. Se esse currículo plural[3] na disciplina de Educação Física é válido, não cabe aqui julgar, entretanto, parece incoerente que a disciplina seja regimentada apenas por práticas tradicionais, sobretudo em tempos de segunda modernidade (Beck, 2011, 2012) ou modernização reflexiva (Beck, 2012; Giddens, 2012), em que os atores sociais estão se tornando mais reflexivos e se desgarrando das formas tradicionais de se viver (Giddens, 2012).

Essa destradicionalização do movimentar-se (Souza, 2019), em alguma medida, fica evidente nos próprios resultados encontrados, onde fora da escola é possível ter um contato com uma profusão de práticas (Figura 2), em que pesem, é verdade, os esportes com maior carga cultural ainda sejam predominantes no âmbito brasileiro, como exemplo do futebol. Contudo, não se pode atribuir a culpa aos professores e muito menos a escola por essa limitação nas práticas, pois como se sabe, principalmente, em instituições públicas há uma grande carência, tanto em termos de estrutura como de materiais e equipamentos, que acabam por favorecer o ensino das modalidades tradicionais, por serem mais acessíveis nas escolas. Além disso, é importante frisar que a disciplina de Educação Física não é espaço apenas para a prática esportiva e tampouco tem a finalidade de formar atletas. Todavia, não se pode negar que a escola é um dos primeiros redutos onde as crianças têm contato com o desporto, o que reforça a forte necessidade de a Educação Física construir laços prazerosos e duráveis com esse gênero do movimentar-se humano (Parlebas, 1997; Souza, 2019).

Nessa linha de raciocínio, em que pesem os objetivos da Educação Física Escolar orbitem o esporte mais com intencionalidades educacionais e pedagógicas (Costa & Kunz, 2013), ainda assim a disciplina não pode prescindir de construir ambientes harmônicos e motivacionais. É nesse cerne que se insere a importância da motivação, para que os escolares se mantenham aderentes as práticas associadas ao ensino do movimento. Contudo, quando se levou a efeito a comparação entre os locais de prática, viu-se que no âmbito de "Treinamento" os sujeitos partilham de uma motivação esportiva mais acentuada em relação à "Escola" e a "Outros" locais. Ainda que esse comportamento, em alguma intensidade, já fosse esperado, haja visto o papel ativo e propositado do agente no treinamento, é interessante notar que a escola como um *locus* sistematizado de prática, ao menos no presente estudo, não conseguiu evidenciar níveis motivacionais mais significativos que outros ambientes com atmosfera mais recreativa de prática. Isto é, os dados sugerem que praticar esporte por conta própria ou na escola proporciona climas motivacionais equivalentes (Figura 3 e Tabela 2).

Antes de continuar explorando analiticamente essas diferenças entre os locais de prática, é relevante sublinhar que nos três grupos, independente das discrepâncias das amplitudes motivacionais das subescalas, observou-se um comportamento bastante análogo entre os locais investigados, em que as motivações intrínsecas se sobressaem em relação às extrínsecas (Figura 3). Sob esse aspecto, a literatura sinaliza que estar intrinsecamente mais motivado permite que o

[2]Os documentos normativos nada mais são que os materiais produzidos por especialistas da Educação Física que visam orientar a forma com que a disciplina pode ou deve ser trabalhada na escola. No Brasil, destacam-se os guias e manuais ofertados pelo Conselho Federal e Regional de Educação Física (CONFEF/CREF); os Parâmetros Curriculares Nacionais (PCNs), as Diretrizes Curriculares da Educação Básica (DCEs); a Base Nacional Comum Curricular (BNCC) e dentre outros documentos.

[3]De acordo com Pierre Parlebas, um dos principais nomes da Educação Física mundial e dono de uma das teorias mais fundamentadas no campo, acredita que não é possível comtemplar um grande número de atividades no âmbito escolar. Portanto, ele diverge da ideia do quanto mais melhor, defendendo ao invés disso, que as aulas devem ser estruturadas de acordo com grandes famílias coerentes de atividades, contemplando os principais domínios da ação motora. Como sugestão ver: Parlebas, P. (2001). *Juegos, deportes y sociedade: léxico de praxiología motriz.* Barcelona: Paidotribo.

indivíduo se engaje mais naturalmente com a modalidade, uma vez que o agente ingressa e se mantém no esporte por vontade própria, sem pressões ou coerções externas que possam se manifestar como elementos preponderantes para a permanência na prática (Balbinotti et al., 2012; Oliveira et al., 2017; Ryan & Deci, 2000; Vignadelli et al., 2018). Ademais, é muito comum nesse tipo de motivação que os sujeitos se aproximem das atividades esportivas em função do prazer e da satisfação que a modalidade proporciona (Bernardes et al., 2015; Vieira et al., 2011).

Embora tenha se verificado esse comportamento similar quanto às razões para a prática do esporte entre os grupos, ao realizar a análise de comparação notou-se uma clara superioridade motivacional para o contexto de "Treinamento" em inúmeras das subescalas do instrumento (Tabela 2). Dentre as dimensões, destacam-se todas as intrínsecas, como MI-C, MI-AO, MI-EE. Em linhas gerais, os dados apontam que os escolares praticantes de esportes em locais de performance elencam-se mais motivados para buscar aprender sobre o funcionamento da atividade motriz de interesse, apresentam maiores satisfações no que diz respeito ao domínio de habilidades e superação de desafios, bem como praticam esportes almejando alcançar doses elevadas de prazer, emoção, excitação e dentre outras pulsões ligadas à motivação intrínseca (Deci & Ryan, 2000; Pelletier et al., 2013).

Não obstante, ao imergir mais nos dados, verificou-se que não apenas a motivação intrínseca foi superior para o grupo "Treinamento", mas também as razões de ordem extrínsecas, em especial, para a ME-RE. Nesse tipo de motivação, o agente alimenta o imaginário que o esporte possa melhorar a sua imagem e seu impacto social face aos outros (Costa et al 2011). Em outros termos, apresentar motivações extrínsecas acentuadas indica que o indivíduo está preocupado com questões externas à atividade, que podem sim, servir, grosso modo, como combustível para a aderência à prática (Coimbra et al., 2013; Pizani et al., 2016; Vignadelli et al., 2018). Por sinal, quando comparada a escala de desmotivação entre os grupos, fica nítido que no "Treinamento" há menos pessoas desmotivadas (Tabela 2) ou com baixa motivação (Tabela3).

Portanto, locais sistematizados de desporto como de treinamento parecem exercer atmosferas mais alvissareiras em termos de motivação quando contrastado com a "Escola" ou "Outros" espaços em que se sucede a ação motriz esportiva. Embora isso não seja uma regra, no treino de performance, os elementos da motivação podem ser mais bem estimulados ou aguçados, desde que o treinador, é claro, consiga oportunizar uma boa experiência aos seus alunos/atletas, criando um ambiente livre de excessos ou de cobranças desnecessárias que possam induzir o arrefecimento da motivação (Interdonato et al., 2008; Rocha, 2009). Assim sendo, é necessário criar um espaço equilibrado, mesmo que o esporte seja repleto de pressões ou tensionamentos (Coimbra et al., 2013). A propósito, são essas próprias tensões que, em alguma medida, estimulam as pessoas a buscarem o desporto, pois em sua essência, essa atividade permite que os indivíduos externalizem pulsões que não seriam bem recebidas em outros espaços, principalmente nas rotinas de seriedade[4] (Elias & Dunning, 2019). Tal por isso, o esporte moderno e atividades similares servem como uma válvula de escape em relação ao rígido processo de civilização[5] que regimenta a sociedade moderna (Elias, 2011b; Elias & Dunning, 2019).

Além do exposto, soma-se o fato que no treinamento os indivíduos já começam a flertar com as competições, bem como com as prerrogativas da imagem do ser atleta, o que pode potencializar ainda mais os níveis de excitação para a prática esportiva (Grubertt et al., 2019). Com efeito, a vontade de ter êxito no esporte pode impelir o agente a treinar e melhorar cada vez mais suas ações cinéticas, mantendo-o focado e aderente à prática. Nesse sentido, à medida que o indivíduo vai estabelecendo laços duradouros e satisfatórios com a sua modalidade, mais a sua motivação pode ser desenvolvida, em que pesem, é claro, os objetivos possam ser alterados conforme o tempo decorre. Aliás, foi exatamente essa relação que se verificou quando confrontado o tempo de prática para o grupo treinamento, em que praticantes com mais tempo de experiência evidenciaram níveis motivacionais substancialmente mais elevados do que os iniciantes (Tabela 4), o que está de acordo com inúmeras investigações socializadas na literatura (Bernardes et al., 2015; Jõesaar & Hein, 2011; Guedes & Missaka, 2015; Grubertt et al., 2019; Vignadelli et al., 2018).

Em resumo, através da digressão aqui realizada, pôde-se apurar que o esporte escolar ou esporte realizado em condições recreativas não sistemáticas não conseguem prover

[4]Segundo o sociólogo alemão Norbert Elias, existem atividades do cotidiano que são compreendidas como sérias da vida, em que não é possível externar comportamentos que não seriam bem aceitos nesse espaço dado o processo civilizador que a sociedade atingiu como resultado de uma escala de longuíssima duração. Todavia, em que pesem os códigos de conduta ou etiqueta estabelecidos no tecido social se restringiram no tecido social, resíduos desse processo ficaram inconscientemente interiorizados nos seres humanos, sendo necessário criar mecanismos de arrefecimento das pulsões dada a necessidade de excitação e tensão que as pessoas possuem. Foi assim, com efeito, que o esporte emergiu como um excelente espaço para profusão dos sentimentos reprimidos. Ler: Elias, N., Dunning, E. (2019). *A busca da excitação: desporto e lazer no processo civilizacional*. Lisboa: Edições 70.

[5]O processo civilizador é a teoria proposta por Elias para demonstrar como a sociedade se desenvolveu no decorrer do tempo a partir de mudanças comportamentais dos indivíduos, em especial, no exercício das relações de interdependência. Ver: Elias, N. (2011b). *O processo civilizador: uma história dos costumes*. Rio de Janeiro: Jorge Zahar.

amplitudes motivacionais equiparadas ao contexto de treinamento, ainda que a motivação se apresente em níveis considerados moderados e altos (Tabela 3). Nesse sentido, é interessante refletir que, mesmo em um espaço sistematizado por meio da disciplina de Educação Física, a escola não produz ares motivacionais tão mais proeminentes que locais recreativos ou desinteressados de prática. Isso chama atenção, porque à frente da Educação Física escolar existe um mediador, assim como o técnico no prisma do treinamento. Dessa forma, mesmo que os objetivos sejam diferentes, até onde se sabe, a aula de Educação Física não pode abdicar de motivação, principalmente em locais de aprendizado em que os aprendizes estão em fase de descoberta e familiarização com o universo das condutas motrizes. Diante disso, a Educação Física mediante ao seu contrato social com a humanidade, como ciência do movimento humano, não só pode como deve estimular o prazer pelo movimentar-se e certamente o esporte é uma das atividades motrizes a ser considerada (Souza, 2019). Por isso, parece não fazer sentido desmerecer o esporte no ambiente escolar, como se costuma apregoar dentro de alguns círculos acadêmicos.

Embora os resultados tenham revelado o treinamento como o lugar de maior constructo motivacional, como limitações da pesquisa, não se pode descartar a hipótese de que se tivesse restringindo ainda mais as variáveis intervenientes, talvez resultados diferentes pudessem emergir. Para além do fator idade e sexo, poderia ter sido equiparado também a modalidade praticada e o nível de escolaridade. Ou seja, eleger os participantes agrupando de acordo com as mesmas práticas (coletivas e individuais) e instrução acadêmica, isso porque esportes (Coimbra et al., 2013; Guedes & Netto, 2013;) e escolaridades diferentes (Caruzzo et al., 2017; Januário et al., 2012;) podem influir na motivação. Além disso, é possível que, se esse estudo tivesse sido reproduzido em instituições privadas, os resultados também pudessem revelar comportamentos diferentes, uma vez que ao se tratar de escolares com diferentes tipos de capitais (econômico e cultural, principalmente) e *habitus*[6], esses teriam a sua disposição outra estrutura para o desenvolvimento de suas práticas esportivas. Em síntese, essas seriam algumas das limitações do estudo que podem, inclusive, servir como lacunas para futuras investigações.

Por fim, como contributo principal desta pesquisa, os resultados apontam que os níveis motivacionais para a prática esportiva na escola podem ser potencializados. Isto é, os professores não só podem como devem ser incentivados a criarem contextos mais imersivos e satisfatórios de prática, de modo que os alunos possam desenvolver laços mais prazerosos e longevos com esporte. É obvio que com isso não estamos querendo dizer que a escola deve se tornar um espaço de treinamento, mas que os professores podem mobilizar elementos que auxiliem na aproximação dos alunos com o esporte. A propósito, esse seria um interessante problema de pesquisa.

CONCLUSÕES

Após o levantamento e análise dos dados, verificou-se que ambientes sistematizados de prática, em especial, aqueles que visam performance, habilitam o sujeito a expandir os seus níveis de motivação esportiva. Por outro lado, na contramão desse comportamento, ao perscrutar outros espaços como a escola e locais recreativos de prática, esses visivelmente não exibem níveis próximos de motivação em relação ao treinamento. De modo geral, os dados apontam que a disciplina de Educação Física não tem criado climas motivacionais amplamente imersivos e aderentes ao menos para a realidade investigada.

Dessa forma, se a disciplina de Educação Física não tem conseguido preservar elevados níveis motivacionais para as práticas motrizes, isso sugere que o desenvolvimento da disciplina deve ser repensado, uma vez que a Educação Física possui uma importante missão, qual seja, ajudar os indivíduos a construírem as suas autobiografias de movimento que continuarão a ser prescritas e escritas após os agentes encerrarem as suas trajetórias escolares. Tal por isso, a disciplina tem função vital no espaço escolar, porque a partir dela, os escolares podem ser impelidos a construírem uma relação mais agradável, harmônica e de identificação com o movimentar-se. Mas mesmo diante desse importante papel, por que ainda, em muitos contextos, principalmente na educação pública brasileira, a Educação Física ainda ressente de problemas e tem encontrado dificuldades para justificar sua relevância no tecido escolar e social?

Seria a falta de maiores investimentos na infraestrutura e na ofertabilidade de equipamentos os fatores limitantes para a desenvolvimento da área na escola? Ou ainda, o problema seria exclusivamente de ordem pedagógica, de modo

[6]Para Pierre Bourdieu, entre os modelos de capital, talvez o mais relevante seja o capital econômico: "[...] o capital econômico é a espécie dominante, em relação ao capital simbólico, ao capital social e mesmo ao capital cultural" (Bourdieu, 1990, p. 133), pois a influência desse capital é capaz de associar outros tipos, ou seja, ele tem os recursos necessários para gerir racionalmente e relacionalmente outros trunfos. Subjacente a essa compreensão dos capitais, destaca-se também o *habitus de classe*, aquele incorporado por exemplos de conduta e correções dos adultos frente as crianças, um superego mais estável e duradouro, modificado e aprimorado ao longo da vida, em outras palavras, aquele *habitus* gerado diretamente no ambiente familiar. Isto é, a hipótese é que alunos da educação privada, como detentores de mais capitais, sobretudo econômico, teriam a sua disposição uma melhor estrutura para criar um *habitus* esportivo, tanto fora como dentro da escola, por isso poderiam evidenciar níveis motivacionais mais intensos quando comparados com alunos da escola pública. Ver: Bourdieu, P. (1990). *Coisas ditas*. São Paulo, Brasiliense.

que os professores da educação básica seriam os culpados – como alguns grupos costumam apontar para reduzir o peso da crítica sobre seus programas de pesquisa – por não saberem fazer funcionar as proposições aventadas nos documentos normativos ou teorias produzidas pelos ditos especialistas da área? Ou o inverso, não ser-lhe-iam os intelectuais da "torre de marfim" os verdadeiros culpados por produzirem respostas com pouco grau de correspondência à realidade dos sujeitos, que de algum modo ressoa na forma com que a disciplina é conduzida na escola? E, por fim, longe de esgotar todos os questionamentos, será que a Educação Física brasileira enquanto licenciatura não tem seguido agendas que não seria escopo de atenção da área e por isso tem deixado a desejar no que concerne os reais objetivos da disciplina? Por ora, só nos cabe indagar e ensejar que pesquisas vindouras respondam tais questionamentos.

AGRADECIMENTOS

Os autores agradecem à Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) pelo suporte financeiro aos bolsistas.

REFERÊNCIAS

Balbinotti, M. A. A., Juchem, L., Barbosa, M. L. L., Saldanha, R. P., & Balbinotti, C. A. A. (2012). Qual é o perfil motivacional característico de tenistas infanto-juvenis brasileiros? *Motriz: Revista de Educação Física*, *18*(4), 728-734.

Beck, U. (2012) A reinvenção da política: rumo a uma teoria da modernização reflexiva. In A. Giddens, S. Lash, & U. Beck (Eds.). *Modernização reflexiva: política, tradição e estética na ordem social moderna*. São Paulo: Editora da Unesp.

Beck, U. (2011). *Sociedade de risco: rumo a uma outra modernidade* (2ª ed.). Ed. 34.

Bernardes, A. G., Yamaji, B. H. S., & Guedes, D. P. (2015). *Motivos para prática de esporte em idades jovens: um estudo de revisão. Motricidade*, *11*(2), 163-173. https://doi.org/10.6063/motricidade.3066

Bourdieu, P. (1983). "Como é possível ser esportivo?". In: P. Bourdieu (Ed.). *Questões de sociologia*. Rio de Janeiro: Marco Zero.

Bourdieu, P. (1990). *Coisas ditas*. São Paulo, Brasiliense.

Bourdieu, P. (1997). *Sobre a televisão*. Oeiras: Celta.

Bracht, V. (2005). *Sociologia crítica do esporte: uma introdução*. Ijuí: Unijuí.

Cagigal, J. M. (1972). *Deporte, pulso de nuestro tiempo*. Editora Nacional, Colección Cultura y Deporte.

Campos, L. T. S., Vigario, P. S., & Lurdof, S. M. A. (2011). Fatores motivacionais de jovens atletas de vôlei. *Revista Brasileira de Ciências do Esporte*, *33*(2), 303-317. https://doi.org/10.1590/S0101-32892011000200003

Caruzzo, N. M., Belem, I. C., Codonhato, R., Moreira, C. R., Sitoe, S. A., Rodrigues, J. C., & Fiorese, L. (2017). Motivação para a prática de atividades esportivas em escolares da região noroeste do paraná. *Corpoconsciência*, *21*(3), 46-54.

Coimbra, D. R., Gomes, S. S., Oliveira, H. Z., Rezende, R. A.; Castro, D., Miranda, R., & Bara-Filho, M. G. (2013). Características motivacionais de atletas brasileiros. *Motricidade*, *9*(4), 64-72. https://doi.org/10.6063/motricidade.9(4).1179

Costa, A. R., & Kunz, E. (2013) Esporte na escola: conhecer, experimentar e transformar. *Em Aberto, 26*(89), 119-129. https://doi.org/10.24109/2176-6673.emaberto.26i89.2388

Costa, V. T., Albuquerque, M. R., Lopes, M. C., Noce, F., Costa, I. T., Ferreira, R. M., & Samulski, D. M. (2011). Validação da escala de motivação no esporte (SMS) no futebol para a língua portuguesa brasileira. *Revista brasileira Educação Física e Esporte*, *25*(3), 537-546. https://doi.org/10.1590/S1807-55092011000300015

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self determination of behaviour. *Psychological Inquiry, 11*(4), 227-268. https://doi.org/10.1207/S15327965PLI1104_01

Elias, N. (2011a). *Introdução à Sociologia*. Edições 70.

Elias, N. (2011b). *O processo civilizador: uma história dos costumes*. Jorge Zahar.

Elias, N., & Dunning, E. (2019). *A busca da excitação: desporto e lazer no processo civilizacional*. Edições 70.

Giddens, A. (2012). A vida em uma sociedade pós-tradicional. In A. Giddens, S. Lash, & U. Beck (Eds.). *Modernização reflexiva: política, tradição e estética na ordem social moderna*. Editora da Unesp.

Grubertt, G. A., Cavazzotto, T. G., Vaz-Junior, A., Mouad, M., & Serassuelo-Junior, H. (2019). "Quero ser um atleta rico e famoso": motivos para a prática esportiva de jovens atletas escolares. *Motrivivência*, *31*(60), 01-14. https://doi.org/10.5007/2175-8042.2019e58373

Guedes, D. P., & Netto J. E. S. (2013). Motivos para a prática de esportes em atletas jovens e fatores associados. *Journal of Physical Education*, *24*(1), 21-31. https://doi.org/10.5007/2175-8042.2019e5837310.4025/reveducfis.v24.1.14695

Guedes, D. P., & Missaka, M. S. (2015). Sport participation motives of young Brazilian judo athletes. *Motriz*, *21*(1), 84-91. https://doi.org/10.1590/S1980-65742015000100011

Interdonato, G. C., Miarka, B., Oliveira, A. R., & Gorgatti, M. G. (2008). Fatores motivacionais de atletas para a prática esportiva. *Motriz, 14*(1) 63-66.

Januário, N., Colaço, C., Rosado, A., Ferreira, V., & Gil, R. (2012). Motivação para a prática desportiva nos alunos do ensino básico e secundário: Influência do género, idade e nível de escolaridade. *Motricidade*, *8*(4), 38–51. https://doi.org/10.6063/motricidade.8(4).1551

Jõesaar, H., & Hein, V. (2011). Psychosocial determinants of young athletes' continued participation over time. *Perceptual and Motor Skills*, *113*(1), 51–66. https://doi.org/10.2466/05.06.13.PMS.113.4.51-66

Marchi-Júnior, W., Almeida, B. S., & Souza, J. (2018). *Introdução à sociologia do esporte*. InterSaberes.

Oliveira, V. M., Silva, T. R., Brasil, M. R.; Estevão, B. J., Chumlhak, Z., & Silva, S. R. (2017). Nível de motivação e coordenação motora em escolares ingressantes em um projeto de futsal. *Revista Brasileira de Futsal e Futebol, 9*(32), 42-52.

Oliveira, V. M., & Souza, J. (2018). A infância, o brincar e o jogar: reflexões a partir do referencial teórico de Norbert Elias. *Educação em Revista*, *34*, 1-22. https://doi.org/10.1590/0102-4698186748

Parlebas, P. (2001). *Juegos, deportes y sociedade: léxico de praxiología motriz*. Paidotribo.

Parlebas, P. (1997). Problemas teóricos y crisis actual en la Educación Física. *Lecturas: Educación Física y Deportes*, *2*(7).

Pelletier, L. G., Rocchi, M. A., Vallerand, R. J., Deci, E. L., & Ryan, R. M. (2013). Validation of the revised sport motivation scale (SMS-II). *Psychology*

of Sport and Exercise, 14(3), 329-341. https://doi.org/10.1016/j.psychsport.2012.12.002

Pelletier, L. G., Tuson, K. M., Fortier, M., Vallerand, R. J., Brière, N., & Blais, M. R. (1995). Toward a New Measure of Intrinsic Motivation, Extrinsic Motivation, and Amotivation in Sports: The Sport Motivation Scale (SMS). *Journal of Sport e Exercise Psychology*, *17*(1), 35-53. https://doi.org/10.1123/jsep.17.1.35

Pizani, J., Barbosa-Rinaldi, I. P., Miranda A. C. M., & Vieira, L. F. (2016). (Des) motivação na educação física escolar: uma análise a partir da teoria da autodeterminacão. *Revista Brasileira de Ciências do Esporte, 38*(3), 259-266. https://doi.org/10.1016/j.rbce.2015.11.010

Rocha, C. C. M. (2009). *A motivação de adolescentes do ensino fundamental para a prática da educação física escolar* [Dissertação de mestrado]. Faculdade de Motricidade Humana, Universidade Técnica de Lisboa.

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well Being. *American Psychologist*, 55, p.68-78. https://doi.org/10.1037/0003-066X.55.1.68

Sérgio, M. (1994). *Para uma epistemologia da motricidade humana: prolegómenos a uma nova ciência do homem* (2ª ed.) Compendium.

Serpa, S., Alves, P., & Barreiros, A. (2004). *Versão portuguesa da Sport Motivational Scale (SMS) e da Sport Academic Scale (AMS): processos de tradução, adaptação e fiabilidade* [Tese de doutoramento]. Universidade Técnica de Lisboa.

Souza, J. (2019). Educação Física Reflexiva – problemas, hipóteses e programa de pesquisa. *Movimento*, *25*, 1-15. https://doi.org/10.22456/1982-8918.78269

Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2007). *Métodos de pesquisa em atividade física.* Artmed.

Vieira, L. F., Balbim, G. M., Pimentel, G. G. A., Hassumi, M. Y. S. S., & Garcia, W. F. (2011). Estado de fluxo em praticantes de escalada e skate downhill. *Motriz*, *17*(4), 591-599. https://doi.org/10.1590/S1980-65742011000400003

Vignadelli, L. Z., Ronque, E. R. V., Bueno, M. R. O.; Dib, L. R. P., & Serassuelo-Junior, H. (2018). Motives for sports practice in young soccer and volleyball athletes. *Revista Brasileira de Cineatropometria e Desempenho Humano*, *20*(6), 585-597. https://doi.org/10.5007/1980-0037.2018v20n6p585

Zahariadis, P. N., Tsorbatzoudis, H., & Grouios, G. (2005). The sport motivation scale for children: preliminary analysis in physical education classes. *Perceptual and Motor Skills*, *101*(1), 13-54. https://doi.org/10.2466/pms.101.1.43-54

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.20701

Acute physiological responses during a Brazilian endurance triathlon race

Danielli Mello[1]*, Eduardo Borba Neves[2], Wagner Romão[1], Antony Santos[1], Filipe Farias[1], Thiago Dias[1], Marcio Sena[3], Marcos Dias Pereira[4], Guilherme Rosa[5], Rodrigo Vale[6]

ABSTRACT

Triathlon is one of the most flourishing sports in the world. This study aimed to analyze the acute effects of physiological markers and subjective perception variables in amateur trained athletes. Participated in the present study 8 male endurance triathletes with race experience. The injury markers and oxidative stress parameters were investigated in the blood plasma and measured at baseline and post-race. Heat, comfort, and humidity perception, and Borg ratings of perceived exertion were measured during the baseline, transition area, and post-race. Descriptive and inferential statistics were used with significance set as $p<0.05$. The variables of injury and muscle fatigue presented a significant increase comparing the baseline and post-race data, CK ($p= 0.005$; $d= 5.7$), LDH ($p= 0.004$; $d= 1.3$) and lactate ($p< 0.001$; $d= 7.2$). It was observed a significant increase in CP ($p= 0.021$; $d= 2.2$) and a significant decrease in DPPH ($p= 0.002$; $d= -1.4$) in post-race, no significant changes in LP ($p= 0.217$; $d= 0.6$) and TT ($p= 0.881$; $d= -0.1$) oxidative stress markers was verified. A significant increase ($\Delta\% = 30.95$, $p = 0.001$; $d = 6.8$) was observed in urine temperature and color (range [1-7], $p = 0.039$). Even with the significant increase in fatigue, with a significant increase in the injury markers, oxidative stress markers suggested a good antioxidant defense. It was observed an increase in exertion and heat perception, as well as a reduction in heat comfort and skin wetness.

KEYWORDS: athletic performance, physiology, biochemistry.

INTRODUCTION

Triathlon is one of the most flourishing sports in the world. The only to mix three different sports (swimming, cycling and running) with different races and distances: short distance (750m, 20km, and 5km); Olympic distance (1.5km, 40km, and 10km); half distance (1.9km, 90km, and 21.1km) and full distance (3.8km, 180km, and 42.2km)(Olcina et al., 2018).

Compared to individual sports, the great challenge in triathlon is integrating three distinct modalities that differ from the others in duration, exercise mode, limb movement patterns, and main muscular groups (Sleivert & Rowlands, 1996). The success in triathlon has been related to the specific performance of each sport (swimming, cycling, and running) and its technical and/or tactical approaches during the race(Ofoghi, Zeleznikow, Macmahon, Rehula, & Dwyer, 2016).

The triathlete level performance depends on several factors (anthropometry, physiology, biomechanics, nutrition, or environmental conditions) (Olcina, et al., 2018). As it is performed outdoors, environmental aspects also influence the effort perception and thermal load, affecting the performance during the race (Logan-Sprenger, 2019). The influence of the environment is, in general, a growing reflection,

[1]Physical Education College of the Brazilian Army (EsEFEx/EB), Rio de Janeiro, Brazil.
[2]Brazilian Army Sports Commission (CDE/EB), Rio de Janeiro, Brazil.
[3]Research Institute of Brazilian Army Physical Capacitation (IPCFEx/EB), Rio de Janeiro, Brazil.
[4]Institute of Chemistry of Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, Brazil.
[5]Estacio de Sá University (UNESA), Rio de Janeiro, Brazil.
[6]Exercise and Sports Science Program of Rio de Janeiro State University (PPGCEE/UERJ), Rio de Janeiro, Brazil.
*Corresponding author: Av. João Luiz Alves s/n., Fortaleza São João, Urca, Rio de Janeiro, RJ, CEP 22291-090, Brazil.
E-mail: danielli.mello@gmail.com

Conflict of Interest: nothing to declare. Funding: This work was supported by the Brazilian Army (CCFEx/FSJ) and CADESM/DECEx/EB. The funding source has not been involved in the study design; in the data collection, analysis, and interpretation; in the writing of the report; and in the decision to submit the article for publication.
Manuscript received at 08 06, 2020; Accepted at 11 12, 2020

and it is often neglected even though environmental stress can have a considerable impact on performance and safety (Whyte, Loosemore, & Williams, 2015).

Effectively, among environmental factors, the amount of water vapor in the air (absolute humidity) generates a great influence because the pressure gradient of the water vapor between the skin and the environment leads to cooling through evaporation by sweating (Wenger, 1972). The temperature and air velocity (for example, relative wind) are other contributors to the total heat exchange, in addition to radiant heat (Pezzoli, Cristofori, Moncalero, Giacometto, & Boscolo, 2013). Consequently, the clothes used modify the heat exchange rate, which is a preponderant factor for cooling through perspiration (Brocherie, Girard, Pezzoli, & Millet, 2014).

More recently, total body mass and body surface were clearly identified as important independent factors on thermoregulated results during exercise (Cheuvront & Haymes, 2001; Neves, Salamunes, de Oliveira, & Stadnik, 2017). Long-distance runners showed higher evaporative heat loss when the ambient temperature increased. Consequently, neglecting the body composition led to an underestimation of the restricted evaporation stress. All these characteristics can lead to diseases caused by heat, such as heat exhaustion (Armstrong et al., 1996).

However, most triathletes own and wear new wearable technology during racing and training that allow the athletes to track time, distance, speed, pace, heart rate, power output, and many other variables. This technology could produce information on physical performance-related variables with physiological measurements during each of the three modalities of an actual race. This can improving ability to determine factors associated with race total time(-Buckingham, 2018).

Furthermore, endurance exercises increase cytokine responses and reactive oxygen species (ROS) production. In these cases, antioxidant defenses are mostly required to protect the body cells from oxidative damage (Mrakic-Sposta et al., 2020). These biochemical responses in endurance activities are important to understand the physical performance during a competition (Santos, Neves, Fortes, Martinez, & Júnior, 2018) and can serve as a basis for the development of training programs for the triathlon. From the material published on the triathlon modality, no study was found that involved a set of environmental, biochemical, and subjective variables in relation to the acute effects of triathlon competition. Thus, the aim of this study was to analyze the acute effects of the endurance triathlon race on physiological markers and subjective perception variables in athletes.

METHODS

Participants

Participants were selected among places of triathlon training in Rio de Janeiro city, and consisted of 8 male triathletes, age between 25 and 39 years-old, with race experience and a week training volume of six days per week and three hours per day.

To be included in the study, participants should: no apparent risk factors that could prevent their participation in the study according to the Risk Stratification Criteria of the American Heart Association – AHA(ACSM, 2014), trained male athletes who used to compete in standard (Olympic) and endurance (long-distance) at least one year; age between 25 and 39 years, who trained regularly and answered the Par-Q questionnaire negatively (ACSM, 2018).

The study adopted the following exclusion criteria: athletes who did not finish the race; who used some medicine or substance which could influence the blood sample; who lost one of the data collection moments; who presents pathology or muscle articular injuries, or others clinic scream that could influence the results and performance.

The sample size was estimated by the G Power 3.1 software. As input, were informed to Test family: F tests; Statistical test: ANOVA: repeated measurements, within factors, effect size = 0.5, $\alpha = 0.05$, power ($1-\beta$ err prob) = 0.95, number of groups = 1, number of measurements = 4 and correlation coefficient among repeated measures = 0.5. The G Power 3.1 estimated the need for a total of 10 individuals.

At the end of the sampling process, the study had 10 volunteers, but two athletes dropped out of the study due to personal reasons. Thus, the sample consisted of 8 participants that completed the study. The participants signed an informed consent document to participate in research involving human subjects according to the Declaration of Helsinki (WMA, 2014). The research project was also approved by the Ethics Committee in Research Involving Human Beings of the Galeão Air Force Hospital, Rio de Janeiro, Brazil, under protocol number (77577617.6.0000.5250).

Triathlon race's data collection

The data collection was realized during the Triathlon Endurance 2017 race of UFF Rio Triathlon circuit, in Recreio dos Bandeirantes, Rio de Janeiro City, Brazil. Table 1 shows the Triathlon race's structure and the measurements carried out.

The baseline data collection occurred from 5:30 a.m. to 6 a.m. The triathlon race started at 6:50 a.m., and the post-race data collection occurred between 10 and 11 a.m., according to the total race time of each athlete. The minimum and maximum duration of the first transition was 3 and 5 minutes, and in the second transitions was 1 and 3 minutes, respectively.

Table 1. The Triathlon race's structure and the measurements carried out

Moment	Measurements
Baseline	Blood markers: creatine kinase (CK), lactate dehydrogenase (LDH), lactate, oxidative stress (Lipid peroxidation (LP), carbonylated proteins (CP), α-diphenyl-β-picrylhydrazyl (DPPH), total thiols (TT)), dehydration level, RPE Borg (0-10), Heat comfort, Skin wetness, Heat perception, Dry bulb globe temperature (C°), Wet bulb globe temperature (C°), Ocean temperature (C°), Relative Humidity (%)
Swimming 1,5km	-
1ª Transition	RPE Borg (0-10), Heat comfort, Skin wetness, Heat perception, Dry bulb globe temperature (C°), Wet bulb globe temperature (C°), Relative Humidity (%)
Cycling 60km	-
2ª Transition	RPE Borg (0-10), Heat comfort, Skin wetness, Heat perception, Dry bulb globe temperature (C°), Wet bulb globe temperature (C°), Relative Humidity (%)
Running 15km	-
Post-race	Blood markers: creatine kinase (CK), lactate dehydrogenase (LDH), lactate, oxidative stress (Lipid peroxidation (LP), carbonylated proteins (CP), α-diphenyl-β-picrylhydrazyl (DPPH), total thiols (TT)), dehydration level, RPE Borg (0-10), Heat comfort, Skin wetness, Heat perception, Dry bulb globe temperature (C°), Wet bulb globe temperature (C°), Relative Humidity (%)

Experimental procedures

Body composition and estimate maximum oxygen consumption (VO2max.) were measured in the Physical Education College of Brazilian Army (EsEFEx) laboratories.

Body mass was measured using a 150kg capacity scale with 100 g accuracy. Height was measured using a Filizola® (Brazil) stadiometer. It was used the procedures recommended by the International Society for the Advancement of Kinanthropometry – ISAK. Body Mass Index (BMI) was calculated by the ratio of body weight and the square of the height (kg/m^2). The Jackson and Pollock protocol was used to assess body fat percentual (Jackson & Pollock, 1985).

The VO2max. was estimated by treadmill ergometric ramp protocol by ACSM (ACSM, 2018). Three minutes warm up to 9.0 km/h. Specific part increasing 0.5 km/h to every 30 seconds and 3 minutes cool down in 40% of maximum speed following American Heart Association recommendations (ACSM, 2014). The variables measured during the test were heart rate (HR) using HRM-Run™, HRM-Tri™, or HRM-Swim™ cardiac monitor, connect by pulse GPS Forerunner 920XT; Borg ratings of perceived exertion (RPE Borg (Borg, 2000). The temperature (T) and relative humidity (RH) were controlled in the lab (T=20,6°; RH=62%) following the recommendation of ACSM (ACSM, 2018).

One week before the triathlon race, these variables were collected to characterize the triathlon athletes' fitness level, which participated in the present study.

Physiological markers

Blood markers of creatine kinase (CK), lactate dehydrogenase (LDH), lactate, oxidative stress (Lipid peroxidation (LP), carbonylated proteins (CP), α-diphenyl-β-picrylhydrazyl (DPPH), total thiols (TT)), and dehydration level were collected in two moments: baseline and post-race. These two moments of data collection were determined not to affect the athletes' performance and race time. Blood samples were collected using mineral-free needles (25 X 0,7 mm), the blood samples (14 ml) of the individuals were collected by the cubital vein, with the individuals remaining in a seated position in a tent. Mineral-free vacuum tubes and gloves were used, and the samples were transported to the laboratory for atomic absorption analysis and chemiluminescence immunoenzymatically assay to measure the serum levels concentrations(Marshall, Lapsley, Day, & Ayling, 2016). The automated biochemical Analyzer of the BT 3000 brand, manufactured by the company Wiener Lab. The recommendations of the commercial Kit (Wierner Lab.). The analysis procedures were performed in duplicate to confirm the results obtained.

After completion of all blood sample analysis procedures, the leftovers of laboratory samples containing blood were discarded in accordance with ANVISA legislation – RDC 306 of December 7, 2004, which provides on the technical regulation for waste management of health services.

Urinary and dehydration level. The urine collection of each volunteer was collected pre and post-race to compare to urine color index and analyzed the temperature and gravity of urine by the digital refractometer model RTD-95 (Instrutherm Ltda) measured (Minton, O'Neal, & Torres-McGehee, 2015). These two moments of data collection were determined not to affect the athletes' performance and race time. The amount and type of liquid ingested by each athlete during the competition were free but controlled and measured at the end. Thermal stress control was registered using model TGD 400 (Instrutherm). The body mass before and using only underwear and all the athlete's clothing and accessories was also measured. For this measurement, it was

used the balance Filizola ® Model PL 2007. The following equations were used:

$$Sweating\ rate = total\ body\ mass \in baseline - total\ body\ mass\ postrace \quad (1)$$

$$Estimated\ sweating\ rate = \frac{total\ sweat\ loss}{exercise\ time \in hours} \quad (2)$$

Subjective perception variables

The thermal perception was measured by heat (score 1 to 7), comfort (score 1 to 6) and humidity (score 1 to 7) perception (Ackerley, Olausson, Wessberg, & McGlone, 2012), and the CR10 Borg Rate Perceived Exertion (RPE Borg), with a score between zero and 10 (Borg, 2000) was measure before the race, during transitions moments and post-race (Table 2). The researcher showed the printed visual analog scales for assessing thermal perception in different environments (Leon, Koscheyev, & Stone, 2008) at the moments described above. For the overall reliability, Cronbach's alpha value was 0.80, suggesting a normal distribution of the data and satisfactory internal consistency level (Taber, 2018).

Statistics

The statistical procedures were processed with the *Statistical Package for the Social Sciences* software (IBM SPSS Statistics 23, Chicago, USA). Descriptive statistics were applied to determine the mean, standard deviation, minimum and maximum values. The Shapiro-Wilk (SW) test was used to verify the normality of data. Paired Student's t-test was used to analyze the intragroup comparisons to physiological and biochemical variables on baseline and post-race. Freedman's ANOVA followed by Post Hoc of Dunn was used to compare the scores of CR10 Borg, Heat comfort, Skin wetness, and Heat perception on different moments (Baseline, 1a transition, 2a transition, and Post-race). The effect size of Cohen (*d*) was measured to analyze the magnitude of a treatment effect. It was classified into small ($d \leq 0.2$); medium ($0.2 < d < 0.79$) and large ($d \geq 0.8$) (Cohen, 2013). The significance level was $p<0.05$.

RESULTS

The mean age of the triathlon athletes was 32.88±4.31years old (SW p=0.429), presented a total body mass of 78.46±8,10 kg (SW p=0.972), body fatness of 6.70±0.93 % (SW p=0.163), and maximum oxygen consumption of 69.61±3.81 mlO2/kg/min (SW p=0.223). During the triathlon race, the ocean temperature remained at 18 ° C and the relative humidity at 60%. There was a variation between the ambient temperature (15.9 - 22.6 ° C) and the heat stress (15.9 - 23.2 ° C). No change in the relative humidity was observed. It could be observed in Table 2 the heat, environmental, and exertion perception and data collect during the Triathlon race.

It was observed a significant increase in RPE Borg on 1ª transition (p< 0.001; *d*= 18.6), 2º transitions (p< 0.001; *d*= 18.9) and post-race (p< 0.001; *d*= 21.4). There was a significant increase in baseline heat comfort to post-race (p= 0.013; *d*= 2.4) and in the 1ª transition to post-race (p= 0.007; *d*= 4.1). Skin wetness baseline presented a significant increase to 1ª transition (p< 0.001; *d*= 13.2) and to post-race (p< 0.001; *d*= 10.0). And the baseline Heat perception showed a significant increase to post-race (p< 0.001; *d*= 6.6).

The Figures 1 presents blood markers of CK, LDH and lactate of sample. The variables of injury and muscle fatigue CK (p= 0.005; *d*= 5.7), LDH (p= 0.004; *d*= 1.3) and lactate (p< 0.001; *d*= 7.2) presented a significant increase comparing the baseline and post-race data.

The Figures 2 presents blood markers of oxidative stress (Lipid peroxidation (LP), carbonylated proteins (CP), α-diphenyl-β-picrylhydrazyl (DPPH), and total thiols (TT) of sample. It was observed a significant increase in CP (p= 0.021; *d*= 2.2) and a significant decrease in DPPH (p= 0.002; *d*= -1.4) in post-race. No significant changes in LP (p= 0.217; *d*= 0.6) and TT (p= 0.881; *d*= -0.1) oxidative stress markers variables was verified.

Table 3 presents the dehydration levels comparing baseline and post-race. A significant increase ($\Delta\% = 30.95$, $p = 0.001$; $d = 6.8$) was observed in urine temperature and color (range [1-7], $p = 0.039$). However, urine gravidity did not change ($\Delta\% = 0.00$, $p = 1.000$). The mean race time was 3.64 ± 0.407 hours, which was within the maximum time for a race with

Table 2. Exertion, heat, and environmental subjective perception scales of the participants.

Variables (scale)	Baseline	1ª Transition	2ªTransition	Post-Race
RPE Borg (0-10)	0.13±0.35	6.63±1.77*	6.75±1.16*	7.63±2.07*
Heat comfort (1-6)	2.38±0.74	2.25±0.46	3.00±1.41	4.13±1.25*#
Skin wetness (1-7)	1.13±0.35	5.75±1.16*	3.88±0.99	4.63±0.74*
Heat perception (1-7)	2.50±0.53	3.63±1.06	5.00±1.31	6.00±0.53*

* p<0.05 to Baseline; # p<0.05 to 1ª Transition.

its characteristics, 5.30 hours. The mean sweating rate was 1925.0 ± 919.27 mL, and the estimated sweating rate (mL/h) was 545.0 ± 0.293, which represents approximately 2 kg of weight loss during a test. No significant correlation ($p < 0.05$) was observed between the Environmental Perception Scales and Ambient Temperature and the athlete's performance.

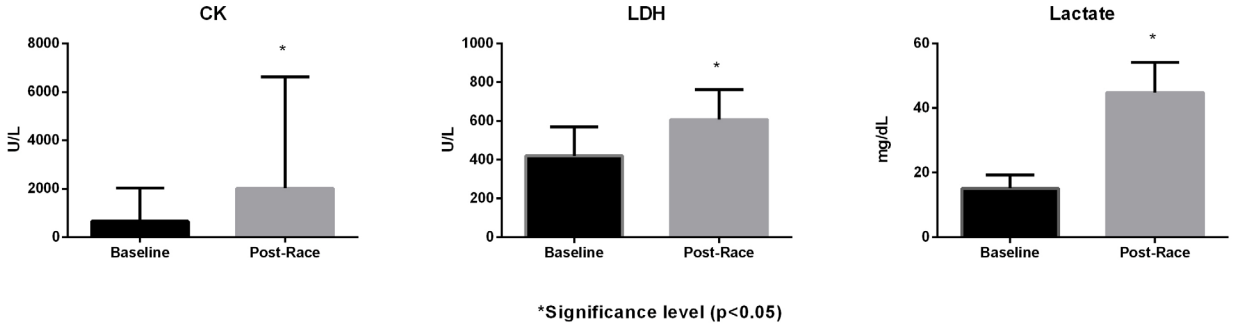

Figure 1. Blood markers of CK, LDH, and lactate of te participants.

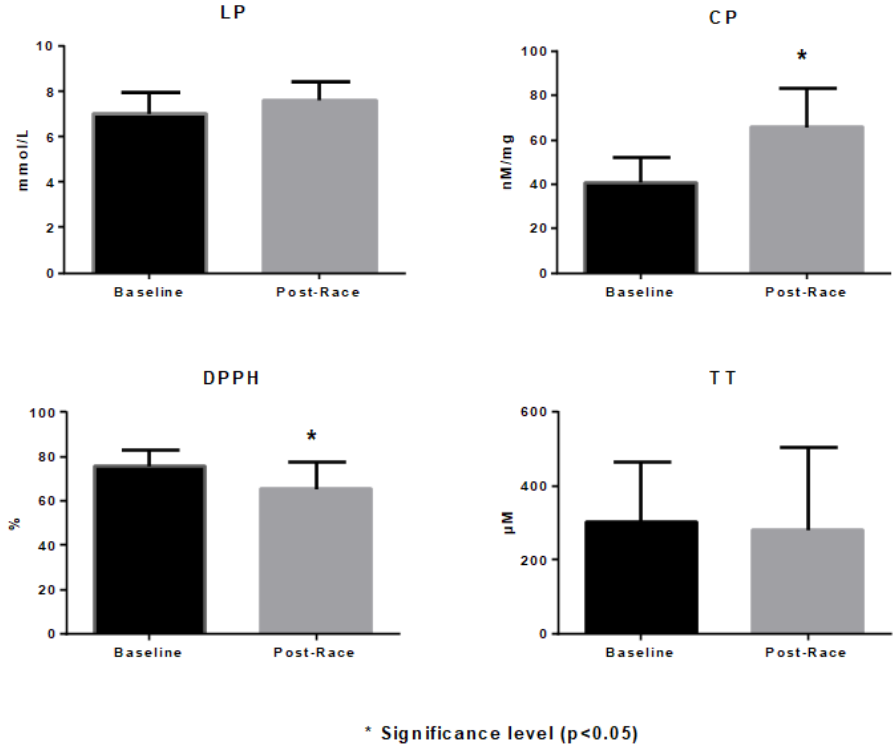

Figure 2. Blood markers of oxidative stress (Lipid peroxidation (LP), carbonylated proteins (CP), α-diphenyl-β-picrylhydrazyl (DPPH), and total thiols (TT) of the participants.

Table 3. Dehydration level of the participants

Variables	Baseline (Mean ± SD)	Post-race (Mean ± SD)	Δ% (p value)
Urine temperature	18.08 ± 0.84	23.75 ± 2.06*	30.95 (p=0.001)
Urine gravidity	1.337 ± 0.004	1.337 ± 0.002	0.00 (p=1.000)
Urine color (mode)	1	7*	85.70 (p=0.039)
Hematocrite (%)	45.61	45.77	0.36 (p=0.801)

* significance level (p<0.05)

DISCUSSION

The participants presented an excellent body composition and aerobic fitness within their respective reference (ACSM, 2014). This fact may have contributed to the accomplishment of the race within the deadline stipulated by the organization of the event (5.30 hours), where the mean race time was 3.64 ± 0.41 hours (Dengel, Flynn, Costill, & Kirwan, 1989; O'Toole & Douglas, 1995).

It was observed the increase of effort perception and heat perception with the reduction of heat comfort and skin wetness in the present study. The same tendency to increase the perceived effort as the triathlon race progresses occurred in a study with twelve triathlon athletes in an Ironman race (Puggina, 2008). The association between the increase of effort perception with the reduction of heat comfort is explained due to the increase of the body temperature as a result of the physical activity (McArdle, Katch, & Katch, 2016). The increase in the heat perception during the race, even with the ambient temperature beneath the values considered for heat stress (23.7ºC), is related to the stress of the exercise and thermoregulation (Ackerley, et al., 2012).

The greatest risk for heatstroke occurs during prolonged high-intensity exercise when the wet-bulb temperature exceeds 28˚C (ACSM, 2014). According to the heat index related to heat sensation, alert descriptions, and recommended sports activities, warm temperatures between 18-24ºC require precautions, hot temperatures between 24-28ºC require extreme caution, and very hot temperatures above 28ºC are dangerous (Brocherie & Millet, 2015).

In our study, the ambient temperature (15.9 - 22.6 ˚C) and the heat stress (15.9 - 23.2 ˚C) were below it, so the athletes were exposed to no thermal stress risks. Endurance performance during whole-body exercise is known to be impaired in the heat, and that subjective thermal strain is an important and independent mediator of the heat-induced impairment in endurance performance (Van Cutsem, Roelands, De Pauw, Meeusen, & Marcora, 2019). Triathletes with hyperthermia during the marathon of Ironman World Championship in Kona run more slowly (Olcina, Crespo, Timón, Mjaanes, & Calleja-González, 2019).

Regarding the blood markers, the CK, LDH, and lactate presented a significant increase comparing the baseline and post-race data. A similar study with 23 athletes who completed the Ironman in Johannesburg (1983) presented a significant increase in CK activity post-race and changes in other biochemical indicators such as glucose, fatty free acids, and lactate (Van Rensburg, Kielblock, & Van der Linde, 1986). It was also observed in a 70.3 Ironman race, an increase of CK and LDH post-race in 12 volunteer athletes (Puggina, 2008). Another study performed with 12 athletes, similar to Ironman, presented a high activity of LDH post-race (Margaritis, Tessier, Verdera, Bermon, & Marconnet, 1999). It was noticed the oxidative damage, inflammation, and increase of CK and LDH (Clifford et al., 2016) even in different race distances.

Olcina et al. (2018) reported a significant change in blood variables after the Olympic triathlon race as the muscle damage caused by an increase in blood levels of LDH and CPK. However, the increases observed were lower than in others races due to the distance and duration of the olympic race. These data suggest that muscle damage occurs after the Olympic distance triathlon but less than in triathlons of longer distances (Olcina, et al., 2018). In our study, the distances of endurance triathlon race were higher (1.5 km swimming, 60km cycling, 15 km running).

The tissue damage most common causes are neutrophil infiltration, calcium ion imbalance, free radical production, and excretion of cytokines (Withee et al., 2017), and the antioxidant defenses of the body are usually adequate to prevent substantial tissue damage (Cooper, Vollaard, Choueiri, & Wilson, 2002). Other factors are also associated with physical exercise, such as tissue inflammation. This factor can lead to oxidative stress and contribute to performance loss, fatigue, and muscle injury(Petersen & Pedersen, 2005). Moreover, the high-volume and high-intensity training combined with the emotional and physiologic stress caused by the competition could influence the immunological and hormone responses (Olcina, et al., 2019).

Usually, the antioxidant system is not enough to eliminate oxidative damage during and after exercise, although the body's complex antioxidant defense system (Pinho et al., 2010). Oxidative damage in exercise depends on its type and intensity. However, studies have shown that endurance training improves antioxidant defense as well as oxidative capacity in skeletal muscle (Pereira, Rosa, Safi, Bechara, & Curi, 1994). The markers of oxidative stress in our study suggested a good antioxidant defense.

Cutter at al. (2019) evaluated the effects of strenuous exercise and the risk of oxidative stress in eleven well-trained triathletes scheduled to compete in the Full Ironman Placid or Ironman Placid Half for summer 2017 and summer 2018. The athletes who completed the full Ironman triathlon experienced increased amounts of oxidative stress denoted by the elevated cortisol levels, increased 8-oxo-dG concentrations, and increased ROS concentrations (Cutter, Cruz, Cristall III, Lacey, & Julian, 2019). In the present study, the significant increase in CP and decrease in DPPH post-race and no significant changes in oxidative stress markers LP and TT

seems to contribute to the idea of improvement of antioxidant defense as triathlon training adaption.

A systematic review and meta-analysis that aimed to identify biomarkers associated with altered exercise performance following intensified training concluded that many biomarkers were altered with intensified training but not in a manner related to changes in exercise performance(Brocherie & Millet, 2015).

Kim et al. (2018) reported that the high-intensity long-term aerobic exercise triathlon leads to temporary weight loss, DNA damage, and muscle damage after the race and such changes are affected by exercise duration and intensity. Furthermore, during these changes, the defense mechanisms to protect against DNA and muscle damage, such as antioxidant defenses, may also occur during recovery and race (Kim et al., 2018). Seems to exist a dose-response relationship between adaptations of antioxidant enzymes and responses to ultra-endurance exercise, related to volumes and intensities of activity associated with ultra-endurance training confer protection against increases in free radical damage, resulting in improved oxidative balance (Ackerley, et al., 2012). We could also observe in our study the improvement of endurance training in the antioxidant defense.

Other relevant data, the total body mass of the triathletes in our study reduced by approximately 2 kg, characterizing dehydration. The effects of dehydration can occur even with a moderate reduction in total body mass (1-3%)(Armstrong, Costill, & Fink, 1985). Dehydration between 1.9 and 4.3% of total body mass can reduce resistance by 22-48% and VO2max by 10-22% (Whyte, et al., 2015). Moreover, there is an increased risk of heat illness if the exercise is performed in a state of dehydration (Mello, 2018).

Although the urine density values did not change, they were above the pre-test reference values, however, these values did not suffer a significant change in the post-test. While a significant increase in color was observed post-race, characterizing as "very dehydrated", even with an orientation of free hydration during the race. It is an important alert that can compromise the performance. James et al. (2019) stated that hypohydration seems to impair endurance performance through a combination of mechanisms, driven by hypovolemia and these physiological and perceptual responses due to the increased perception of effort compromising the performance (James, Funnell, James, & Mears, 2019). So, athletes' health and performance are dependent on avoidance of performance, limiting hypohydration or overhydration (Hoffman, 2019).

It can be highlighted that the triathlon is a single modality and not as the sum of three distinct sports modalities, and the present study demonstrated the impact of an endurance triathlon race on physiological markers and subjective perception variables in amateur triathletes. The limitations are the small number of participants because most of the selected athletes were not volunteers, assuming that the study protocol could influence their race performance. It was not controled the daily activities, the total amount of training, and sleeping hours during the week race. Furthermore, for future research, it is suggested a larger sample and evaluate other types of triathlon race, like Ironman.

CONCLUSIONS

It can be concluded that the acute effects of the endurance triathlon race on variables of injury and muscle fatigue presented an increase comparing the baseline and post-race data. The same behavior was observed in carbonylated proteins (CP), α-diphenyl-β-picrylhydrazyl (DPPH), and a decrease in α-diphenyl-β-picrylhydrazyl (DPPH).

Regarding the subjective perception variables, a significant increase in RPE Borg was observed along the moments of the race. There was an increase in heat comfort and heat perception in post-race compared with baseline.

The knowledge produced in this study can be applied in a practical way to control training intensity (training load control) and as a reference of these biomarkers for the modality. It can be recommended: hydration mainly after swimming and during cycling due to the masking of the thermal sensation at these times; active recovery with the bicycle on the roller or light running is recommended for better post-race enzymatic recovery; and application of recovery scales and late muscle pain, as well as the reduction of the total training volume, when the biochemical markers of injury and tissue inflammation are elevated after the competition or training.

ACKNOWLEDGMENTS

The authors would like to thank the CBTri (Confederação Brasileira de Triathlon) and FTERJ (Federação de Triathlon do Estado do Rio de Janeiro) for supporting the realization of this research.

REFERENCES

Ackerley, R., Olausson, H., Wessberg, J., & McGlone, F. (2012). Wetness perception across body sites. *Neuroscience letters, 522*(1), 73-77. doi: https://doi.org/10.1016/j.neulet.2012.06.020

ACSM. (2014). *American College of Sports Medicine. Guidelines for exercise testing and prescription* (9th ed ed.). Philadelphia: Lippincott Williams & Wilkins.

ACSM. (2018). *American College of Sports Medicine's guidelines for exercise testing and prescription* (10 ed.). Philadelphia, PA: Wolters Kluwer Health.

Armstrong, L., Costill, D., & Fink, W. (1985). Influence of diuretic-induced dehydration on competitive running performance. *Medicine and Science in Sports and Exercise, 17*(4), 456-461.

Armstrong, L., Epstein, Y., Greenleaf, J., Haymes, E., Hubbard, R., Roberts, W., & Thompson, P. (1996). Heat and cold illnesses during distance running. *Medicine Science and Sports Exercise, 28*(12), 377-390.

Borg, G. (2000). *Escalas de Borg para a dor eo esforço: percebido*. São Paulo: Manole.

Brocherie, F., Girard, O., Pezzoli, A., & Millet, G. (2014). Outdoor exercise performance in ambient heat: Time to overcome challenging factors? *International Journal of Hyperthermia, 30*(8), 547-549. doi: https://doi.org/10.3109/02656736.2014.979257

Brocherie, F., & Millet, G. (2015). Is the wet-bulb globe temperature (WBGT) index relevant for exercise in the heat? *Sports Medicine, 45*(11), 1619-1621.

Buckingham, T. M. (2018). *Physiological and Performance-Related Variables that Are Associated with Finish Time in Olympic Distance Triathlons*. Kinesiology – Doctor of Philosophy Dissertation, Michigan State University, Michigan.

Cheuvront, S., & Haymes, E. (2001). Thermoregulation and marathon running. *Sports Medicine, 31*(10), 743-762.

Clifford, T., Allerton, D. M., Brown, M. A., Harper, L., Horsburgh, S., Keane, K. M., . . . Howatson, G. (2016). Minimal muscle damage after a marathon and no influence of beetroot juice on inflammation and recovery. *Applied Physiology, Nutrition, and Metabolism, 42*(3), 263-270. doi: https://doi.org/10.1139/apnm-2016-0525

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*: Routledge.

Cooper, C., Vollaard, N. B., Choueiri, T., & Wilson, M. (2002). Exercise, free radicals and oxidative stress. *Biochemistry Society, 30*.

Cutter, N. L., Cruz, E., Cristall III, F., Lacey, K., & Julian, R. (2019). Strenuous Exercise Increases the Risk of Oxidative Stress in Ironman Triathlon Participants. *International Journal of Undergraduate Research and Creative Activities, 11*(6), 1-17. doi: http://doi.org/10.7710/2168-0620.1144

Dengel, D., Flynn, M., Costill, D., & Kirwan, J. (1989). Determinants of success during triathalon competition. *Research Quarterly for Exercise and Sport, 60*(3), 234-238.

Hoffman, M. D. (2019). Proper hydration during ultra-endurance activities. *Sports Medicine and Arthroscopy Review, 27*(1), 8-14. doi: https://doi.org/10.1097/JSA.0000000000000229

Jackson, A., & Pollock, M. (1985). Practical assessment of body composition. *The Physician and Sports Medicine, 13*(5), 76-90.

James, L. J., Funnell, M. P., James, R. M., & Mears, S. A. (2019). Does hypohydration really impair endurance performance? Methodological considerations for interpreting hydration research. *Sports Medicine*, 1-12. doi: https://doi.org/10.1007/s40279-019-01188-5

Kim, D.-E., Paik, I.-Y., Cho, S.-Y., Woo, J.-H., Bae, J.-Y., & Roh, H.-T. (2018). Effects of Long-Term Aerobic Exercise on Antioxidant System and Lymphocyte DNA Damage by Triathlon Distance. *Journal of Men's Health, 14*(2), e42-e55. doi: https://doi.org/10.22374/1875-6859.14.2.6

Leon, G. R., Koscheyev, V. S., & Stone, E. A. (2008). Visual analog scales for assessment of thermal perception in different environments. *Aviation, space, and environmental medicine, 79*(8), 784-786.

Logan-Sprenger, H. M. (2019). Fluid balance and thermoregulatory responses of competitive triathletes. *Journal of Thermal Biology, 79*, 69-72. doi: https://doi.org/10.1016/j.jtherbio.2018.12.003

Margaritis, I., Tessier, F., Verdera, F., Bermon, S., & Marconnet, P. (1999). Muscle enzyme release does not predict muscle function impairment after triathlon. *Journal of Sports Medicine and Physical Fitness, 39*(2), 133-139.

Marshall, W., Lapsley, M., Day, A., & Ayling, R. (2016). *Bioquímica clínica: Aspectos clínicos e metabólicos* (3 ed.). Rio de Janeiro: GEN Guanabara Koogan.

McArdle, W., Katch, F., & Katch, V. (2016). *Exercise physiology: energy, nutrition, and human performance* (8th ed ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Mello, D. (2018). Thermal Stress - The Effects of Heat on Physical Performance. *Revista de Educação Física/Journal of Physical Education, 87*(4), 541-545.

Minton, D. M., O'Neal, E. K., & Torres-McGehee, T. M. (2015). Agreement of urine specific gravity measurements between manual and digital refractometers. *Journal of Athletic Training, 50*(1), 59-64. doi: https://doi.org/10.4085/1062-6050-49.3.47

Mrakic-Sposta, S., Gussoni, M., Vezzoli, A., Dellanoce, C., Comassi, M., Giardini, G., . . . Greco, F. (2020). Acute Effects of Triathlon Race on Oxidative Stress Biomarkers. *Oxidative Medicine and Cellular Longevity, 2020*. doi: https://doi.org/10.1155/2020/3062807

Neves, E. B., Salamunes, A. C. C., de Oliveira, R. M., & Stadnik, A. M. W. (2017). Effect of body fat and gender on body temperature distribution. *Journal of thermal biology, 70*, 1-8. doi: https://doi.org/10.1016/j.jtherbio.2017.10.017

O'Toole, M., & Douglas, P. (1995). Applied physiology of triathlon. *Sports Medicine, 19*(4), 251-267.

Ofoghi, B., Zeleznikow, J., Macmahon, C., Rehula, J., & Dwyer, D. (2016). Performance analysis and prediction in triathlon. *Journal of Sports Sciences, 34*(7), 607-612. doi: https://doi.org/10.1080/02640414.2015.1065341

Olcina, G., Crespo, C., Timón, R., Mjaanes, J. M., & Calleja-González, J. (2019). Core temperature response during the marathon portion of the Ironman World Championship (Kona-Hawaii). *Frontiers in Physiology, 10*. doi: 10.3389/fphys.2019.01469

Olcina, G., Timón, R., Brazo-Sayavera, J., Martínez-Guardado, I., Marcos-Serrano, M., & Crespo, C. (2018). Changes in physiological and performance variables in non-professional triathletes after taking part in an Olympic distance triathlon. *Research in Sports Medicine, 26*(3), 323-331. doi: https://doi.org/10.1080/15438627.2018.1447472

Pereira, B., Rosa, L. C., Safi, D., Bechara, E. J. H., & Curi, R. (1994). Superoxide dismutase, catalase and glutathione peroxidase activities in the lymphoid organs of diabetic rats. *Journal of Endocrinology, 142*(1), 161-165.

Petersen, A. M. W., & Pedersen, B. K. (2005). The anti-inflammatory effect of exercise. *Journal of Applied Physiology, 98*(4), 1154-1162.

Pezzoli, A., Cristofori, E., Moncalero, M., Giacometto, F., & Boscolo, A. (2013). *Effect of the Environment on the Sport Performance*. Paper presented at the icSPORTS.

Pinho, R. A., Silva, L. A., Pinho, C. A., Scheffer, D. L., Souza, C. T., Benetti, M., . . . Dal-Pizzol, F. (2010). Oxidative stress and inflammatory parameters after an Ironman race. *Clinical Journal of Sport Medicine, 20*(4), 306-311.

Puggina, E. (2008). *Estudo do stress fisiológico em atletas de triathlon*. Doutorado, Universidade de São Paulo, São Paulo.

Santos, N. C. d. M. S., Neves, E. B., Fortes, M. d. S. R., Martinez, E. C., & Júnior, O. d. C. F. (2018). The influence of combat simulation exercises on indirect markers of muscle damage in soldiers of the brazilian army. *Bioscience Journal, 34*(4). doi: https://doi.org/10.14393/BJ-v34n1a2018-39467

Sleivert, G., & Rowlands, D. (1996). Physical and physiological factors associated with success in the triathlon. *Sports Medicine, 22*(1), 8-18.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273-1296. doi: DOI 10.1007/s11165-016-9602-2

Van Cutsem, J., Roelands, B., De Pauw, K., Meeusen, R., & Marcora, S. (2019). Subjective thermal strain impairs endurance performance in a temperate environment. *Physiology & behavior, 202*, 36-44. doi: https://doi.org/10.1016/j.physbeh.2019.01.011

Van Rensburg, J., Kielblock, A., & Van der Linde, A. (1986). Physiologic and biochemical changes during a triathlon competition. *International Journal of Sports Medicine, 7*(01), 30-35.

Wenger, C. (1972). Heat of evaporation of sweat: thermodynamic considerations. *Journal of Applied Physiology, 32*(4), 456-459.

Whyte, G., Loosemore, M., & Williams, C. (2015). *ABC of sports and exercise medicine*. New Jersey: John Wiley & Sons.

Withee, E. D., Tippens, K. M., Dehen, R., Tibbitts, D., Hanes, D., & Zwickey, H. (2017). Effects of Methylsulfonylmethane (MSM) on exercise-induced oxidative stress, muscle damage, and pain following a half-marathon: a double-blind, randomized, placebo-controlled trial. *Journal of the International Society of Sports Nutrition, 14*(1), 1–11. doi: https://doi.org/10.1186/s12970-017-0181-z

WMA. (2014). General Assembly of the World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *The Journal of the American College of Dentists, 81*(3), 14.

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.21120

O papel dos instrutores de fitness na adesão à prática de exercício físico em Portugal: a importância dos comportamentos de suporte e dos climas motivacionais

Fitness instructors role on exercise adherence in Portugal: the importance of need-supportive behaviors and motivational climates

Filipe Rodrigues[1,2,3]*, Diogo Monteiro[2,4], Diogo Teixeira[5,6], Luís Cid[1,2]

RESUMO

O presente estudo avaliou o efeito dos comportamentos interpessoais e dos climas motivacionais dos instrutores na adesão futura à prática de exercício físico. Para dar resposta a este objetivo, realizaram-se dois estudos com duas amostras independentes: no primeiro, analisou-se o efeito dos comportamentos de suporte e de frustração nas necessidades psicológicas básicas e a sua associação com a adesão; no segundo estudo, examinou-se o efeito dos climas motivacionais com envolvimento para a tarefa e para a ego nas necessidades psicológicas básicas, sendo estas por sua vez associadas à adesão à prática de exercício físico. Foram recolhidos dados de praticantes de atividades fitness inseridos em diversos ginásios e *health clubs* em Portugal. Os resultados evidenciaram uma associação positiva entre os comportamentos de suporte, e do clima motivacional com envolvimento para a tarefa, e a satisfação das necessidades psicológicas básicas. As necessidades psicológicas básicas por sua vez encontram-se associadas de forma positiva e significativa com a adesão à prática. Pelo contrário, os comportamentos de frustração apresentam uma associação negativa com as necessidades psicológicas básicas e o clima motivacional com envolvimento para o ego não apresenta nenhuma associação com as necessidades psicológicas básicas. Em suma, os resultados demostram claramente uma associação entre a forma como o instrutor de fitness é percecionado pelo praticante e o número de acessos que o praticante terá nos seis meses seguintes ao do momento de avaliação inicial. Assim sendo, os profissionais de exercício físico têm uma capacidade considerável de influenciar positivamente a adesão do praticante, ao criarem um ambiente de suporte durante a sessão de treino.

PALAVRAS-CHAVE: exercício físico; comportamentos interpessoais; climas motivacionais; adesão.

ABSTRACT

The present study aimed to examine the association between fitness instructors' interpersonal behaviors and motivational climates and exercise adherence. Two studies were conducted: in the first study, the effect of need-supportive and need-thwarting behaviors on basic psychological needs, and consequently on exercise adherence was analyzed; in the second study, the effect of ego and task-involving motivational climates on basic psychological needs, and consequently on exercise adherence was examined. Data was collected from several exercisers engaged in fitness activities in several gym and health clubs in Portugal. The results showed a positive association between need-supportive behaviors, task-involving climate, and basic psychological needs. These needs were respectively positively and significantly correlated with exercise adherence. Contrarily, need-thwarting behaviors displayed a negative, while ego-involving climates no association at all, with basic psychological needs. Overall, the data clearly shows an association between the way the fitness instructor is perceived by the exerciser and the number of accesses that the exerciser will have in the six months following the moment of the initial assessment. Therefore, fitness instructors have a considerable capacity to positively influence the exerciser's adherence, by creating a supportive environment during the training session.

KEYWORDS: exercise; Interpersonal behaviors; motivational climates; adherence.

[1]Sport Science School of Rio Maior (ESDRM – IPSantarém), Rio Maior, Portugal
[2]Research Center in Sport, Health and Human Development (CIDESD), Vila Real, Portugal
[3]Life Quality Research Center (CIEQV), Santarém, Portugal
[4]ESECS, Polytechnique of Leiria, Leiria, Portugal
[5]University of Lusófona (ULHT), Lisbon, Portugal
[6]Centro de Investigação em Desporto, Educação Física e Exercício e Saúde (CIDEFES), UHLT, Lisboa, Portugal
*Autor Correspondente: Sport Science School of Rio Maior, Av. Dr. Mário Soares nº110 E-mail: frodrigues@esdrm.ipsantarem.pt

Conflito de interesses: Nada a declarar. Financiamento: Filipe Rodrigues was supported by the national funds through the Portuguese Foundation for Science and Technology, I.P., under the project UIDP/04748/2020. Luís Cid and Diogo Monteiro were supported by national funds through the Portuguese Foundation for Science and Technology, I.P., under the project UID04045/2020.
Artigo recebido a 10 05, 2020; Aceite a 11 05, 2020

INTRODUÇÃO

A prática regular e estruturada de atividade física tem evidenciado , uma associação positiva entre a prática de atividade física e os benefícios físicos e psicológicos (Warburton & Bredin, 2017; Warburton et al., 2006; Williamson & Pahor, 2010). Contudo, a população portuguesa está cada vez mais sedentária e fisicamente inativa, observando-se assim um decréscimo nas últimas décadas nos níveis de atividade física, seja esta realizada em contexto recreativo ou desportivo (Eurobarómetro, 2018). Em 2003, o Eurobarómetro (2003) indicava que 60% da população portuguesa era fisicamente inativa. Quando questionados "*com que frequência pratica exercício físico ou desporto?*", 68% dos portugueses em 2018 afirmava "*Nunca*" (Eurobarómetro, 2018).

Em 2010, 45% dos portugueses confirmou que realizava atividade física de forma regular (Eurobarómetro, 2010). Em 2014, voltamos a observar uma queda na percentagem de praticantes de exercício físico ou desporto, onde 64% dos portugueses inquiridos apontavam ser fisicamente inativos (Eurobarómetro, 2014). Essa tendência veio a piorar, sendo que no último Eurobarómetro (2018), 68% da população portuguesa afirmava não praticar exercício físico nem desporto.

Outros relatórios realizados em Portugal corroboram com estes números. De facto, de acordo com o Inquérito Alimentar Nacional e de Atividade Física (AINAF; Lopes et al., 2016), em 2016 apenas 39% afirmavam praticar atividade física, sendo a percentagem em 2017 significativamente inferior, ao qual apenas 27% confirmavam ser fisicamente ativo. Estes números não são distintos do Barómetro Nacional de Atividade Física, conduzido pela Direção Geral de Saúde (DGS, 2017), demonstrando que apenas 40% dos portugueses cumpria com os mínimos relativamente às recomendações para a prática de atividade física. Estes números demonstram uma clara tendência: a população portuguesa está cada vez mais fisicamente inativa. A percentagem da população portuguesa que cumpre com as recomendações mínimas de atividade física para a obtenção dos benefícios é baixa, e este número tem vindo a diminuir ao longo dos últimos 20 anos.

Quando se pensa em atividade física estruturada, assume-se os ginásios e os *health clubs* como um dos meios privilegiados para este comportamento. De facto, dos portugueses que afirmam praticar exercício físico ou desporto, os ginásios e os *health clubs* apresentam-se como um dos meios escolhidos para esta prática (Eurobarómetro, 2018). No entanto, diversos relatórios têm evidenciando uma taxa de cancelamento elevada (AGAP, 2020; 2018). Especificamente, a taxa de cancelamento por parte dos praticantes inscritos em ginásios ou *health clubs* ronda os 60%-70% (AGAP, 2018; 2014). Por outras palavras, significa que a cada 100 pessoas que se inscrevem num ginásio, 60 a 70 dessas pessoas irá cancelar a sua inscrição no ginásio ou *health club* onde estava inserido num período de um ano. Esta elevada taxa de abandono demonstra claramente uma necessidade de serem realizados estudos que analisem com detalhe as determinantes para a prática de atividade física neste contexto.

Não obstante, a pouca literatura existente (Rodrigues et al., 2019a; Teixeira et al., 2020) parece ser consensual no que diz respeito às determinantes para a prática de atividade física estruturada e regular em contexto de ginásios e *health clubs* em Portugal: os fatores contextuais tais como as abordagens feitas pelos técnicos de exercício físico, ou seja, a forma como o praticante perceciona os comportamentos e os climas por parte dos instrutores poderá determinar a contínua prática de exercício físico, ou a sua desistência (Rodrigues et al., 2020a). De facto, estudos a nível nacional têm corroborado com esta afirmação, demonstrando o papel preponderante dos instrutores de fitness no que diz respeito aos níveis de autodeterminação para a prática de exercício físico (Rodrigues et al., 2020b), bem como na redução de massa corporal (Silva et al., 2011), maiores níveis de divertimento (Rodrigues et al., (2019b) e melhoria de respostas emocionais positivas (Teixeira et al., 2016). Estas evidências foram recentemente discutidas numa carta ao editor escrita por Teixeira et al. (2020) e demonstrando que: "*Vários fatores de natureza contextual…parecem contribuir para a experiência subjetiva do praticante, sendo que este fator se tem evidenciado nos últimos anos como um importante preditor do comportamento futuro…*" (pág. 4). Assim, para entender melhor o panorama relativamente ao que o praticante vê e sente durante o seu treino, deve-se ter em consideração os quadros teóricos mais contemporâneos e proeminentes no que diz respeito à análise da prática de exercício físico.

Entre os diversos quadros teóricos adotados no estudo do comportamento humano e da motivação, destaca-se a Teoria da Autodeterminação (TAD; Ryan & Deci, 2017) e a Teoria dos Objetivos de Realização (TOR; Nicholls, 1984) pelos resultados robustos obtidos em diversos estudos empíricos (Duda et al., 2013; Monteiro et al., 2018; Rodrigues et al., 2019b; Teixeira et al., 2019). A TAD foca-se nos fatores do contexto envolvente, fatores da personalidade, bem como as causas e as consequências do comportamento autodeterminado. Este modelo teórico analisa e explica como as determinantes motivacionais, tais como os comportamentos interpessoais, poderão ser responsáveis por resultados positivos ou consequências negativas a nível emocional, cognitivo e comportamental (Ryan & Deci, 2017). Por sua vez a TOR preocupa-se em compreender a capacidades das pessoas em demonstrarem competência, conseguirem obter sucesso e/ou

evitarem o fracasso. Assim, os climas motivacionais induzidos pelas pessoas mais próximas poderão estar relacionados com a forma como o indivíduo experiência a sua competência e a sua busca por resultados positivos ou negativos em contextos de realização (Duda et al., 2013).

De acordo com as evidências existentes (Roberts, 2012), não são os comportamentos interpessoais e os climas motivacionais que determinam de forma direta a realização (ou não) de um determinado comportamento. Por exemplo, não será a forma como praticante perceciona os comportamentos e os climas do instrutor de fitness que determinará se este ou esta pretende manter a sua frequência, ou se pretende desistir da prática (Rodrigues et al., 2020b). A relação fatores contextuais e consequências comportamentais são mediadas pela satisfação/frustração das três necessidades psicológicas básicas, inatas e universais a todos os seres humanos, independentemente do sexo, idade, raça, ou outras características pessoais (Ryan & Deci, 2017). Estes autores (Ryan & Deci, 2017) afirmam que a satisfação das necessidades psicológicas básicas de autonomia, competência e relação concebe os nutrientes essenciais e universais para a saúde psicológica e o desenvolvimento da motivação intrínseca. A autonomia representa a capacidade que o indivíduo tem em regular o seu comportamento através das suas próprias ações; a competência é definida pela capacidade que a pessoa tem em ser eficiente na interação com o meio envolvente; e a relação explica a necessidade que o indivíduo tem em procurar e desenvolver relações e ligações positivas e afetos com as outras pessoas no contexto onde está inserido/inserida (Ryan & Deci, 2017). A satisfação destas três necessidades determinará então, a regulação do comportamento da pessoa em que as pessoas tendem a participar mais em atividades físicas estruturadas. Por oposição, quando estas três necessidades não são satisfeitas, ou até mesmo frustradas, o comportamento tende a ser regulado por forças externas, sendo o abandono ou níveis baixos de adesão o resultado mais provável (Rodrigues et al., 2018).

Tal como referido, a TAD contempla o contexto social envolvente como preditor do comportamento humano, através do seu efeito nas necessidades psicológicas básicas, do qual os indivíduos estão constantemente a extrair informação a partir das pessoas mais relevantes, de forma a interpretarem os seus próprios comportamentos (Ryan & Deci, 2017). De acordo com este modelo teórico, os indivíduos podem perceccionar comportamentos de suporte e de frustração, que terão um impacto diferenciado no que diz respeito às necessidades psicológicas básicas de cada pessoa (Vaansteenkiste & Ryan, 2013). Quando as pessoas percecionam comportamentos interpessoais de suporte (e.g., *os instrutores de fitness dão aos praticantes a oportunidade de escolher os exercícios/ treinos de que mais gostam, transmitem feedback eficiente e criam ligações afetivas e reais*), as pessoas tendem a demonstrar elevados níveis de satisfação das necessidades psicológicas básicas, estando mais predispostas a resultados positivos tais como níveis elevados de divertimento durante a prática de exercício físico e de respostas emocionais positivas (Moutão et al., 2015; Rodrigues et al., 2019; Teixeira et al., 2018a; Teixeira & Palmeira, 2016). Contrariamente, ao percecionar e experienciar comportamentos de frustração (e.g., *os técnicos ignoram o praticante, impõem os seus comportamentos sobre estes, encaram o praticante como um fim monetário ou manipulam o praticante sem preocupação com o bem-estar deste*) os indivíduos tendem a manifestar ações menos autodeterminadas, devido aos baixos níveis de satisfação e/ou elevados níveis de frustração (Warburton et al., 2019).

O mesmo acontece na associação entre os climas motivacionais com a satisfação das necessidades psicológicas básicas. Instrutores de fitness que adotam um clima motivacional com envolvimento para a tarefa (e.g., *faz uma avaliação autorreferenciada, coloca ênfase na tarefa e não no resultado, foca-se no crescimento individual*), estão mais próximos de promoverem a satisfação das necessidades psicológicas básicas por parte do praticante, levando, consequentemente a maiores níveis de adesão (Klain et al., 2014; Alesi et al., 2019). Por outro lado, quando os instrutores promovem uma clima com envolvimento para o ego (e.g., *quando os instrutores os comparam com os pares, valorizam o status social, e focam-se nos resultados por qualquer meio*), estes tendem a experienciar menores níveis de satisfação das necessidades, evidenciando por conseguinte menores níveis de persistência na prática de atividade física regular (Klain et al., 2014; Alesi et al., 2019).

Tomando em consideração as evidências existentes, parece existir uma associação positiva entre os comportamentos interpessoais de suporte, o clima motivacional com envolvimento para a tarefa, a satisfação das necessidades psicológicas básicas e a adesão à prática de exercício físico. Contrariamente, o efeito dos comportamentos de frustração e de um clima com envolvimento para o ego parecem apresentar um efeito negativo no que diz respeito à satisfação das necessidades psicológicas básicas e consequentemente, à prática regular de atividade física estruturada. Apesar de existirem evidências que suportam estas relações, existem ainda diversas lacunas que devem ser colmatadas para que os investigadores, docentes e profissionais se tornem capazes de analisar em detalhe o fenómeno da desistência-adesão à prática de atividade física em particular em ginásios/health clubs. Neste sentido, parece que até à data, nenhum estudo comparou o efeito dos dois determinantes contextuais (i.e., comportamentos interpessoais e climas motivacionais) nas necessidades psicológicas básicas, e posteriormente na adesão à prática de exercício físico, bem como as associações

entre as determinantes motivacionais e o comportamento. Não obstante, são também escassos os estudos que tenham analisado objetivamente a adesão à prática de exercício físico em Portugal (e.g., Rodrigues et al., 2020b). Concretamente, a maior parte dos estudos têm avaliado a prática de exercício físico através de valores auto-reportadas (e.g., IPAQ), sabendo antecipadamente que existe um viés e uma visão tendenciosa relativa ao volume e à intensidade do comportamento. Uma revisão sistemática analisou em detalhe a diferença entre comportamentos auto-reportados e medidos de forma objetiva, indicando que os estudos devem examinar de forma concreta e objetiva o comportamento, dado não existir nenhuma correlação com questionários onde os indivíduos podem apontar os valores "supostos" (Prince et al., 2020). Por último, apesar dos modelos sociocognitivos explicarem apenas 25% o comportamento (Hagger & Chatzisarantis, 2008), os próprios autores afirmam que apesar deste valor ter um impacto baixo, não devemos colocar de parte o estudo do comportamento humano usando estes modelos teóricos. Para além do referido, estes autores apontam que devem ser realizados mais estudos na compreensão dos fenómenos e determinantes adjacentes à realização e manutenção de comportamentos saudáveis, tais como a prática de exercício físico. Assim, este estudo representa um incremento significativo à literatura, pois parece ser difícil examinar e criar protolocos eficientes, quando os números de pessoas fisicamente ativas tendem a diminuir, e o número de estudos realizados em Portugal neste contexto é ainda escasso.

Tomando em consideração a literatura existente e todos os pressupostos supramencionados, o objetivo deste estudo foi analisar a associação entre os comportamentos interpessoais e os climas motivacionais, as necessidades psicológicas básicas e a consequente adesão à prática de exercício físico em contexto de ginásio e *health clubs*. Para dar resposta a este objetivo, realizaram-se dois estudos: o estudo 1 consistiu na análise dos comportamentos interpessoais, enquanto que o estudo 2 analisou os climas motivacionais como fatores contextuais determinantes das necessidades psicológicas básicas e a resultante adesão à prática de exercício físico.

ESTUDO 1

MÉTODOS

Participantes

O estudo 1 consistiu em analisar o efeito da perceção dos praticantes de exercício físico nos comportamentos interpessoais de suporte e de frustração nas necessidades psicológicas básicas, e consequente na adesão à prática de exercício físico. Para dar resposta a este objetivo, foram recrutados 437 (sexo feminino = 235) praticantes de exercício físico em ginásios e *health clubs* no norte de Portugal, na região do Minho e alto Douro, com idades compreendidas entre 18 e 64 anos (M = 31.14; DP = 9.47). Estes praticantes tinham uma média de experiência de prática de 40.34 (DP = 48.92) meses e uma média de frequência semanal de 1.78 (DP = .98) treinos. Relativamente às atividades, 55% estavam maioritariamente envolvidos em atividades na sala de musculação e os restantes 45% realizavam com maior frequência aulas de grupo.

Procedimentos

Foram contactados diversos diretores técnicos e gestores de ginásios e *health clubs* do norte de Portugal. Após explicação dos objetivos e aprovação ter sido garantida, os investigadores abordaram os potenciais participantes na zona de receção dos ginásios e *health clubs*. Os potenciais participantes que concordaram em participar voluntariamente no estudo, assinaram individualmente um consentimento informado previamente ao preenchimento dos questionários. Adicionalmente foi explicado a todos os participantes os objetivos do estudo e foi-lhes providenciada a informação de anonimato e livre participação.

Todo o processo de recolha de dados esteve de acordo com a Declaração de Helsínquia e este estudo foi aprovado pela comissão ética do Centro de Investigação em Desporto, Saúde e Desenvolvimento Humano (ref: UID4045/2020). O tempo de aplicação dos questionários demorou aproximadamente 25 minutos.

Instrumentos

Para medir os comportamentos interpessoais, utilizou-se o *Interpersonal Behavior Questionnaire* traduzido e validado para a população portuguesa praticante de exercício físico (Rodrigues et al., 2019c). Este instrumento é composto por 24 itens, medindo a forma como o praticante perceciona os comportamentos de suporte a cada necessidade psicológica básica (12 itens) e de frustração (12 itens). Os comportamentos de suporte à autonomia, à competência e à relação são agrupados num fator compósito seguindo as recomendações de diversos autores (Rodrigues et al., 2019d; Rocchi et al., 2016).

Para avaliar as necessidades psicológicas básicas foi utlizada a *Basic Psychological Needs Satisfaction and Frustration Scale* validado no contexto do exercício físico na população portuguesa e foi usado para analisar o grau de satisfação das necessidades psicológicas básicas durante a prática (Rodrigues et al., 2019d). Especificamente, utilizaram-se apenas os itens relacionados com a satisfação, nomeadamente a autonomia

(4 itens), acompetência (4 itens) e a relação (4 itens). Os itens são precedidos da afirmação "*quando pratico exercício físico*" ao qual os praticantes avaliam o grau de concordância a cada item. Estudos prévios suportam a validade da escala (Chen et al., 2015; Rodrigues et al., 2019d).

A adesão foi medida com recurso aos registos eletrónicos dos ginásios e *health clubs*. Tomando em consideração os acessos semanais, somaram-se todas as entradas que o praticante teve nos seis meses seguintes ao momento de avaliação inicial. Estudos prévios analisaram a adesão de forma semelhante (Rodrigues et al., 2019c; Gomes et al., 2018).

Análises estatísticas

Como analises preliminares, foram calculados os valores da tendência central e de dispersão, bem como os valores de assimetria e curtose. Para aceitação de uma distribuição normal univariada, os valores de assimetria e de curtose devem estar contidos entre -2/+2 e -7/+7, respetivamente (Gravetter & Wallnau, 2014). Os coeficientes de fiabilidade compósita foram calculados para examinar se os itens medem o fator que pretendem medir, assumindo valores iguais ou superiores a 0.70 como aceitáveis (Raykov et al., 2015). Igualmente foram calculadas as correlações bivariadas tomando em consideração a magnitude dos intervalos propostos por Cohen (1988).

Numa segunda instância, foi realizado um modelo de equações estruturais, em função das recomendações propostas por diversos autores (Byrne, 2011; Hair et al., 2019), através do programa estatístico Mplus 7.4 com o recurso ao estimador robusto da máxima verosimilhança, dado ser o estimador mais robusto contra a não normalidade dos dados (Múthen & Múthen, 2010). O teste do qui-quadrado será apresentado por motivos de transparência, mas não analisado nem interpretado, dado ser sensível à complexidade do modelo e ao tamanho da amostra. Nesse sentido, foram utilizados e considerados os seguintes índices de ajustamento para a aceitação do modelo: *Comparative Fit Index* (CFI), *Tucker-Lewis Index* (TLI), *Standardized Root Mean Square Residual* (SRMR), *Root Mean Error of Approximation* (RMSEA) e o respetivo Intervalo de Confiança a 90% (IC90%). No presente estudo, foram adotados os valores de corte sugeridos por Hair et al. (2019), nomeadamente: CFI e TLI ≥ 0.90, e SRMR e RMSEA ≤0.08.

RESULTADOS

Na tabela 1 é possível observar que a perceção dos comportamentos de suporte e as necessidades psicológicas básicas apresentam valores acima do ponto médio das respetivas escalas. Contrariamente, os comportamentos de frustração apresentam um valor inferior ao ponto médio da escala, indicando que os participantes deste estudo valorizam mais os comportamentos de suporte por parte dos instrutores de fitness. Todas as variáveis apresentaram uma distribuição normal, uma vez que os valores de assimetria e curtose estão contidos dentro dos valores de corte. Os coeficientes de fiabilidade compósita apresentam valores superiores a 0.70, evidenciando assim uma consistência interna ajustada. No que diz respeito às correlações, as perceções de comportamentos de suporte apresentam uma correlação positiva e significativa com as necessidades psicológicas básicas e com a adesão ao exercício físico. A satisfação das necessidades psicológicas básicas apresenta uma associação negativa e significativa com a perceção de comportamentos de frustração e apresenta uma correlação positiva e significativa com a adesão à prática de exercício físico. Para mais detalhes ver Tabela 1.

Relativamente ao modelo proposto, este apresentou um ajustamento aceitável aos dados, tomando em consideração os valores de corte dos índices absolutos e incrementais: [$\chi 2$ = 272.303, gl = 146, p <0.001, CFI = .922, TLI = .908, SRMR = 0.04, RMSEA = .042 (.034, .050)]. Na figura 1 está representado o modelo estrutural, bem como valores das regressões entre as variáveis em estudo. De acordo com os resultados, é possível evidenciar que os comportamentos

Tabela 1. Estatísticas descritivas e correlações entre variáveis no Estudo 1

	M	DP	A	C	Correlações		
					1	2	3
Estudo 1 (n = 437)							
1. Comportamentos de suporte	5.49	.79	-.16	-.42	*.80*		
2. Comportamentos de frustração	2.09	.83	.86	1.79	-.44**	*.72*	
3. Necessidades Psicológicas Básicas	4.09	.52	-.45	.92	.52**	-.27**	*.75*
4. Adesão futura	43.78	25.47	1.02	-.54	.12**	-.09*	.25**

Notas: M = Média; DP = Desvio Padrão; A = Assimetria; C = Curtose; Coeficientes de fiabilidade compósita estão na diagonal em itálico; * p <0.05 ** p <0.01.

de suporte apresentam um efeito positivo e significativo na satisfação das necessidades psicológicas básicas, e um efeito indireto igualmente significativo na adesão à prática de exercício físico. Contrariamente, a perceção de comportamentos de frustração apresenta um efeito negativo e significativo na satisfação das necessidades psicológicas básicas, e um efeito indireto positivo e significativo na adesão ao exercício físico.

ESTUDO 2

MÉTODOS

Participantes

O estudo 2 consistiu em examinar o efeito da perceção dos praticantes de exercício físico sobre climas motivacionais com envolvimento para a tarefa e para o ego nas necessidades psicológicas básicas, e consequente na adesão à prática de exercício físico. Para o estudo 2, foram recolhidos dados de uma amostra independente. No total, participaram 487 (sexo feminino = 234) praticantes de exercício físico em ginásios e *health clubs* no centro de Portugal, na região do Ribatejo e vale do Tejo, com idades compreendidas entre 18 e 64 anos (M = 31.42; DP = 9.66). Estes praticantes tinham uma média de experiência de prática de 41.34 (DP = 49.82) meses e uma média de frequência semanal de 2.08 (DP = 1.02) treinos. Relativamente às atividades, 59% estavam maioritariamente envolvidos em atividades na sala de musculação e os restantes 41% realizavam com maior frequência aulas de grupo (e.g., *Pilates*, *Indoor Cycling*).

Procedimentos

Recorreu-se aos mesmos procedimentos utilizados no estudo 1. Todos os participantes que se disponibilizaram a participar voluntariamente neste estudo assinaram consentimento informado previamente ao preenchimento do questionário. O tempo de aplicação dos questionários demorou aproximadamente 20 minutos.

Instrumentos

Para medir os climas motivacionais induzidos pelos instrutores de fitness, utilizou-se o *Perceived Motivational Climate in Exercise Questionnaire* versão portuguesa (Cid et al., 2012). Este instrumento é composto por 10 itens, cinco itens em cada fator, os quais avaliam a forma como o praticante perceciona um clima com envolvimento para a tarefa (5 itens) e um clima com envolvimento para o ego (5 itens).

Para medir a satisfação das necessidades psicológicas básicas em contexto de ginásio e *health clubs*, recorreu-se ao *Basic Psychological Needs in Exercise Scale* versão portuguesa Moutão et al. (2012). Este instrumento é composto por 12 itens, quatro itens para cada fator, os quais avaliam a forma como o praticante sente que a necessidade de autonomia (exemplo: "*sinto que faço exercício de acordo com os meus interesses*"), de competência (exemplo: "*sinto-me bem com as pessoas com que faço exercício*") e de relação (exemplo: "*sinto que realizo com sucesso as atividades do meu programa de exercício*") estão a ser satisfeitas durante a prática de exercício físico. Os valores obtidos são depois agrupados em fatores compósitos, conforme sugerido por Cid et al. (2020).

A adesão à prática de exercício físico foi a mesma utilizada no estudo 1. Utilizaram-se os registos eletrónicos dos ginásios, somando todas as entradas no ginásio ou *health club* nos seis meses seguintes ao momento de avaliação inicial, de acordo com os pressupostos realizados em estudos anteriores (Klain et al., 2014; Rodrigues et al., 2019b).

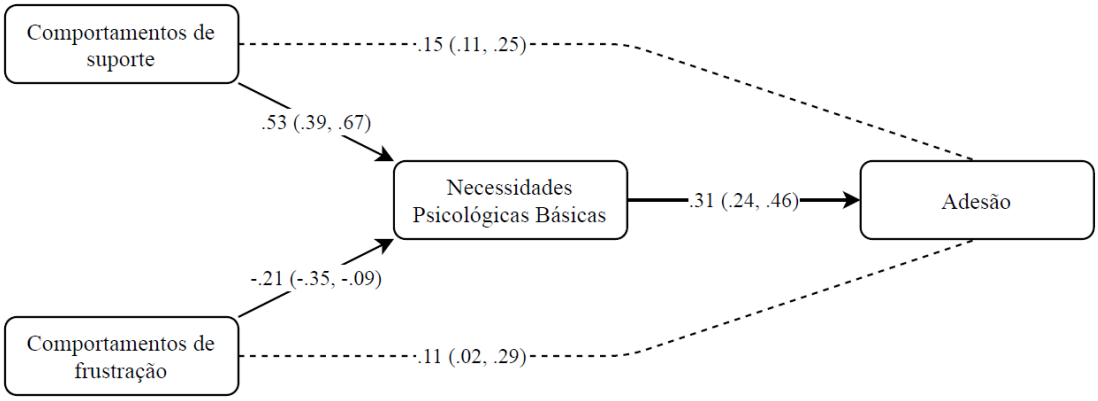

Figura 1. Modelo estrutural do Estudo 1. **Notas:** Os coeficientes apresentados são os estandardizados; valores entre parênteses = IC a 95%.

Análises estatísticas

Foram adotados os mesmos planos estatísticos do estudo 1. Isto é, foram calculadas as medidas de tendência central e de dispersão, bem com os valores de assimetria e curtos. Adicionalmente foram calculados os coeficientes de fiabilidade compósita, bem como as correlações entre as variáveis em estudo. Por último, foi realizado um modelo de equações tal como proposto pela literatura, seguindo as mesmas recomendações descritas no estudo 1.

RESULTADOS

Na Tabela 2 é possível observar que a perceção do clima com envolvimento para a tarefa e as necessidades psicológicas básicas apresentam valores acima do ponto médio da escala. Contrariamente, o clima com envolvimento para o ego apresentou um valor abaixo do ponto médio da escala, indicando que os participantes deste estudo valorizam mais o clima com envolvimento para a tarefa. Todas as variáveis apresentaram uma distribuição normal, uma vez que os valores de assimetria e curtose estão contidos dentro dos valores de corte. Os coeficientes de fiabilidade compósita apresentaram valores superiores a 0.70, evidenciando assim uma consistência interna adequada. No que diz respeito às correlações o clima motivacional com envolvimento para a tarefa apresentou uma correlação positiva e significativa com o clima com envolvimento para a ego e com as necessidades psicológicas básicas, mas não apresentou uma associação significativa com a adesão. A satisfação das necessidades psicológicas básicas não apresentou uma associação significativa com um clima motivacional com envolvimento para o ego, mas apresentou uma correlação positiva e significativa com a adesão à prática de exercício físico (Tabela 2).

Relativamente ao modelo proposto, este apresentou um ajustamento aceitável aos dados, tomando em consideração os valores de corte dos índices absolutos e incrementais: [$\chi 2$ = 394.550, gl = 224, p <0.001, CFI = .918, TLI = .908, SRMR = 0.51, RMSEA = .040 (.033, .046)]. Na figura 2 está representado o modelo estrutural, bem como os valores de regressão entre as variáveis em estudo. De acordo com os resultados, é possível evidenciar que um clima com envolvimento para a tarefa apresenta um efeito positivo e significativo na satisfação das necessidades psicológicas básicas, e um efeito indireto igualmente significativo na adesão à prática de exercício físico. Contrariamente, um clima com envolvimento para o ego não apresenta qualquer efeito significativo na satisfação das necessidades psicológicas básicas nem na adesão ao exercício físico.

Tabela 2. Estatísticas descritivas e correlações entre variáveis no Estudo 2

	M	DP	A	C	Correlações		
					1	2	3
Estudo 2 (n = 487)							
1. Clima envolvimento para a tarefa	4.01	.49	-.74	1.74	*.72*		
2. Clima envolvimento para o ego	2.21	.73	.07	-.03	.10*	*.81*	
3. Necessidades Psicológicas Básicas	4.03	.38	.48	.10	.33**	.06	*.81*
4. Adesão futura	44.89	26.93	.93	-.14	.03	-.05	.14**

Notas: M = Média; DP = Desvio Padrão; A = Assimetria; C = Curtose; Coeficientes de fiabilidade compósita estão na diagonal em itálico; * p <0.05 ** p <0.01.

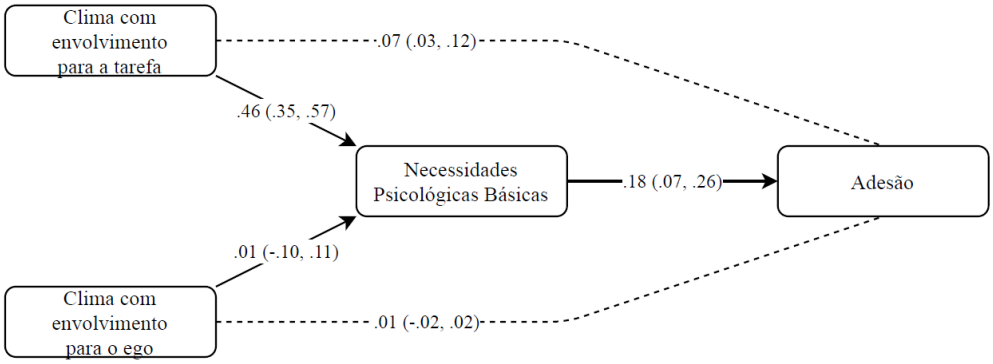

Figura 2. Modelo estrutural do Estudo 2. **Notas:** Os coeficientes apresentados são estandardizados; valores entre parênteses = IC a 95%.

DISCUSSÃO

O presente estudo (estudo 1 e 2) consistiu em analisar a associação entre os comportamentos interpessoais, os climas motivacionais e a adesão à prática de exercício físico em praticantes de atividade física de ginásios e *health clubs* em Portugal, considerando o papel mediador das necessidades psicológicas básicas inerentes a todo o ser humano, tal como estipulado no quadro teórico da TAD (Ryan & Deci, 2017). Em geral, os resultados evidenciaram uma associação positiva entre os comportamentos de suporte, e do clima motivacional com envolvimento para a tarefa, e a satisfação das necessidades psicológicas básicas. Por sua vez, as necessidades psicológicas básicas encontram-se associadas de forma positiva e significativa com a adesão à prática. Pelo contrário, os comportamentos de frustração apresentam uma associação negativa, e o clima motivacional com envolvimento para o ego não apresenta uma associação significativa com as necessidades psicológicas básicas. Os resultados corroboram com estudos prévios (Klain et al., 2014; Rodrigues et al., 202b; Teixeira et al., 2012), evidenciando o papel determinante dos instrutores no que diz respeito a manutenção do comportamento por parte do praticante.

Os resultados confirmam o efeito dos comportamentos interpessoais na satisfação das necessidades psicológicas básicas, tal como evidenciado em estudos anteriores no mesmo contexto (Klain et al., 2014; Moutão et al., 2015). De facto, os resultados deste estudo sugerem que a forma como os praticantes de exercício físico em contexto de ginásio e *health clubs* percecionam pessoas próximas e cruciais no contexto, ou seja, os instrutores de fitness, têm uma relação forte e significativa na forma como as necessidades psicológicas básicas são satisfeitas ou não. De facto, os comportamentos de suporte determinam positivamente a satisfação das necessidades (Rodrigues et al., 2020c) e posteriormente a adesão (Rodrigues et al., 2020b). Ou seja, um praticante que percecione que o instrutor de fitness se preocupa com este, que se sente apoiado nas decisões, que é avaliado de forma autorreferenciada, que recebe feedback eficiente e positivo pelo progresso feito e que é respeitado enquanto pessoa, estará a experienciar maiores níveis de satisfação das necessidades psicológicas básicas, determinando que pode e quer regular o seu comportamento de forma mais autodeterminada, o que consequentemente se traduz em maiores níveis de adesão ao comportamento. Estas ligações são corroboradas por diversos estudos neste contexto em Portugal (Rodrigues et al., 2020a; 2020b; Silva et al., 2011). bem como em estudos internacionais (Hagger & Chatzisarantis, 2008; Teixeira et al., 2012). Hagger e Chatzisarantis (2008) e Rodrigues et al. (2018) concluíram que o perfil motivacional definido pelos instrutores de fitness com elevado grau de suporte é importante na manutenção do comportamento da prática do exercício a longo prazo por parte dos praticantes.

Os comportamentos interpessoais de frustração apresentam uma associação negativa e significativa com a satisfação das necessidades psicológicas básicas bem como o comportamento em estudo (i.e., adesão ao exercício físico), tal como teoricamente expectável (Ryan & Deci, 2017). De facto, um praticante que percecione por parte do instrutor de fitness comportamentos controladores , que não valorizam o crescimento e os objetivos alcançados por parte do praticante, que fomentem relações pessoais para fins extraprofissionais e que trocam a comunicação pessoal pelos meios digitais, está a experienciar baixos níveis de satisfação das necessidades psicológicas básicas, sentido que o seu comportamento não é controlado pelo próprio, sendo por isso o abandono ou a fraca adesão uma consequência provável. Estes resultados reforçam o descrito por Teixeira et al. (2020), na medida em que a determinante mais próxima do praticante no que diz respeito à frequência e intenção de manter a prática é a forma como o instrutor fitness interage com o praticante.

Salienta-se ainda que os comportamentos de frustração apresentaram um efeito indireto positivo e significativo na adesão ao exercício físico, através da satisfação das necessidades psicológicas básicas. Acredita-se que estes resultados possam estar relacionados com o valor preditivo da satisfação das necessidades com a adesão. Isto é, dado os comportamentos de suporte apresentarem um efeito positivo e significativo considerável na satisfação das necessidades e naturalmente na adesão, este poderá estar a diminuir o poder explicativo dos comportamentos de frustração, como que um efeito de "contenção" (Teixeira et al., 2018b). Contudo, é de salvaguardar que o efeito indireto dos comportamentos interpessoais de frustração na adesão com a adesão via a satisfação das necessidades psicológicas básicas é residual (.11 [.02, .29], R^2 = 0.01).

Tomando em consideração as evidencias do estudo 2, os resultados exibem que um clima motivacional com envolvimento para a tarefa apresenta uma associação positiva e significativa com as necessidades psicológicas básicas, bem como um efeito indireto significativo na adesão à prática de exercício físico. Este mecanismo pode assim explicar os resultados obtidos em estudos anteriores com o propósito de testar o efeito dos climas motivacionais na adesão à prática de exercício físico. De facto, um praticante que percecione que instrutor de fitness se preocupa com o desenvolvimento das competências e das suas habilidades na tarefa, que valorizam o empenho e que estão a auxiliar a pessoa a julgar as suas próprias competências e não as dos outros, estará mais

próximo de experienciar maiores níveis de satisfação das necessidades psicológicas básicas, estando estas consequentemente ligadas à adesão, tal como demonstrado no estudo 1.

No que diz respeito ao clima motivacional com envolvimento para o ego, este determinante contextual não apresentou nenhuma associação com as necessidades psicológicas básicas, nem com a adesão. De acordo com os nossos resultados, parece que esta variável não é percecionada pelos praticantes de exercício físico como sendo relevante neste contexto. O julgamento subjetivo à concretização de um determinado resultado, a comparação com os pares, e/ou a avaliação normativa não parece fazer parte do panorama da associação com a adesão. Estes resultados são ligeiramente diferentes aos resultados encontrados por Klain et al. (2014) e em estudos realizados nos Estados Unidos (Brown et al., 2014a; 2014b), onde um clima com envolvimento para o ego apresentou uma associação negativa e significativa com a persistência à prática de exercício. No entanto é de destacar que a persistência e a adesão são conceitos distintos e que por isso devem ser analisados de forma díspar. Enquanto que a persistência se refere a um ponto no tempo em específico, sendo analisado de forma dicotómica (persiste vs. desiste/não persiste, ou seja, qualitativo), a adesão é a frequência ou acessos que o praticante vai tendo ao longo do tempo (quantitativo). Mesmo assim, é de salientar que um clima motivacional com envolvimento para o ego apresenta resultados não desejados, contribuindo para o abandono da prática de exercício físico, colocando de parte todos os benefícios adjacentes à realização do comportamento (Brown et al., 2014a).

No entanto, em contexto de ginásios e *health clubs*, a vertente social e lúdica parecem contribuir mais para a manutenção do comportamento, estando estas ligadas à perceção de comportamentos que fomentem ligações interpessoais positivas e afetivas (Teixeira et al., 2018). Neste ponto, importa não só repensar a forma como os instrutores de fitness devem abordar os praticantes durante o seu treino, mas também toda a estrutura que suporta e agrega estes profissionais (Teixeira et al., 2020). De facto, parecem haver indícios claros de que instrutores de fitness que estão dispostos a preocuparem-se com as necessidades dos praticantes estarão a contribuir para que estes se mantenham na prática, contribuindo assim para o crescimento do sector, ajudando consequentemente na luta contra os elevados níveis de sedentarismo e de inatividade física onde atualmente se encontra Portugal.

As evidências apresentadas demonstram claramente a importância de entender a perceção que os praticantes de exercício físico têm sobre os profissionais de exercício físico e o modo como os comportamentos interpessoais e os climas motivacionais podem influenciar a satisfação das necessidades psicológicas básicas, no contexto do exercício físico. Especificamente, estes resultados corroboram com outros estudos (Klain et al., 2014; Rodrigues et al., 2019a; 202b; Silva et al., 2011) alguns deles realizados em território nacional no contexto dos ginásios e *health clubs* ou em países de língua portuguesa.

Apesar do presente estudo apresentar avanços científicos relevantes para o contexto em questão, é fundamental perceber as limitações existentes. O desenho transversal com um acompanhamento do comportamento ao longo de seis meses limita a interpretação de inferência, pelo que futuros estudos devem desenvolver intervenções que avaliem e manipulem as determinantes motivacionais. Não obstante, a literatura existente tem comprovado que o recurso a técnicas de mudança comportamental pode levar a uma melhoria na comunicação do instrutor de fitness, facilitando a relação praticante-instrutor (Ntoumanis et al., 2017).

Em segundo lugar, foi calculado um fator compósito para as necessidades psicológicas básicas, de forma a facilitar a interpretação dos resultados. Partindo da premissa conceptual de que resultados positivos apenas podem ser alcançados através da satisfação de todas as necessidades psicológicas básicas em simultâneo (Ryan & Deci, 2017), e apesar de vários estudos empíricos terem comprovado essa afirmação (Cid et al., 2020; Teixeira et al., 2018b), não foi possível traçar uma associação entre cada necessidade e a adesão à prática. Nesse sentido, sugerimos que sejam realizados mais estudos, de forma a garantir um maior e mais concreto entendimento da forma como cada necessidade se relaciona com a adesão à prática de exercício físico.

Por último, só foi possível recolher dados de duas zonas de Portugal, sendo que os dados não poderão ser generalizados para toda a população praticante de atividade física em ginásios e *health clubs* a nível nacional. Acrescido, não se analisou com detalhe a possibilidade de haver um efeito moderador de algumas variáveis sociodemográficas (e.g., idade, sexo), bem como na escolha das atividades de fitness (e.g., musculação vs. aulas de grupo). Nesse sentido, este estudo abre portas para que futuros estudos possam analisar o fenómeno da prática de exercício físico, bem como a compreensão das causas e consequências do comportamento autodeterminado neste contexto.

CONCLUSÃO E IMPLICAÇÕES PRÁTICAS

Considerando a importância apresentada neste estudos, em particular sobre o efeito dos comportamentos interpessoais

de suporte e do clima motivacional com envolvimento para a tarefa na adesão à prática de exercício físico, será importante que os instrutores de fitness, bem como os agentes responsáveis pelas condutas dos instrutores e que interagem neste contexto, tenham em consideração as necessidades do praticante e não as próprias. De acordo com os resultados obtidos, parece ser fundamental que os instrutores olhem para a prescrição do exercício como uma ferramenta de melhoria da aptidão física da pessoa, mas também como uma atividade que esteja em harmonia com aquilo que o praticante quer e procura. Tal como demonstrado a imposição de comportamentos controladores ou avaliações normativas representam uma associação nula ou até mesmo negativa, que por sua vez poderá ser responsável pelo abandono da prática por parte do praticante. Especificamente, é recomendado que os instrutores de fitness se foquem nas respostas aos objetivos e problemas apresentados pelos praticantes, em vez de investirem tempo e recursos no reconhecimento social e crescimento comercial. De facto, os resultados do presente estudo suportam a afirmação que a relação praticante-instrutor é um dos fatores nevrálgicos para a adesão ao exercício físico.

Desta forma, parece-nos evidente que a forma como os praticantes de exercício orientam os seus objetivos de realização, bem como a forma como percecionam os comportamentos interpessoais vai ter um impacto significativo na forma como regulam o seu comportamento, ou seja, quando os seus objetivos de realização assentam num clima com envolvimento para a tarefa ou percecionam comportamentos de suporte, isso promoverá formas mais autodeterminadas do comportamento. Por sua vez, ao experienciarem a satisfação das três necessidades psicológicas básicas, estão a aumentar as probabilidades de manterem a frequência do exercício no futuro, ou seja, quanto mais os praticantes se identificam com a importância/valor do exercício e da sua prática maior maior satisfação retiram (i.e. prazer e divertimento), e mais vezes irão "visitar" o ginásio ou *health club* no futuro.

A falta de integração social e acompanhamento, o uso de abordagens meramente comerciais e o foco em componentes meramente do "consumidor" e o seu "ciclo de vida" em instalações de fitness revela um desconhecimento sobre a estrutura pela qual se rege o ser humano: ligações respeitáveis e honestas. A qualidade da prática de exercício físico, e a quantidade da mesma, parece estar dependente da qualidade das abordagens feitas pelos instrutores de fitness, que por sua vez se insere como variável na equação da sustentabilidade. É de salientar que não é a única variável preditora do comportamento dos praticantes, tal como demonstrado nos resultados, no entanto, parece de extrema importância a sua análise e compreensão de forma a que sejam criadas intervenções eficientes para que os instrutores de fitness possam contribuir com melhores práticas interpessoais.

Em suma, os instrutores de fitness devem auxiliar os praticantes a incorporem o exercício físico no seu quotidiano para que estes possam sentir e experienciar os seus benefícios, como forma de aumentar a frequência semanal subjacente à adesão continua ao longo do tempo. Estes profissionais devem orientar e acompanhar o processo de crescimento da pessoa e resposta às necessidades desta, como forma de contribuir para uma relação saudável, sustentável e duradoura.

AGRADECIMENTOS

Nada a declarar

REFERÊNCIAS

AGAP (2020). *Barómetro do Fitness em Portugal. 2020.* Universidade Autónoma de Lisboa.

AGAP (2018). *Barómetro do Fitness em Portugal. 2018.* Universidade Autónoma de Lisboa.

AGAP (2014). *Barómetro do Fitness em Portugal. 2014.* Universidade Autónoma de Lisboa.

Alesi, M., Gómez-López, M., Borrego, C., Monteiro, D., & Granero-Gallegos, A. (2019). Effects of a Motivational Climate on Psychological Needs Satisfaction, Motivation and Commitment in Teen Handball Players. *International Journal of Environmental Research and Public Health, 16*(15), 2702. https://doi.org/10.3390/ijerph16152702

Brown, T., & Fry, M. (2014a). Motivational climate, staff and members 'behaviors, and members' psychological well-being at a national fitness franchise. *Research Quarterly for Exercise and Sport, 85*(2), 208-217. https://doi.org/10.1080/02701367.2014.893385

Brown, T., Fry, M., & Little, T. (2014b). The psychometric properties of the Perceived Motivational Climate in Exercise Questionnaire. *Measurement Physical Education and Exercise Science, 17*(1), 22–39. https://doi.org/10.1080/1091367X.2013.741360

Byrne, B. (2011). *Structural Equation Modeling with Mplus - Basic Concepts, Applications, and Programming.* Routledge

Cid, L., Moutão, J., Leitão, J., & Alves, J. (2012). Translation and validation of the adaptation for the exercise of the Perceived Motivational Climate Sport Questionnaire. *Motriz: Revista de Educação Física, 18*(4), 708-720. https://doi.org/10.1590/S1980-65742012000400009

Cid, L., Rodrigues, F., Santos Teixeira, D., Alves, J., Machado, S., Murillo-Rodríguez, E., & Monteiro, D. (2020). Exploração de um modelo de segunda ordem da Versão Portuguesa da Escala de Necessidades Psicológicas Básicas em Exercícios (BPNESp): validade do construto e invariância. *Cuadernos de Psicología del Deporte, 20*(2), 95-111. https://doi.org/10.6018/cpd.407391

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*, 216–236. https://doi.org/10.1007/s11031-014-9450-1

Cohen, J. (1988). A power primer. *Psychological Bulletin, 112*(1), 155-159. https://doi.org/10.1037/0033-2909.112.1.155

DGS. (2017). *Programa Nacional Para a Promoção da Atividade Física.* Ministério da Saúde.

Duda, J. (2013). The conceptual and empirical foundations of Empowering Coaching™: Setting the stage for the PAPA project. *International Journal of Sport and Exercise Psychology, 11*(4), 311–318. https://doi.org/10.1080/1612197X.2013.839414

Eurobarometer (2018). *Special Eurobarometer 472 - Sport and Physical Activity*. European Comission

Eurobarometer (2014). *Special Eurobarometer 412 - Sport and Physical Activity*. European Comission

Eurobarometer (2010). *Special Eurobarometer 334 - Sport and Physical Activity*. European Comission

Eurobarometer (2003). *Special Eurobarometer 183 - Physical Activity*. European Comission

Gomes, A., Gonçalves, M., Maddux, J., & Carneiro, L. (2018). The intention-behavior gap: An empirical examination of an integrative perspective to explain exercise behavior. *International Journal of Sport and Exercise Psychology, 16*(6), 607-621. https://doi.org/10.1080/1612197X.2017.1321030

Gravetter, F., & Wallnau, L. (2014). *Essentials of Statistics for the Behavioral Sciences*. Cengage Learning.

Hagger, M., & Chatzisarantis, N. (2008). Self-determination Theory and the psychology of exercise. *International Review of Sport and Exercise Psychology, 1*(1), 79-103. https://doi.org/10.1080/17509840701827437

Hair, J., Black, W., Babin, B., & Anderson, R. (2019). *Multivariate Data Analysis*. Pearson Educational, Inc

Klain, I., Rombaldi, A., Matos, D., Leitão, J., Cid, L., & Moutão, J. (2015). Adesão e desistência de programas de treino personalizado. *Revista Iberoamericana de Psicología del Ejercicio y Deporte, 11*(1), 15-21

Klain, I., Cid, L., Matos, D., Leitão, J., Hickner, R., & Moutão, J. (2014). Motivational climate, goal orientation and exercise adherence in fitness centers and personal training contexts. *Motriz: Revista de Educação Física, 20*(3), 249-256. https://doi.org/10.1590/S1980-65742014000300002

Lopes, C., Torres, D., Oliveira, A., Severo, M., Alarcão, V., Guiomar, S., Mota, J., Teixeira, P., Rodrigues, S., Lobato, L., Magalhães, V., Correia, D., Carvalho, C., Pizarro, A., Marques, A., Vilela, S., Oliveira, L., Nicola, P., Soares, S., & Ramos E. (2018). *National Food, Nutrition, and Physical Activity Survey of the Portuguese General Population, IAN-AF 2015-2016: Summary of Results*. EFSA Supporting Publication. ISBN: 9789897462023

Monteiro, D., G. Pelletier, L., Moutão, J., & Cid, L. (2018). Examining the motivational determinants of enjoyment and the intention to continue of persistent competitive swimmers. *International Journal of Sport Psychology, 49*(6), 484-504. https://doi.org/10.7352/IJSP.2018.49.484

Moutão, J., Alves, S., & Cid, L. (2015). O papel de mediação de necessidades psicológicas na associação entre suporte de capacidade e bem-estar psicológico em praticantes de fitness. *Motricidade. 211*(3), 29-40. https://doi.org/10.6063/motricidade.3734

Moutão, J., Cid, L., Leitão, J. C., Alves, J., & Vlachopoulos, S. (2012). Validação da Escala de Necessidades Psicológicas Básicas em Exercícios em uma Amostra Portuguesa. *Spanish Journal of Psychology,15*(1), 399-409.

Muthén, L., & Muthén, B. (2010). *Mplus User's Guide*. Muthén & Muthén.

Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91*(3), 328-346. https://doi.org/10.1037/0033-295X.91.3.328

Ntoumanis, N., Thogersen-Ntoumani, C., Quested, E., & Hancox, J. (2017). The effects of training group exercise class instructors to adopt a motivationally adaptive communication style. *Scandinavian Journal of Medicine and Science in Sports, 27*(9), 1026-1034. https://doi.org/10.1111/sms.12713

Prince, S. A., Cardilli, L., Reed, J. L., Saunders, T. J., Kite, C., Douillette, K., Fournier, K., & Buckley, J. P. (2020). A comparison of self-reported and device measured sedentary behaviour in adults: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 17*(1), 31. https://doi.org/10.1186/s12966-020-00938-3

Raykov, T., Gabler, S., & Dimitrov, D. (2015). Maximal Reliability and Composite Reliability: Examining Their Difference for Multicomponent Measuring Instruments Using Latent Variable Modeling. *Structural Equation Modelling, 23*(3), 384-391. https://doi.org/10.1080 /10705511.2014.966369

Roberts, G. (2012). Motivation in Sport and Exercise from an Achievement Goal Theory Perspective: After 30 Years, Where Are We? In G. Roberts & D. Treasure (Eds.), *Advances in Motivation in Sport and Exercise* (5-58). Human Kinetics. https://doi.org/10.3765/sp.5.6

Rocchi, M., Pelletier, L., & Desmarais, P. (2016). The Validity of the Interpersonal Behaviors Questionnaire (IBQ) in Sport. *Measurement in Physical Education and Exercise Science, 21*(1), 15-25. https://doi.org/10.1080/1091367x.2016.1242488

Rodrigues, F., Teixeira, D., Neiva, H., Cid, L., & Monteiro, D. (2020a). The bright and dark sides of motivation as predictors of enjoyment, intention, and exercise persistence. *Scandinavian Journal of Medicine and Science in Sports, 30*(4):787-800. https://doi.org/10.1111/sms.13617

Rodrigues, F., Teixeira, D., Neiva, H., Cid, L., & Monteiro, D. (2020b). Understanding Exercise Adherence: The Predictability of Past Experience and Motivational Determinants. *Brain Science, 10*(2), 98. https://doi.org/10.3390/brainsci10020098

Rodrigues, F., Pelletier, L. G., Rocchi, M., Neiva, H. P., Teixeira, D. S., Cid, L., Silva, L., & Monteiro, D. (2021). Trainer-exerciser relationship: The congruency effect on exerciser psychological needs using response surface analysis. *Scandinavian Journal of Medicine & Science in Sports, 31*(1), 226–241. https://doi.org/10.1111/sms.13825

Rodrigues, F., Teixeira, D., Cid, L., & Monteiro, D. (2019a). Promoting Physical Exercise Participation: The Role of Interpersonal Behaviors for Practical Implications. *Journal of Functional Morphology and Kinesiology, 4*(2), 40. https://doi.org/10.3390/jfmk4020040

Rodrigues, F., Teixeira, D. S., Cid, L., & Monteiro, D. (2019). Have you been exercising lately? Testing the role of past behavior on exercise adherence. *Journal of Health Psychology*, 1359105319878243. https://doi.org/10.1177/1359105319878243

Rodrigues, F., Pelletier, L., Neiva, H. P., Teixeira, D. S., Cid, L., & Monteiro, D. (2019). Initial validation of the Portuguese version of the Interpersonal Behavior Questionnaire (IBQ & IBQ-Self) in the context of exercise: Measurement invariance and latent mean differences. *Current Psychology*. https://doi.org/10.1007/s12144-019-00374-y

Rodrigues, F., Hair, J., Neiva, H., Teixeira, D., Cid, L., & Monteiro, D. (2019d). The Basic Psychological Need Satisfaction and Frustration Scale in Exercise (BPNSFS-E): Validity, Reliability, and Gender Invariance in Portuguese Exercisers. *Perceptual and Motor Skills, 126*(5), 949-972. https://doi.org/10.1177/0031512519863188

Rodrigues, F., Bento, T., Cid, L., Pereira Neiva, H., Teixeira, D., Moutão, J., Almeida Marinho, D., & Monteiro, D. (2018). Can Interpersonal Behavior Influence the Persistence and Adherence to Physical Exercise Practice in Adults? A Systematic Review. *Frontiers in Psychology, 9*. https://doi.org/10.3389/fpsyg.2018.02141

Ryan, R., & Deci, E. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.

Silva, M., Markland, D., Carraça, E., Vieira, P., Coutinho, S., Minderico, C., Matos, M., Sardinha, L., & Teixeira, P. (2011). Exercise autonomous motivation predicts 3-yr weight loss in women. *Medicine and science in sports and exercise, 43*(4), 728-737. https://doi.org/10.1249/MSS.0b013e3181f3818f

Teixeira, D., Monteiro, D., Rodrigues, F., Sousa, M., Chaves, C., & Cid, L. (2020). Ginásios e health clubs em Portugal: Estaremos perante uma república das bananas? *Motricidade, 16*(1), 3-17. https://doi.org/10.6063/motricidade.19688

Teixeira, D., Pelletier, L., Monteiro, D., Rodrigues, F., Moutão, J., Marinho, D., & Cid, L. (2019). Motivational patterns in persistent swimmers: A serial mediation analysis. *European Journal of Sport Science, 20*(5), 660–669. https://doi.org/10.1080/17461391.2019.1675768

Teixeira, D., Marques, M., & Palmeira, A. (2018a). Associations between affect, basic psychological needs and motivation in physical activity contexts: Systematic review and meta-analysis. *Revista Iberoamericana de Psicología Del Ejercicio y Deporte, 13*(2), 225-233

Teixeira, D., Silva, M., & Palmeira, A. (2018b). How does frustration make you feel? A motivational analysis in exercise context. *Motivation and Emotion, 42*(3), 419-428. https://doi.org/10.1007/s11031-018-9690-6

Teixeira, D., & Palmeira, A. (2016). Needs Satisfaction Effect on Exercise Emotional Response: A Serial Mediation Analysis with Motivational Regulations and Exercise Intensity. *Motriz: Revista de Educação Física, 22*(4), 368-375. https://doi.org/10.1590/s1980-6574201600040023

Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 78. https://doi.org/10.1186/1479-5868-9-78

Vansteenkiste, M., & Ryan, R. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263–280. https://doi.org/10.1037/a0032359

Warburton, V., Wang, J., Bartholomew, K., Tuff, R., & Bishop, K. (2020). Need satisfaction and need frustration as distinct and potentially co-occurring constructs: Need profiles examined in physical education and sport. *Motivation and Emotion, 44*, 54–66. https://doi.org/10.1007/s11031-019-09798-2

Warburton, D., & Bredin, S. (2017). Health benefits of physical activity: a systematic review of current systematic reviews. *Current Opinion in Cardiology, 32*(5), 541-556. https://doi.org/10.1097/HCO.0000000000000437

Warburton, D., Nicol, C., & Bredin, S. (2006). Health benefits of physical activity: the evidence. *Canadian Medical Association Journal, 174*(6), 801-809. https://doi.org/10.1503/cmaj.051351

Williamson, J., & Pahor, M. (2010). Evidence regarding the benefits of physical exercise. *Archives of Internal Medicine, 170*(2), 124–125. https://doi.org/10.1001/archinternmed.2009.491