ARTIGO ORIGINAL

PROFILE AND CLASSIFICATION OF HANDGRIP AND HORIZONTAL JUMP IN SCHOOLCHILDREN PHYSICAL EDUCATION CLASS PRACTITIONERS AND SPORTS PRACTITIONERS

Perfil e classificação da preensão manual e do salto horizontal em escolares praticantes de Educação Física e de praticantes de Esportes

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ABSTRACT

The aim of the study was to compare and classify the body mass index, handgrip, and horizontal jump of adolescents. The study included 48 individuals, aged 14 to 16 years, subdivided into four groups: a) students practicing physical education classes (GPEF, n=15); b) soccer players (GPF, n=14); c) athletics practitioners (runners, throwers, and jumpers) (GPA, n=11); and d) judo practitioners (GPJ, n=8). We collected data on body mass, stature, body mass index (BMI), handgrip test, and horizontal impulse. For statistical analysis, the Kruskal Wallis ANOVA was applied, followed by Dunn Post Hoc, with a significance level < 0.05. BMI and horizontal jump data were compared and classified using Proesp-Br tables (2012) and handgrip using percentiles from the study of Serrano et al. (2009). The GPA, GPJ, and GPF groups presented longer activity duration when compared to the GPEF. The variables BMI, handgrip, and horizontal jump demonstrated no statistical differences between the groups. Handgrip was rated higher than the 50th percentile for the GPF, GPA, and GPJ groups. The horizontal jump in the GPJ and GPEF groups was classified as weak and reasonable, while the results of the GPF and GPA groups were good and excellent. It was found that the relative frequency, in percentage, of individuals who practice sports, points to better performance in the muscular strength of the upper and lower limbs.

Keywords: Muscle strength. Schoolchildren. Young athletes.

RESUMO

O objetivo do estudo foi comparar e classificar o índice de massa corporal, a preensão manual e o salto horizontal de adolescentes. Participaram da pesquisa 48 indivíduos, entre 14 a 16 anos, subdivididos em quatro grupos: a) escolares praticantes de aulas de educação física (GPEF, n=15); b) praticantes de futebol (GPF, n=14); c) praticantes de atletismo (corredores, arremessadores e saltadores) (GPA, n=11); d) praticantes de Judô (GPJ, n=8). Foram coletados dados de massa corporal, estatura e índice de massa corporal (IMC), teste de preensão manual e impulsão horizontal. Para análise estatística aplicou-se ANOVA, teste de Kruskal Wallis seguido do Post Hoc de Dunn com nível de significância < 0,05. Os dados do IMC e salto horizontal foram comparados e classificados com tabelas Proesp-Br (2012) e a preensão manual foi em percentil com o estudo de Serrano et al. (2009). Os grupos GPA, GPJ, GPF tiveram maior duração de atividades quando comparado ao GPEF. As variáveis IMC, preensão manual e salto horizontal não apresentaram diferença estatística entre os grupos. A preensão manual obteve maior classificação acima do percentil 50 para os grupos GPF, GPA e GPJ. O salto horizontal nos grupos GPJ e GPEF classificou-se entre fraco e razoável, enquanto os grupos GPF, GPA entre bom e excelente. Constatou-se que a frequência relativa, em percentual, de indivíduos que praticam esportes aponta para melhor desempenho na força muscular de membros superiores e inferiores.

Palavras-chave: Força muscular. Escolares. Atletas jovens.

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INTRODUÇÃO

Growth, maturation, and development are related to new motor acquisitions that cannot be explained simply by biological or environmental factors, but by a biocultural approach present throughout human life[1]. During growth the young adolescent goes through a period of important physical alterations whose impact is related to behavioral actions and new motor demands that occur during this early phase, incorporating a sensitive period of physiological, environmental, and behavioral changes[2].

In adolescence, physical exercise stimulates efforts that promote body adaptations, providing systematic learning of distinct movements and sports, and translating them into a plurality of stimuli[3]. The school is a conducive environment, in which Physical Education is a discipline where the student has the opportunity to relate the practice of physical exercise with healthy habits for the development of health and quality of life, so that School Physical Education should assume the role of caring for students' health, considering the discipline as a prerogative for the development of motor skills and physical abilities and awareness of healthy eating habits, as well as the importance of regular lifelong physical activity[4].

The body actions experienced by children in physical education classes represent an important phase in their development and growth, and may bring benefits to their biological nature. Thus, the regular practice of physical exercises favors the development and maintenance of physical fitness, reducing the incidence of chronic degenerative dysfunctions and adiposity, and providing benefits through the improvement in muscle strength and body composition[5-6].

According to Rogol, Clark and Roemich (2000), individual longitudinal growth, considering the physiological variations in development, requires some care in relation to the health status of children and adolescents, including the nutritional status, range of acquired physical abilities, amount of training that the individual is exposed to, and the maturation phase[7].

Hypothetically it is possible to suggest a relationship between infant-youth physical activity and continuity of practice in adulthood, as the fact is that regardless of the phase, the child, adolescent, or adult should be concerned about adopting healthy habits based on an active lifestyle[8].

Some studies sought to evaluate the physical fitness of school-aged individuals undergoing training and individuals who participated in physical education classes; the training was efficient in the development of physical abilities, demonstrating important gains due to the intervention[9-10].

Currently, the literature presents

several models of evaluation, classification, and ordering of motor abilities. These models are characterized by presenting quantitative subsidies of body segments or defined abilities that express characteristics related to muscle action or biological energy[11]. Measurement procedures to quantify muscle strength, body composition, and other variables are adopted through batteries and tests, Ruiz et al. (2011) reinforce the validity and reliability of handgrip tests, horizontal distance jumps, and the body mass index as reliable procedures for evaluating body composition and muscle fitness in schoolchildren[12]. The Proesp-Br (2012) manual is an auxiliary testing and fitness tool that seeks to guide physical education teachers by providing methods and frameworks for body growth, nutritional status, and health and sports related physical fitness. All tests adopt simple measurement procedures, facilitating applicability, and contain tables with reference values that enable research through comparison and classification of variables[13].

Based on the assumption that there may be variations in the muscle fitness of young athletes and schoolchildren when evaluating different segments, identifying the degree of development of functional abilities of schoolchildren and athletes becomes important, as it allows monitoring of whether the results are within the international, national, and regional standards, pointing to a relationship of physical well-being and health conditions in these individuals.

OBJECTIVES

To compare and classify the body mass index, handgrip, and horizontal jump of teenagers engaged in physical education classes and sports practitioners.

MATERIAL AND METHODS

This is a randomized cross-sectional study. Forty-eight individuals aged 14 to 16 years, participating in physical education classes and sports were included, divided into four groups: a) students practicing physical education classes (GPEF) (n=15); b) soccer practitioners (GPF) (n=14); c) athletics practitioners (GPA) (n=11) (runners, throwers, and jumpers); and d) judo practitioners (GPJ) (n=8), recruited from the under-15 soccer team of the Piracicaba XV de Novembro sport club, SESI athletics, judo training teams, and students from the SESI educational center in the city of Piracicaba - SP. Volunteers were invited to participate in the study, and interested individuals were given clarification on the details of the research development, as well as information on risks and benefits. Minors and their guardians signed the informed consent form approved by the research ethics committee of the Methodist University of Piracicaba under protocol 72/13. The tests were performed at the place and time of classes or sport training of volunteers,

the researcher in charge visited the location and carried out the demarcation and general adjustments to begin the evaluations.

Evaluations

Body mass, stature, and body mass index (BMI) data were collected. For chronology, age in years of life was used. Weight was assessed using a Crinical Medic® scale, for stature assessment an Alturaexata® stadiometer was used, and the body mass index (BMI) was calculated through the formula weight/stature2 (PROESP-BR, 2012).

Information was collected regarding the weekly frequency of classes or training in each of the groups studied.

For the aptitude tests, methods of muscle strength assessment were adopted; handgrip test for upper limbs and horizontal impulse for lower limbs. For the handgrip test the Smedley Mechanical Dynamometer - Takey® was used. The volunteer was placed in the orthostatic position, holding the dynamometer in the forearm line, which was parallel to the longitudinal axis of the body. The second joint of the hand was required to fit under the bar and take the weight of the instrument and then squeeze between the fingers and the base of the thumb. During the execution of the handgrip, the arm remained immobile, with only flexions of the finger joints. Two measurements were taken in each hand, alternately, and the dominant hand was recorded. The best result in the tests was considered14.

For the horizontal impulse test, the distance of the jump with parallel feet was adopted. Procedure: A measuring tape approximately 10 meters long was fixed to the ground, which served as a measurement scale, where the zero point coincided with the starting line. Execution: the subject jumped horizontally, with simultaneous thrust of the legs, and totally free movement of the arms and trunk, trying to reach the farthest possible point, preferably with parallel feet13.

Statistical treatment

Descriptive data analysis was performed, the Kruskal-Wallis ANOVA test was applied to the sample followed by Dunn's post hoc, and a significance level < 0.05 was adopted. The statistical program Bioestat 5.3 was used.

Classification

The research is based on the reference criteria of the sport project manual, Brazil (PROESP-BR, 2012), for classification of nutritional status (normal, overweight, obese) and health risk (health risk zone and healthy zone), as well as the functional classification of lower limb muscle fitness through the horizontal jump that classifies the performance into five levels; weak (P<40), reasonable (P 40 – 59), good (P 60 – 79), very good (P 80 – 98), and excellent (P<98)[13]. For the handgrip test,

the study by Serrano et al. (2009) was used15. The authors evaluated Spanish children and adolescents and determined the percentile of performance (P5, P25, P50, P75, P90, P99), considering age and sex.

RESULTS

Data on body mass, stature, BMI, upper limb strength, and lower limb strength obtained in the evaluations are expressed as median and quartile, Table 1.

Table 1 – Median and quartiles of the variables: body mass, stature, BMI, upper limb strength, and lower limb strength.

	GPEF	GPF	GPA	GPJ	Kruskal-Wallis
	P50(P_{25}, P_{75})	**P50(P_{25}, P_{75})**	**P50(P_{25}, P_{75})**	**P50(P_{25}, P_{75})**	**p**
Age (years)	15 (14, 15)*	14 (14, 14)*	14 (14, 15)	15 (14, 15.2)	0.0030
Body mass(Kg)	62.1 (53.7, 73.2)	62.2 (52.8, 66.3)	65.6 (62.3, 75.2)	74,4 (54.2, 88.2)	0.4560
Stature (cm)	171 (169.2, 175.5)	169 (165.7, 170.5)	173 (171.5, 175.5)	166 (163.7, 171)	0.0946
BMI (Kg/m²)	21.1 (18.3, 25)	21.6 (18.2, 22.4)	21.9 (20.7, 26.2)	25.9 (20.6, 27.6)	0.3946
RHG (Kgf)	41 (32.5, 46)	38 (37, 45.2)	46 (38, 51)	43 (36, 47,7)	0.4407
LHG (Kgf)	39 (33, 42)	37.5 (34.5, 40.7)	43 (36, 46)	43.5 (38, 48.5)	0.2342
HJ (cm)	173 (154, 216)	198 (185.2, 208)	213 (190, 237)	182 (156, 199)	0.0915

* significance < 0.05

BMI – body mass index; **RHG –** Right hand grip; **LHG –** Left hand grip; **HJ –** Horizontal jump.

Figure 1 presents the weekly frequency values in minutes that the groups participated in activities.

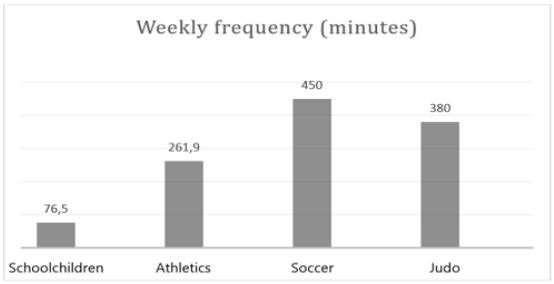

Figure 1. Weekly frequency in minutes of training (class) groups.

Figures 2, 3, and 4 show the variation in median and quartiles of BMI and performance of handgrip and vertical jump of the groups.

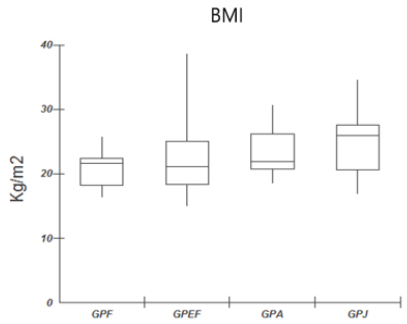

Figure 2. Box-Plot of intergroup BMI variation (Kg/m^2).

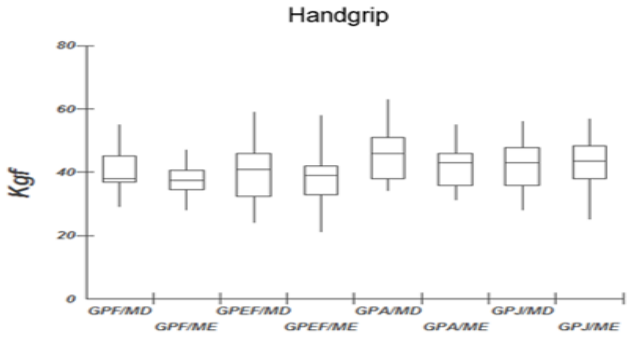

Figure 3. Box-Plot of intergroup handgrip variation (Kgf).

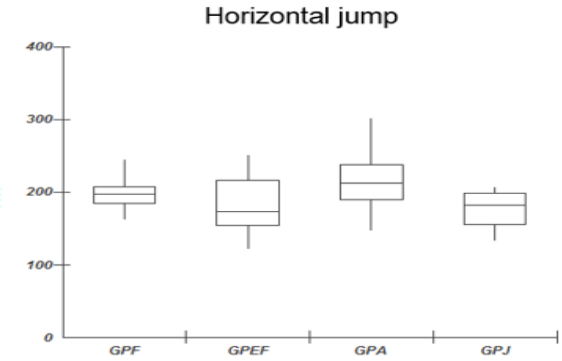

Figure 4. Box-Plot of intergroup horizontal jump variation (cm).

Figure 5 highlights the relative frequency (%) of the BMI classification of the groups compared to the table in the manual (PROESP-BR, 2012).

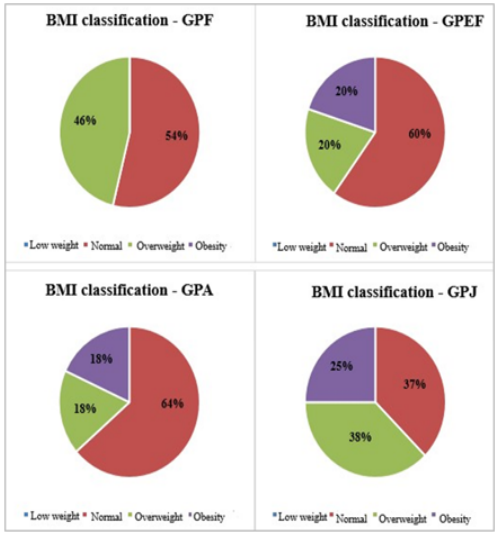

Figure 5. Body mass index classification of the groups (PROESP-BR, 2012).

Figure 6 shows the relative frequency (%) of the right handgrip performance of the groups classified in the study of (SERRANO et al., 2009).

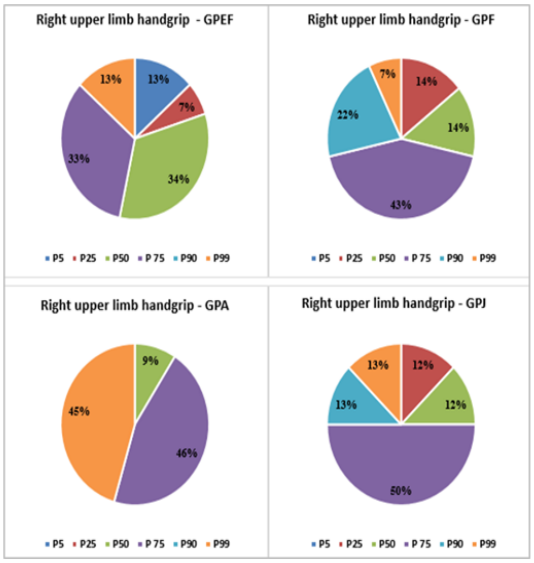

Figure 6. Right upper limb handgrip classification of the groups (SERRANO et al., 2009).

Figure 7 shows the relative frequency (%) of the left handgrip performance of the groups classified in the study of (SERRANO et al., 2009).

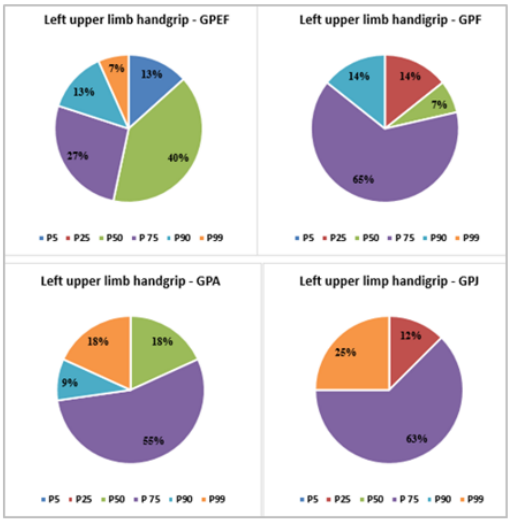

Figure 7. Left upper limb handgrip classification of the groups (SERRANO et al., 2009).

Figure 8 shows the relative frequency (%) of horizontal jump performance of the groups classified in the manual (PROESP-BR, 2012).

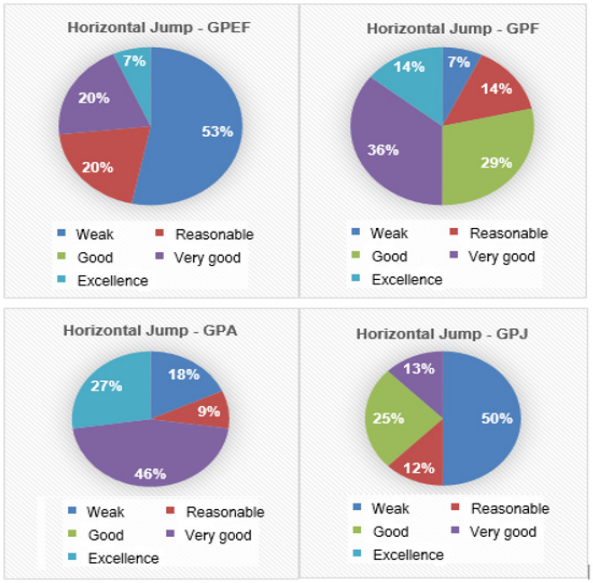

Figure 8 – Horizontal jump classification of the groups (PROESP-BR, 2012).

DISCUSSION

Physical fitness should be considered a marker of health in adolescence. Monitoring variables related to performance in children and adolescents is important, as they allow the growth and development of this population to be followed[16]. Some studies recommend the evaluation of handgrip performance as a strength marker for upper limbs and horizontal jump performance for lower limbs in children and adolescents[12-17].

The present study showed in the weekly frequency factor that adolescents from sports groups have more time practicing physical exercises when compared to the group of school students. Jannsen and Leblank (2010) found in a review that the recommended daily exercise time for children and adolescents is an average of 60 minutes of moderate intensity exercise[6]. In our results sports practitioners equaled or surpassed this time, unlike physical education students who participated in less weekly practice time. Therefore, this group has a lower frequency of weekly physical exercise than recommended by the literature.

The BMI analyzed between the groups presented a prevalence of normality when classified in the Proesp-Br (2012) reference table. Only the GPJ showed prevalence in the overweight range when compared with the GPA, GPEF, and GPF groups; the biotype of the students practicing judo may have favored these data. The biotype factor may also have favored the presence of obese adolescents in the GPA, as the group included young people who participate in shooting events. The variability and biotype did not allow accurate distribution within the groups, so that the data behaved in a non-significant way when compared. Studies show that BMI as an anthropometric indicator can lead to inaccuracies in the evaluation, since this is a superficial variable which may mask the real body composition data[18-19].

The results of handgrip were not significant in the comparative distribution between the groups, however when comparing and classifying the reference table of Serrano et al. (2009) it was observed that the individual distribution (%) of the GPF, GPA, and GPJ groups was higher, being above the 50th percentile in the analysis of the right and left upper limbs. The GPEF included a higher participation of adolescents classified below the 50th percentile in the evaluation of the upper limbs. The distribution of the groups within this classification showed that when compared to the handgrip performance of Spanish adolescents the sports groups achieved good performance, while the GPEF did not demonstrate the same level. Catley and Tomkinson (2013) evaluated, among others, the strength of Australian adolescents and observed median values between 30.7 to 36.5 kgf in adolescents aged fourteen to fifteen[20]. Cohen et al. (2010) evaluated handgrip strength

in English adolescents and plotted percentile curves. The authors observed median performance (50th percentile) between 30 and 40 kgf and a range of 40 to 50 kgf above the 90th percentile21. Another study by Ferreira et al. (2011) aimed to assess the handgrip strength of Brazilian adolescents and found values between 38.2 and 40.5 kgf. Compared with the data of the present study, the values found in the literature were close to the GPEF and GPF, while the GPA and GPJ groups reached higher median values[22].

The values attained in the horizontal jump did not present statistical significance in the distribution between the GPEF, GPF, GPA, and GPJ groups. Individual data (%) were classified in the table of the Proesp-Br (2012) manual and showed that the GPEF and GPJ groups presented higher performance in the poor and reasonable range and the GPF and GPA groups achieved higher performance in the good, very good, and excellent range. In this aspect the modality practiced may have influenced the classification of the performance in the horizontal jump. Browne et al. (2013), evaluating adolescent badminton players, found median values for horizontal jump near 211 cm[23]. Chaves, Baxter-Jones, Maia (2014) evaluated the horizontal jump in Portuguese children and adolescents and plotted performance percentiles, obtaining median values (50th percentile) of 180.33 to 199.02 cm and higher values (90th percentile) close to 210.46 to 230.03 cm in the horizontal jump for individuals aged fourteen to sixteen years24. Bezerra et al. (2013) evaluated adolescent soccer players and found horizontal jump values of 210 ± 6.07 cm[25]. Chung et al. (2013) sought to evaluate Chinese children and adolescents and by classifying the percentiles found mean values (50th percentile) from 165 to 181 cm and higher values (90th percentile) between 200 and 240 cm[26]. In this perspective the GPEF, GPF, and GPJ groups were close to the median values and the GPA achieved values close to those reached by the athletes and higher in the performance percentile tables described by the studies.

Regular participation of children and adolescents in training programs can induce an exponential increase in muscle strength and gain in motor skills, positively influencing health, including body composition and metabolic factors[27]. It appears that strength may be induced by improvement in the neuromuscular component related to motor unit activation and coordination by improving fiber recruitment[28-29].

Overall, statistically our data presented no differences in the variables BMI, handgrip strength, and horizontal jump. The variability in anthropometric characteristics and the intragroup age may have influenced the results. As a consequence, it was possible to observe performance distribution in national and international reference tables with normative

values. It was found that the relative frequency (%) of individuals who practice sports points to superior performance in upper and lower limb muscle strength. Longer training and practice in the sport can lead to neuromuscular and coordinative adaptations that enabled higher classification in good and excellent levels, as well as above the 50th percentile for the sports groups.

CONCLUSION

It was concluded that there were no differences between groups in the variables BMI, handgrip strength, or horizontal jump. The variability of BMI and strength performance in the handgrip and horizontal jump tests may have influenced the data to behave in a not significant way.

The weekly frequency of exercises was higher in the sports groups, contributing to better classification strata in the sports groups. Further studies are needed to better understand body composition variables and muscle strength during growth.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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OBSERVAÇÃO: Os autores declaram não existir conflitos de interesse de qualquer natureza.