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Projeto Esporte Brasil: physical fitness profile related to sport performance of children and adolescents

Projeto Esporte Brasil: perfil da aptidão física relacionada ao desempenho esportivo de crianças e adolescentes

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Abstract – The aim of this study was to outline the physical fitness profile related to sport performance of Brazilian children and adolescents, stratified by sex. This is a descriptive cross-sectional study and information was obtained from the *Projeto Esporte Brasil* (PROESP-Br). The sample consisted of 8,750 voluntary subjects aged 7-17 years evaluated in the period between 2013 and 2015. The following variables were evaluated: lower limb strength (LLS) through the horizontal jump test and upper limb strength (ULS) through mediceball pitch, speed through the 20-meter sprint test and agility through the square test. Variables were classified with PROESP-Br criteria. For data processing, means, standard deviations, absolute and relative frequencies and confidence intervals were used. The results for boys have shown that the "poor" category had the highest prevalence: LLS (40.2%), ULS (29.7%), speed (41.4%) and agility (37.5%). The "excellent" category, as expected, had the lowest prevalence: LLS (3.7%), ULS (4.9%), speed (2.0%) and speed (3.5%). The results for girls were similar to those of boys, where the "poor" category had the highest prevalence: LLS (43.7%), ULS (36.8%), speed (43.8%) and agility (41.0 %). The "excellent" category also had the lowest prevalence: LLS (4.2%), ULS (4.3%), speed (1.6%) and speed (3.1%). The results indicated that the majority of Brazilian children and adolescents have physical fitness related to sport performance. Among variables analyzed, LLS for girls and speed for boys were the components with the most unfavorable results.

Key words: Athletic performance; Muscle strength; Physical fitness.

Resumo – *O objetivo deste estudo é delinear o perfil da aptidão física relacionada ao desempenho esportivo de crianças e adolescentes brasileiros, estratificado por sexo. Trata-se de um estudo descritivo com corte transversal. As informações são provenientes do Projeto Esporte Brasil (PROESP-Br). A amostra é voluntária, constituída por 8.750 sujeitos avaliados no período entre 2013 e 2015 com idades entre 7 e 17 anos. Foram avaliadas: força de membros inferiores (FMI) através do teste de salto horizontal e superiores (FMS) através do arremesso de mediceball, velocidade através do teste corrida de 20 metros e agilidade através do teste quadrado. As variáveis foram classificadas com os critérios do PROESP-Br. Para o tratamento dos dados foram utilizadas médias, desvios padrão, frequências absolutas e relativas e intervalos de confiança. Os resultados dos meninos mostram que a categoria "fraco" teve a maior prevalência: FMI (40,2%), FMS (29,7%), velocidade (41,4%) e agilidade (37,5%). A categoria "excelente", como era esperado, teve as menores prevalências FMI (3,7%), FMS (4,9%), velocidade (2,0%) e agilidade (3,5%). Os resultados das meninas foram semelhantes aos dos meninos, onde a categoria "fraco" teve a maior prevalência: FMI (43,7%), FMS (36,8%), velocidade (43,8%) e agilidade (41,0%). A categoria "excelente" também teve as menores prevalências FMI (4,2%), FMS (4,3%), velocidade (1,6%) e agilidade (3,1%). Os resultados indicam que a maioria das crianças e adolescentes brasileiros tem sua aptidão física relacionada ao desempenho esportivo fraca. Dentre as variáveis analisadas a FMI nas meninas e a velocidade nos meninos, foram os componentes com resultados mais desfavoráveis.*

Palavras-chave: *Aptidão física; Desempenho atlético; Força muscular.*

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INTRODUCTION

Physical fitness related to the health of children and adolescents has been extensively investigated[1,2]. Scientific evidence has suggested a significant association between certain levels of physical fitness components such as abdominal strength, cardiorespiratory fitness, flexibility and body composition, and the prevention of a number of health problems[3,4].

However, in addition to the abilities above, there are others that are characterized by involving different types of muscle strength, displacement velocity, agility (change of direction), reaction speed and resistance[5,6]. These variables are related to the performance of specific tasks, either in work activities or sports practice. This group of abilities is called Performance Related Physical Fitness (PRPF)[7].

In this sense, some Brazilian studies have demonstrated that adolescents' PRPF does not reach adequate levels, and that about 40% of adolescents have poor or regular performance[8-10]. Moreover, some studies have shown that the prevalence of adolescents with excellent performance is around 0.5 to 4%[8,11], however, Gaya et al.[12] indicates at population level, considering that excellent performance indicates the possibility of motor talent for Sports practice, which is expected from about 2% of young people who will meet this level of performance.

Some national and international interventions have reported as beneficial to the improvement of these capacities, among them, the systematized sports practice is the most indicated[13,14]. Additionally, studies have reported that variables such as lower and upper limb strength, speed and agility are important abilities for the practice of collective modalities with excellence [15-17].

On the other hand, low PRPF levels tend to keep children and adolescents away from varied body practices, reducing opportunities to improve motor, cognitive and social skills. Such situation may lead to a reduction in the level of general physical activity and consequently increase the risk of developing health problems associated with hypokinetic behavior[8].

For the elaboration of physical education programs and sports aimed at functional or sports performance, teachers, coaches and researchers should have knowledge on the state of art of these variables at national level. Therefore, the present study shows, with a robust sample of Brazilian children and adolescents, an overview of these variables trying to fill the gap of studies related to this topic.

The aim of this study was to outline the physical fitness profile related to the sports performance of Brazilian children and adolescents, stratified by sex.

METHODOLOGICAL PROCEDURES

This is a descriptive study with quantitative and cross-sectional approach.

Projeto Esporte Brasil (PROESP-Br)

All information used comes from the PROESP-Br database, which since 1999

has the voluntary participation of approximately 96,000 children and adolescents from all Brazilian states, from 5,219 public, private and sports schools.

The PROESP-Br is a support tool for the physical education teacher to evaluate the patterns of body development, nutritional status, physical fitness for health and sports performance of Brazilian children and adolescents (aged 6-17 years). This instrument is composed of a manual with a set of standards and criteria[18] and a website[19] used to send the data. Data are collected by physical education teachers who voluntarily joined the project. By submitting their data, they automatically receive the individual results of students classified for each variable. This project was approved by the Research Ethics Committee of the Federal University of Rio Grande do Sul, under protocol No. 2008010.

Sample

For this study, all children and adolescents between aged 7-17 years evaluated between January of 2013 and December of 2015 were selected without criteria exclusion. This period was chosen in an attempt to present the most current data of the project. Therefore, the sample consisted of 8,750 boys and girls from 13 Brazilian states and the Federal District. Each locality accounts for about 6 to 10% of the sample.

Variables and data collection procedures

The variables that were part of the study were: gender (male and female), age (in complete years), Upper Limb Strength (ULS) verified through the mediceball throw test (2 kg), Lower Limb Strength (LLS) verified through the horizontal jump test, speed through the 20-meter run test and agility through the square test. Before tests, adolescents received verbal guidelines and demonstrations regarding their performance. In addition, perform warm-up exercises were performed. For all four tests, adolescents have two opportunities for achievement. The best performance was computed and entered on the website.

In order to perform the test for the ULS measurement, a measuring tape was fixed to the ground perpendicular to the wall. The student sits with knees outstretched, legs joined and back fully supported by the wall. The student holds a mediceball (2 kg) next to the chest with your elbows bent. At the signal of the evaluator, the student throws the ball as far as possible, keeping his back against the wall. The result is recorded in centimeters.

The test for the LLS measurement was carried out with a measuring tape fixed to the ground, perpendicular to the starting line. The starting line was signaled using one of the lines that marked the sports courts. The zero point of the measuring tape was on the starting line. The student stands immediately behind the line, with feet parallel, slightly apart, knees semi-flexed and trunk slightly projected forward. At the signal, the student should jump as far as possible with both feet at the same time. The result was recorded in centimeters.

The test for the speed measurement was carried out using a stopwatch and a 20-meter track demarcated with three parallel lines on the ground

as follows: the first (starting line); the second, 20 meters away from the first (timing line) and the third line, marked one meter from the second (finish line). The third line serves as the finish reference for the student in an attempt to prevent the student from starting the deceleration before crossing the timeline. The stopwatch was triggered by the evaluator at the time the student takes the first step (touches the ground), going beyond the starting line. When the student crosses the second line (20 meters), the stopwatch is stopped. The result was recorded in seconds and milliseconds.

The test for the agility measurement was performed by marking a four-meter square with a cone at each angle of the square. A crepe tape or straight line drawn with chalk indicates the starting line. The student starts from the standing position, with one foot advanced forward just behind the starting line (at one of the vertices of the square). At the sign of the evaluator, the student must move at maximum speed and touch with one hand the cone in the diagonal corner of the square (cross the square). Next, the student must run to touch the cone to his left and then move to touch the cone diagonally (cross the square diagonally). Finally, the student should run towards the last cone, which corresponds to the starting point. The stopwatch was triggered by the evaluator when the student touches with his foot the inside of the square for the first time and is stopped when the student touches the fourth cone with a hand. The result was recorded in seconds and milliseconds.

The classification criteria adopt a system referenced in standards corresponding to the Brazilian population standards, considering age and stratified by sex. There are five physical fitness categories: "poor" (percentile <40), "reasonable" (percentile 40-59), "good" (percentile 60-79) and "very good" (Percentile> 98). "Excellence" category defines the indication of possible motor talent for the evaluated variable[9].

Statistical analysis

Data treatment used descriptive analysis with means and standard deviations for the continuous variables and absolute and relative frequencies with 95% confidence intervals for categorical variables. Continuous analyses were stratified by age and sex and categorical by gender, as the classification criteria already takes into account age. All data were analyzed using the SPSS for Windows version 20.0 statistical package.

RESULTS

For being a voluntary sample, many teachers only performed a few tests. Therefore, of the total participants, 8,280 (4,967 boys and 3,313 girls) performed the horizontal jump; 8,655 (4,751 boys and 3,904 girls) performed the throwing test; 7,967 (4,724 boys and 3,243 girls) performed the velocity test and; 8,032 (4,796 boys and 3,236 girls) the agility test. The sample characterization with information related to each variable was stratified by sex and age (Tables 1 and 2). It was observed that there is a considerable

increase in the performance of adolescents (mean values) with advancing age in both sexes. However, LLS showed a slight oscillation in boys from the age of 13 years.

The classification percentages are presented in table 3. The four variables presented a very similar pattern in the prevalence of each category, and the poor category was the most prevalent and excellent the less prevalent in both boys and girls.

For all variables, in boys and girls, poor / reasonable performance exceeded 40%, a result very similar to good / very good categories. Strength (LLS and ULS) presented good prevalence of excellent performance, about 4%.

Table 1. Characterization of the female sample regarding physical fitness variables related to sports performance.

	LLS			ULS			SPEED			AGILITY		
Age	n	$\bar{x}$	SD	n	$\bar{x}$	SD	n	$\bar{x}$	SD	n	$\bar{x}$	SD
07 years	236	109.48	28.08	226	146.00	46.54	229	5.17	1.00	235	8.35	1.36
08 years	299	110.78	27.05	289	165.49	49.02	306	5.00	1.04	294	7.96	1.32
09 years	337	118.78	25.42	334	185.74	55.22	346	4.80	0.94	341	7.60	1.28
10 years	348	124.68	28.51	344	207.14	66.07	348	4.65	0.85	348	7.64	1.28
11 years	353	132.68	30.99	363	235.41	58.81	365	4.59	1.30	369	7.54	1.41
12 years	353	136.55	26.79	354	268.69	61.03	357	4.35	0.69	353	7.32	1.24
13 years	443	138.98	28.43	428	290.18	64.20	439	4.31	0.83	427	7.24	1.27
14 years	421	133.06	29.36	389	306.98	82.47	396	4.14	0.73	387	6.90	1.09
15 years	260	136.78	31.03	235	335.80	71.51	237	3.98	0.68	243	6.72	1.03
16 years	184	137.25	28.68	168	343.24	55.77	153	3.96	0.69	169	6.60	0.80
17 years	69	136.07	33.39	65	360.70	72.00	67	3.92	0.71	70	6.39	0.85

ULS: Upper limb strength; LLS: Lower limb strength; n: absolute sample value; $\bar{x}$: mean value; SD: standard deviation.

Table 2. Characterization of the male sample regarding physical fitness variables related to sports performance.

	LLS			ULS			SPEED			AGILITY		
Age	n	$\bar{x}$	SD	n	Age	n	$\bar{x}$	SD	n	Age	n	$\bar{x}$
07 years	227	120.78	26.37	216	164.95	49.56	227	4.90	0.94	229	7.84	1.35
08 years	367	124.00	25.23	358	189.23	46.82	371	4.68	0.95	365	7.44	1.21
09 years	451	130.17	26.02	441	212.64	50.38	455	4.57	0.91	451	7.25	1.15
10 years	540	137.71	24.89	526	234.42	55.83	542	4.30	0.73	542	7.01	1.07
11 years	624	145.64	30.05	624	261.89	64.84	611	4.14	0.62	628	6.78	0.93
12 years	694	154.74	29.39	679	305.16	74.86	694	3.92	0.62	690	6.58	0.96
13 years	677	165.94	29.78	655	346.96	90.86	627	3.85	0.80	640	6.40	0.96
14 years	602	180.41	32.12	546	417.18	101.78	533	3.68	0.85	545	6.19	1.03
15 years	367	186.13	30.80	335	474.33	95.26	310	3.40	0.60	334	6.00	1.02
16 years	286	190.90	29.31	254	496.13	102.31	236	3.32	0.48	248	5.74	0.75
17 years	132	194.80	34.80	126	522.46	97.80	118	3.22	0.44	124	5.65	0.82

ULS: Upper limb strength; LLS: Lower limb strength; n: absolute sample value; $\bar{x}$: mean value; SD: standard deviation.

Agility followed this same pattern for both sexes, with slightly lower values of excellent performance. However, speed had more adolescents with good performance and the lowest prevalence of excellent performance (Table 3).

Table 3. Classification of performance-related physical fitness variables stratified by sex

	LLS	ULS	SPEED	AGILITY
		MALE		
	% (CI95%)	% (CI95%)	% (CI95%)	% (CI95%)
Poor	40.2 (38.8 - 41.5)	29.7 (28.4 - 30.9)	41.4 (39.9 - 42.8)	37.4 (36.1 - 38.8)
Reasonable	17.3 (16.2 - 18.3)	18.5 (17.4 - 19.5)	15.1 (14.0 - 16.1)	15.7 (14.6 - 16.7)
Good	19.4 (18.3 - 20.4)	22.6 (21.4 - 23.7)	20.2 (19.0 - 21.3)	18.9 (17.7 - 20.0)
Very Good	19.4 (18.2 - 20.3)	24.3 (23.0 - 25.5)	21.3 (20.1 - 22.4)	24.5 (23.2 - 25.7)
Excellent	3.7 (3.1 - 4.2)	4.9 (4.2 - 5.5)	2.0 (1.6 - 2.3)	3.5 (2.9 - 4.0)
	LLS	ULS	SPEED	AGILITY
		FEMALE		
	% (CI95%)	% (CI95%)	% (CI95%)	% (CI95%)
Poor	43.7 (42.0 - 45.3)	36.8 (41.6 - 56.3)	42.8 (41.1 - 44.4)	41.0 (39.3 - 42.6)
Reasonable	17.6 (16.3 - 18.8)	17.6 (16.2 - 18.9)	16.2 (14.0 - 17.4)	15.7 (14.4 - 16.9)
Good	17.0 (15.7 - 18.2)	19.4 (17.9 - 20.6)	17.0 (15.7 - 18.2)	19.2 (17.8 - 20.5)
Very Good	17.5 (16.2 - 18.7)	21.9 (20.4 - 23.3)	22.4 (20.9 - 23.8)	21.0 (19.6 - 22.3)
Excellent	4.2 (3.5 - 4.8)	4.3 (3.6 - 4.9)	1.6 (1.1 - 2.0)	3.1 (2.5 - 3.6)

LLS: Lower limb strength; ULS: Upper limb strength; %: Proportional sample value; CI 95%: confidence interval of 95%.

DISCUSSION

The physical fitness profile related to sports performance was similar in the four variables analyzed. LLS, agility, speed, and ULS (in girls) had prevalence of approximately 40% of children and adolescents with poor performance, differing only in ULS for boys, where the prevalence was 29%. About 15-20% of adolescents had reasonable, good and very good performance on all variables. Strength (LLS and ULS) had the best prevalence of excellent performance, approximately 4%, followed by agility (3%) and speed (1-2%) with the lowest prevalence.

Overall, the high prevalence of poor performance in all variables is in line with the results of some studies that have indicated that children and adolescents have distanced from sports practice and physical activities in general[20,21]. The results indicated that the performance related to sports practice of young people is unsatisfactory; however, it is also important to emphasize that good levels of these variables, especially speed and LLS are related to increased bone mineral content, prevention of fractures and strengthening of joints, which is indicative of lower risk of injury[22-25].

Few studies have been carried out on the PRPF of children and adolescents in Brazil and the results found, in general, are similar to those of the present study. Santos et al.[26] indicated that adolescents had reasonable performance on ULS, LLS, agility and speed tests at two schools in Pelotas, RS, as well as the results of Luguetti et al. [27] and Verardi et al.[9], in which

the prevalence of adolescents with low performance in tests was between 46.0% and 57.0% for boys and girls, respectively. The highest prevalence was reported by Jochims et al.[28] and Pereira et al.[11], in which adolescents with poor performance reached 70.0% for LLS and 94.0% for agility.

These findings indicate that the PRPF of Brazilian children and adolescents is in a worrisome situation. Some factors may be directly related to the poor performance presented such as low participation in sports practices or general physical activities, including school physical education. In this sense, some studies have analyzed the PRPF levels of adolescents participating in sports programs and school physical education with a differentiated structure. In the study by Silva et al.[13], students of a social program (soccer school) presented average results in the classification of PRPF variables higher than those found in the present study. The authors used the battery of tests and PROESP-Br classification procedures. These results suggest that sports practice beyond school physical education may contribute to better PRPF levels in adolescents. Another study used intervention in school physical education, with one week with practical class and one week with theoretical class for two months to identify the effects on physical fitness[14]. The authors identified that in some components, especially agility, the average results decreased both for boys and girls. Although conceptual aspects may contribute to the increase in the physical activity levels of adolescents and consequently improve the physical fitness levels, the reduction in the number of practical classes seems to have been negative for the physical fitness levels of adolescents.

Some longitudinal studies have reported not only physical fitness levels, but also associations with bone health. In a three-year study conducted with Spanish boys, improvements in speed (30-m sprint test) and explosive force (vertical jump test) were associated with increased bone mass[22]. Additionally, 15-year research data have shown that during adolescence and early adulthood, only muscle fitness (explosive and isometric strength) and speed were related to bone mineral density in adulthood. Similarly, a 20-year survey showed that in adolescence, the main physical fitness component related to adult bone mineral content was muscular physical fitness[23].

In contrast to the above, the present study showed an expected prevalence of adolescents with excellent performance, considering that some studies such as those of Pereira et al.[11] and Mello et al.[8] reported that in some variables, there were no subjects with this level of performance (between 0 and 4%). When these results are analyzed from a sporting perspective, it should consider that the values referring to a certain population characteristic occurring more frequently and with greater regularity are considered as "normal". Therefore, PROESP-Br agrees with the proposal of the National Talent Search Program from the Australian Institute of Sport, which indicates individuals of superior or atypical performance as those that are beyond two standard deviations of the mean (percentile> 98)[12].

The increase in the amount of sports practice and physical activity in general seems to be the main strategy for increasing physical fitness levels

in adolescents[21,30]. In this perspective, school physical education and sports and physical activity programs in general in the different school shifts are important alternatives. However, changes in the school curriculum increasing the number of physical education classes, as well as the increase in the offer of sports programs and physical activity in general in the different school shifts are not considered a simple task. To do so, it is necessary to carry out a broad discussion involving several sectors, where necessarily the public power must be present.

CONCLUSION

Approximately 40% of Brazilian children and adolescents had poor performance on LLS, ULS, speed and agility tests. Among the variables analyzed, LLS in females and speed in males were the components with the most unfavorable results. Approximately 20% of adolescents had good performance on these variables, and 20% had very good performance. Approximately 3 to 4% of adolescents had excellent performance in some of the variables, being able to be indicative of motor talent related to sports practice.

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