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ORIGINAL RESEARCH

Functional exercise capacity and life habits of schoolchildren

Capacidade funcional de exercício e hábitos de vida de crianças escolares

Capacidad funcional de ejercicio y hábitos de vida de niños escolares

Carolina Cotrim Dal Pozzo[1], Fabíola Unbehaun Cibinello[2], Dirce Shizuko Fujisawa[3]

ABSTRACT | This study investigated life habits that can influence the performance on the six-minute walk test (6MWT) in eutrophic and overweight children. Anthropometric evaluations were carried out, as well as the functional exercise capacity and the habits, and Lifestyle in Childhood and Adolescence (Evia, acronym in Portuguese) was assessed in public school children aged between eight and ten years. We assessed 247 students, 132 (53%) girls and 115 (47%) boys; of these, 96 (39%) students were overweight, and 151 (61%) were eutrophic children. The most frequent life habits among children were: to watch TV (95%), to study at home (87%) and to do household chores (86%). No correlation was found between the performance on the 6MWT and the number of sleep/night hours, and between the performance on the 6MWT and the commute to home-school. Sport practice and nutritional classification showed correlation with the performance on the 6MWT with r=0.1793; p=0.0047 and r=0.1280; p=0.0445, respectively, and the multiple linear regression showed they have a weak influence on the performance of the 6MWT with R2=0.03009; p=0.0063 and R2=0.02287; p=0.0174, respectively. We concluded that life habits with low energy expenditure, such as watching television and studying are frequent. The number of sleep/night hours and the commute to home-school showed no correlation with the functional exercise capacity, and the sport practice and nutrition classification influence, even if weakly, the performance on the 6MWT among children in the age group assessed.

Keywords | Child; Overweight; Obesity; Habits; Exercise.

RESUMO | Investigar hábitos de vida que podem influenciar o desempenho no teste de caminhada de seis minutos (TC6') em crianças eutróficas e com excesso de peso. Foram realizadas avaliações antropométricas, capacidade funcional de exercício e dos hábitos e verificado o Estilo de Vida na Infância e Adolescência (Evia) em crianças de escolas públicas, com idade entre oito e dez anos. Avaliaram-se 247 escolares, 132 (53%) meninas e 115 (47%) meninos; destes, 96 (39%) crianças apresentavam excesso de peso e 151 (61%) eram eutróficos. Os hábitos de vida mais frequentes entre as crianças foram: assistir à TV (95%), estudar em casa (87%) e fazer tarefas domésticas (86%). Não houve correlação entre desempenho no TC6' e quantidade de horas de sono/noite, e entre desempenho no TC6' e forma de deslocamento no trajeto casa-escola. A prática de esporte e a classificação nutricional apresentaram correlação com o desempenho no TC6' com r=0.1793; *p*=0.0047 e r=0.1280; p=0.0445, respectivamente, e a regressão linear múltipla mostrou que apresentam fraca influência no desempenho do TC6' com *R2*=0.03009; *p*=0.0063 e *R2*=0.02287; *p*=0.0174, respectivamente. Concluiu-se que hábitos de vida com baixo gasto energético, como assistir à televisão e estudar, são frequentes. A quantidade de horas de sono/noite e a forma de deslocamento no trajeto casa-escola não apresentaram correlação com a capacidade funcional de exercício, e prática de esportes e classificação nutricional influenciam, mesmo que fracamente, o desempenho no TC6' entre as crianças na faixa etária avaliada.

Descritores | Criança; Sobrepeso; Obesidade; Hábitos; Exercício.

Graduate Associate Program at Universidade Estadual de Londrina/Universidade Norte do Paraná (UEL/Unopar) in Rehabilitation Sciences.
[1]Physical therapist, master's degree in Rehabilitation Sciences at Universidade Estadual de Londrina/Universidade Norte do Paraná (UEL/Unopar) – Londrina (PR), Brazil.
[2]Physical therapist, PhD student in Rehabilitation Sciences at Universidade Estadual de Londrina/Universidade Norte do Paraná (UEL/Unopar) – Londrina (PR), Brazil.
[3]Professor at the Department of Physical Therapy at Universidade Estadual de Londrina (UEL) – Londrina (PR), Brazil.

Corresponding address: Dirce Shizuko Fujisawa – Hospital Universitário UEL – Departamento de Fisioterapia – Avenida Robert Koch, 60 – Vila Operária – Londrina (PR), Brazil – Zip Code: 86039-440 – E-mail: dirce_fujisawa@uel.br – Finance Source: Scholarship Program of Research Productivity (Call no. 21/2012; Agreement no. 495/2014) of Fundação Araucária de Apoio ao Desenvolvimento Científico e Tecnológico do Estado do Paraná (FAPPR); Masters scholarship of Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) – Conflict of interest: Nothing to declare – Presentation: Aug. 23rd, 2016 – Accepted for publication: Nov. 15th, 2017 – Approved by the Committee of the Universidade Estadual de Londrina under Opinion No. 431,913.

RESUMEN | Se han investigado hábitos de vida que pueden influenciar el desempeño en la prueba de caminata de seis minutos (PC6') en niños eutróficos y con sobrepeso. Han sido realizadas las evaluaciones antropométricas, la capacidad funcional de ejercicio y de los hábitos y ha sido certificado el Estilo de Vida en la Infancia y Adolescencia (Evia) en niños de escuelas públicas, con edad entre ocho y diez años. Han sido evaluados a 247 escolares, a 132 (el 53%) niñas y a 115 (el 47%) niños; de estos, 96 (el 39%) niños presentaban sobrepeso, y 151 (el 61%) eran eutróficos. Los hábitos de vida más comunes entre los niños han sido: el de ver a la Tele (el 95%), el de estudiar en casa (el 87%) y el de hacer las tareas domésticas (el 86%). No ha habido correlación entre el desempeño en el PC6' y la cuantidad de horas de sueño/noche, y entre el desempeño en el PC6' y la forma de desplazamiento en el trayecto casa-escuela. La práctica de deporte y de la clasificación nutricional han presentado la correlación con el desempeño en el PC6' con r=0.1793; *p*=0.0047 y r=0.1280; p=0.0445, respectivamente, y la regresión lineal múltiple ha enseñado que presentan débil influencia en el desempeño del PC6' con *R2*= 0.03009; *p*=0.0063 y *R2*=0.02287; *p*=0.0174, respectivamente. Se ha concluido que los hábitos de vida con bajo gasto energético como el de ver a la televisión y el de estudiar son comunes. La cuantidad de horas de sueño/noche y la forma de desplazamiento en el trayecto casa-escuela no han presentado correlación con la capacidad funcional de ejercicio, y la práctica de deportes y la clasificación nutricional influencian, aunque débilmente, el desempeño en el PC6' entre los niños en la franja de edad evaluada.

Palabras clave | Niño; Sobrepeso; Obesidad; Hábitos; Ejercicio.

INTRODUCTION

The increase in the prevalence of childhood obesity is alarming and has been the subject of several studies[1-3]. The identification of the causes and consequences of this epidemics has become necessary and urgent in the public health field[4-6], whereas the etiology is multifactorial and involves the life habits of children and their family.

Despite life habits and regular physical activity and their relationship with the functional exercise capacity of children being among the causes and consequences of obesity in childhood, both aspects have not been sufficiently studied, which causes concern, since they involve health care quality. Life habits are difficult to measure as it is a complex behavior that involves mediating and determining variables[7,8], and the functional exercise capacity is an important clinical tool in the evaluation of the metabolic and cardiorespiratory system[9,10].

Thus, this study aimed to investigate the life habits that can influence the performance on the six-minute walk test (6MWT) in eutrophic children and those who were overweight. The initial hypothesis was that nutritional classification and life habits could influence the children's performance on the six-minute walk test.

METHODOLOGY

Cross-sectional study conducted with children from the 3rd and 4th grades of the Municipal Education Network of Londrina/PR, Brazil, 2013/2014. The study was approved by the Ethics Committee/UEL and authorized by the Municipal Department of Education and approved by the principals of the schools.

A total of 247 children of both sexes participated. Inclusion criteria were healthy children from eight to ten years, who had agreed to participate in the study, with the guardian's permission under the signing of the informed consent form. Exclusion criteria were children classified as underweight, with score-z<–2 (WHO)[11], with some type of gait abnormality, and/or those who did not want to cooperate. The study had a stratified sampling, considering the five regions of the municipality (East, West, North, South and Central).

The evaluation included personal, school, and anthropometric data, application of questionnaire on life habits and six-minute walk test (6MWT).

Anthropometric evaluation

Body mass was obtained using the scale *Marte* model LC 200 (2010), with a capacity from 200 kg to 1,000 g, e=d=50 g. Height was measured with retractable metal measuring tape fixed on the wall. The children were weighed and measured without shoes, wearing the school uniform. For weighing, each child was placed in the standing position in the center of the scale, with limbs alongside the body and looking forward. Height was measured with knees extended, feet together, arms loose, with ankles, glutes and shoulders touching the wall.

The nutritional classification was obtained with the Anthro Plus software. Z-score values lower than –2 mean low weight, between –2 and +1, eutrophia, between +1 and +2, overweight, and higher than +2, obesity[11].

Life habits

The Inventory EVIA – Lifestyle in Childhood and Adolescence, was adapted and validated for the Brazilian reality by Cardoso and Gaya[12]. The questionnaire was answered by the children through an individual interview.

Functional exercise capacity

Functional exercise capacity was assessed by trained examiners through the 6MWT, following the ATS[9] criteria, in 30-meter aisles. Two tests were conducted, with minimum interval of 30 minutes between them[13].

Only the data of the best performance on the 6MWT were analyzed, and the predicted distance was calculated based on the formula by Priesnitz et al.[13], which considers body mass, height, age and difference of resting heart rate soon after the test. A portable pulse oximeter Geratherm, model Gt-300C203 and a digital chronometer were used to verify the participants' heart rate.

Data analysis

GraphPad Prism 6 was used, and descriptive analysis was presented in percentage, absolute and mean values with standard deviation. The Shapiro-Wilk test was used to analyze data distribution, the unpaired Student's t-test and the Mann-Whitney were used for comparisons, in addition to the Spearman's correlation and multiple linear regression. We adopted 95% confidence interval and 5% significance.

RESULTS

We evaluated 247 students, 132 (53%) girls and 115 (47%) boys. The average age was 8.75 (±0.719) years, with average height of 1.37 (±0.074) meters and average body mass of 34.76 (±9.336) kg. As for the nutritional classification, 46 (19%) children were overweight; and 50 (20%) were obese. Therefore, 96 (39%) children were above the right weight for their age, sex, height, and 151 (61%) were eutrophic.

Table 1 shows the children's answers to Evia divided into two groups: eutrophic and overweight/obese. Regarding the activities carried out at home, the most frequent were: to watch television, study and do household chores; in addition, video games were more frequent among boys, in both groups.

Table 1. Life habits of eutrophic and overweight/obese children

Life habits	Eutrophic n=151		Overweight/Obese n=96		General n=247 (%)
	Boys n=63 (%)	Girls n=88 (%)	Boys n=52 (%)	Girls n=44 (%)	
Activities at home					
Watches TV	61 (97)	81 (92)	50 (96)	40 (90)	234 (95)
Plays video games	50 (79)	21 (24)	31 (60)	8 (18)	110 (45)
Reads	43 (68)	57 (65)	35 (67)	35 (80)	170 (69)
Listens to music	36 (57)	54 (61)	28 (54)	35 (80)	153 (62)
Plays with friends	47 (75)	65 (74)	32 (62)	30 (68)	174 (70)
Plays alone	38 (60)	59 (67)	33 (63)	31 (70)	161 (65)
Household chores	55 (87)	74 (84)	44 (85)	39 (89)	212 (86)
Helps in the parents' profession	28 (44)	24 (27)	17 (33)	13 (30)	82 (33)
Takes care of younger child	28 (44)	35 (40)	17 (33)	22 (50)	102 (41)
Studies	50 (79)	77 (87)	49 (94)	41 (93)	216 (87)
Outdoor activities					
Cinema	34 (54)	42 (48)	25 (48)	25 (57)	126 (51)
Walks	44 (70)	55 (62)	32 (62)	30 (68)	161 (65)

(continues)

Table 1. Continuation

Life habits	Eutrophic n=151		Overweight/Obese n=96		General n=247 (%)
	Boys n=63 (%)	Girls n=88 (%)	Boys n=52 (%)	Girls n=44 (%)	
Goes on car rides	51 (81)	66 (75)	40 (77)	38 (86)	195 (79)
Strolls in the square/park	41 (65)	45 (51)	36 (70)	26 (59)	148 (60)
Rides a bicycle	49 (78)	56 (64)	37 (71)	30 (68)	172 (69)
Skateboards	34 (54)	15 (17)	25 (48)	7 (16)	81 (33)
Skates	14 (22)	35 (39)	7 (13)	17 (39)	73 (30)
Goes to the mall	52 (83)	65 (74)	39 (75)	42 (95)	198 (80)
Sporting goods they have					
Bicycle	53 (84)	71 (81)	44 (85)	36 (82)	205 (83)
Inline skates	13 (21)	41 (46)	10 (19)	18 (41)	82 (33)
Skateboard	41 (65)	19 (21)	28 (54)	8 (18)	95 (38)
Plastic ball	25 (40)	45 (51)	18 (35)	23 (52)	112 (45)
Soccer ball	47 (75)	24 (27)	34 (65)	22 (50)	126 (51)
Volleyball	17 (27)	27 (31)	10 (19)	12 (27)	66 (27)
Basketball	20 (32)	13 (15)	17 (33)	11 (25)	61 (25)
Football boots	52 (83)	5 (6)	37 (71)	–	94 (38)
Play area					
Backyard	38 (60)	50 (57)	29 (56)	30 (68)	148 (60)
Condo patio	8 (13)	14 (16)	5 (10)	6 (14)	32 (13)
Vacant lot	12 (19)	3 (3)	8 (15)	3 (7)	26 (11)
Street	29 (46)	32 (36)	30 (58)	18 (41)	109 (44)
Square/park	20 (32)	29 (33)	16 (31)	14 (32)	79 (32)
Sport practice					
Yes	31 (49)	26 (30)	26 (50)	15 (34)	98 (40)
No	32 (51)	62 (70)	26 (50)	29 (66%)	149 (60)

When questioned about what they do outdoors, the kids answered more often going for a car ride (79%) and going to the mall (80%). Among the activities with greater energy expenditure, walking (65%) and cycling (69%) stood out. It is also noteworthy the higher percentage of girls in the overweight/obese group who usually go to the mall and go for a car ride, when compared with the girls in the eutrophic group.

Among the sports goods that children have, the most frequent was the bicycle (83%). Soccer ball, football boots and skateboard were more common among boys, in both groups, while inline skates and plastic ball were more common among girls. The children cited the backyard (60%) as the most frequent place where they play, followed by the street (44%).

Only 98 (40%) children practice sports outside the physical education classes. Soccer/Indoor soccer appears as the most common sport among boys (17%) and rhythmic gymnastics/ballet/dance stood out only among the girls in the eutrophic group (20%).

Among the children assessed, 122 (49%) took morning classes and 125 (51%) took afternoon classes. After comparing the children who study in different periods in relation to nutritional classification and performance on the 6MWT, no statistically significant differences were found (p=0.1782 and p=0.7544). However, when the children were divided between school periods and compared regarding sleep/night hours there was statistically significant difference (p=0.0239) with the morning group sleeping an average of 8 h and 58 min±0.8810 and the afternoon group sleeping 9 h and 16 min±1.268.

Table 2 shows that 57% (142) of children commuted passively (motorcycle, car, van or bus) to school, while

43% (105) of them commuted actively (on foot or by bicycle). When comparing the performances on the 6MWT (% of the predicted) between children who commuted actively to school and those who commuted passively a statistically significant difference was found in both groups. However, unlike eutrophic children, those in the overweight/obese group who commuted actively showed a lower performance on the test when compared with those that commuted passively.

Table 2. Performance on the 6MWT in relation to the type of commute to home-school

Groups	Performance on the 6MWT (% of predicted) mean (SD)		*p*
	Active Commute	Passive Commute	
General	101.5±0.7585 n=105	101.0±0.7616 n=142	0.6213
Eutrophic	102.2±1.056 n=58	99.22±0.9493 n=93	0.0410*
Overweight/Obese	100.7±1.081 n=47	104.3±1.141 n=49	0.0215*

When comparing the performances on the 6MWT between eutrophic and overweight/obese groups, no difference was found between those who commuted passively with p=0.0012, with the overweight/obese group obtaining a better performance on the 6MWT than the eutrophic group. The commute did not showed correlation with the performance on the 6MWT (r=0.2332; *p*=0.7154).

Regarding sleeping habits, we observed (Table 3) that 65% (161) of the children usually sleep less than 10 h/night. The overall average was 9 h and 8 min of sleep per night – when divided into groups according to their body mass, no statistical significant difference was found in the time of sleep/night (p=0.3121). In the intra-group comparison, no statistical significant difference was found regarding the performance on the 6MWT among children who sleep less than 10 h/night and those who sleep more than 10 h/night in any of the groups. Also, no statistical significant difference was found in the performance of the 6MWT comparing the eutrophic group with the overweight/obese group. The sleep/night hours showed no correlation with the performance on the 6MWT (r=0.2903; p=0.6498). Nine individuals could not answer the number of sleep/night hours, 8 of them being eutrophic and 1 overweight/obese.

Table 3. Performance on the 6MWT in relation to the hours of sleep/night

Groups	Does not know	Performance on the 6MWT (% of the predicted) mean (SD)		*p*
		Sleeps less than 10 h/night	Sleeps more than 10 h/night	
General	9	101.9±0.6106 n=161	100.2±1.108 n=77	0.1374
Eutrophic	8	101.2±0.7933 n=93	99.06±1.494 n=50	0.1738
Overweight/Obese	1	102.7±0.9773 n=68	102.3±1.479 n=27	0.8082

In Table 4, after comparing the performances on the 6MWT of children who practice sports with those who do not practice, statistically significant difference was found (p=0.0065); however, when classified as eutrophic and overweight/obese, only the eutrophic group obtained statistically significant difference (p=0.0053). Comparing the eutrophic group with the overweight/obese group, statistical significant difference was found among those who did not practice any sport (p=0.0201), and, again, the overweight/obese group obtained better performance on the 6MWT.

Table 4. Performance on the 6MWT in relation to sport practice

Groups	Performance on the 6MWT (% of predicted) Mean (SD)		*p*
	Plays sports	Does not play sports	
General	103.0±0.8741 n=98	100.0±0.6773 n=149	0.0065*
Eutrophic	102.9±1.171 n=57	98.83±0.8789 n=94	0.0053*
Overweight/Obese	103.2±1.327 n=41	102.1±1.005 n=55	0.5060

Sport practice and nutritional classification showed correlation with the performance on the 6MWT with r=0.1793; p=0.0047 and r=0.1280; p=0.0445, respectively. However, the multiple linear regression using the performance on the 6MWT (% of the predicted) as the dependent variable and the sport practice and the nutritional classification as independent variables showed that the sport practice and the nutritional classification have a weak influence on the 6MWT performance with R^2= 0.03009; p=0.0063 and R^2=0.02287; p=0.0174, respectively.

DISCUSSION

The answers regarding life habits corroborates studies that show the preference of the Brazilian child for activities

of low energy expenditure, both in the activities carried out inside the house, such as watching TV and studying, and outside the house, such as going for a car ride and going to the mall[7,8]. In addition, 86% of the children reported doing household chores and 41% taking care of younger children, which can be explained by the socioeconomic condition, in which children are taking over their parents' responsibilities. Another interesting data is the fact that 60% of the children cited the backyard as the place where they play. Some studies had already noticed the decrease in the practice of playing in public areas such as streets and squares, as the one by Burgos et al.[14]. Probably the insecurity of parents regarding violence and traffic, in addition to the bad conservation and restriction on the number of squares and/or public courts, are the causes of this current panorama.

Football/futsal was the most common sport among boys, which can be explained by the ease of access to school projects and cultural issues. The practice of rhythmic gymnastics/ballet/dance also stood out, but only among girls in the eutrophic group (20%), the non-participation of overweight/obese girls in this type of activity is probably related to the physical limitation caused by the excess of body weight or even the mind-set that gymnasts and ballet dancers are skinny.

We noted that children often sleep on average 9 h and 8 min per night, which goes against the National Sleep Foundation's recommendation[15] from 10 to 11 h of sleep per night for children from five to 12 years. The study by Blair et al.[16] also showed this reduction in sleep hours, with an average of 9h49min of sleep/night. Several studies have shown that sleeping for a short period is associated with a high likelihood of being overweight and is also related to insulin resistance, increased waist circumference, decreased physical activity and watching television[17-20].

To walk on the way home or to school could be an alternative to increase the habits with higher daily energy expenditure and improve the functional exercise capacity. However, no correlation was found between the commute to home-school and on the 6MWT performance, and, in the comparison between children who commuted actively, only the eutrophic group showed better performance on the 6MWT, while the overweight/obese group, which commuted passively, obtained better performance. In addition, when the eutrophic children who commuted passively were compared with the overweight/obese children with the same habit, the eutrophic children showed a lower performance on the 6MWT. A possible explanation for this fact is that the children of the overweight/obese group struggled more during the test, which can be evidenced by the comparison of heart rate (HR) at the end of the 6MWT – the overweight/obese group reached on average the HR 145 beats per minute (BPM) and the eutrophic group reached a HR 132 BPM (p=0.0024).

According to the initial hypothesis, the results showed that sports practice, i.e., more active life habits, influence the functional capacity of children. On the comparison between children who does or does not practice sports, eutrophic children obtained better performance on the 6MWT. On the other hand, the children of the overweight/obese group that did not practice sport, when compared with the eutrophic children, who also did not have this habit, obtained better performance on the 6MWT – once again the overweight/obese group (HR=146BPM) reached, on average, frequency heart rate higher than the eutrophic group (HR=132BPM) with p=0.0001.

The limitation of the study is that the questionnaire used covers the usual habits of children, not being specific for measuring the sedentary lifestyle. Another potential limitation in relation to the 6MWT is that the physical activities performed by the children before the test were not controlled, but at least 30 minutes of recovery was anticipated, in case their heart rate increased.

CONCLUSION

The study shows that life habits with low energy expenditure such as watching tv and studying are frequent among children aged between eight and ten years. Sport practice and nutrition classification influence, although weakly, the 6MWT performance of children in this age group, and the number of sleep/night hours and the commute to home-school showed no correlation with the functional exercise capacity.

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