Prevalence of low physical activity level among preschool children

Prevalência de baixo nivel de atividade física em crianças pré-escolares

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Abstract – Physical activity (PA) in children has a decisive role in motor development and prevention of childhood obesity. The available evidence suggests that there is high prevalence of low levels of PA in children, but little is known about the level of PA in preschool children. The objective of this study was to identify the prevalence and the factors associated with low levels of PA in preschool children. This was a cross-sectional study performed in private schools in the municipality of Olinda (state of Pernambuco), with data collection through parent's face-to-face interviews. The study included 265 children (54.3% girls) with mean age of 4.9 years (SD=0.8). Children who did not perform at least 60 minutes/day of outdoors physical activities were considered exposed to low levels of PA. Data analysis was performed by logistic regression considering low level of PA as the outcome. The results showed that 65.3% (95%CI: 9.4-70.8) of children were classified as exposed to 'low level of PA'. Analysis showed that higher parental education (OR=2.41; 95%CI: 1.13-5.10), lack of space for playing at home (OR=2.36; 95%CI: 1.17- 4.78), and attending school in the afternoon (OR=2.92, 95%CI 1.55-5.49) or full-time (OR=57.1, 95%CI 6.57-496.2) were associated with low levels of PA. Preschoolers from families with higher number of children had lower likelihood of low level of PA (OR=0.49; 95%CI 0.26-0.93). It can be concluded that the proportion of children exposed to low levels of PA is high compared to the results of similar studies and that parental and environmental factors are associated with physical activity level in preschool-aged children.

Key words: Epidemiology; Motor activity; Preschool.

Resumo – *A prática de atividades físicas (AF) na infância tem papel decisivo no desenvolvimento motor e prevenção da obesidade infantil. Evidências disponíveis sugerem que há elevada prevalência de baixos níveis de AF em crianças, mas pouco se conhece sobre o nível de AF em pré-escolares. O objetivo do estudo foi identificar a prevalência e os fatores associados ao baixo nível de AF em pré-escolares. Estudo transversal realizado em escolas privadas da Cidade de Olinda (PE), com coleta de dados mediante entrevista "face a face" com os pais das crianças. Participaram do estudo 265 crianças (54,3% meninas) com idade média de 4,9 anos (DP=0,8). Foram consideradas expostas a baixo nível de AF as crianças que não realizavam, no mínimo, 60 minutos/dia de AF ao ar livre. A análise dos dados foi efetuada mediante regressão logística, considerando o baixo nível de AF como desfecho. Os resultados mostram que 65,3% (IC95%: 9,4-70,8) das crianças foram classificadas como expostas a "baixo nível de AF". Análises permitiram identificar que maior escolaridade paterna (OR=2,41; IC95%: 1,13-5,10), falta de espaços para jogos e brincadeiras na residência (OR=2,36; IC95%: 1,17-4,78) e estudar em período vespertino (OR=2,92; IC95%: 1,55-5,49) ou integral (OR=57,1; IC95%: 6,57-496,2) foram fatores associados a baixo nível de AF. Maior número de filhos foi identificado como fator de proteção em relação a baixo nível de AF (OR=0,49; IC95%: 0,26-0,93). Pode-se concluir que a proporção de crianças expostas a baixo nível de AF é alta em comparação aos estudos congêneres e fatores parentais e ambientais estão associados ao nível de atividade física na idade pré-escolar.*

Palavras-chave: *Atividade motora; Epidemiologia; Pré-escolar.*

INTRODUCTION

Studies have shown that physical inactivity in childhood is linked to various health-risk conditions in adulthood[1,2]. Low levels of physical activity are among the possible determinants of childhood obesity[3,4]. Furthermore, a recent study by Tanha et al.[5] also showed that a low level of moderate to vigorous physical activity is significantly related to higher rates of cardiovascular risk in children from 8 to 11 years old.

Besides its connection with acute and chronic health outcomes, lack of physical activity in childhood may be associated with physical inactivity in adolescence and adult life. However, the available findings are controversial and although there is evidence that physical activity in preschoolers is associated with physical activity in later stages of life[6,7], in the study conducted by Mattocks et al.[8] they found the opposite.

The time preschoolers spend in sedentary activities (watching TV, playing video game) is associated to negative health outcomes, such as overweight and obesity in older ages[9,10]. Besides controlling weight, the practice of physical activity at this stage of life seems to have an effect on bone mineral density, motor performance and on psychosocial factors, such as self-esteem and self-image, among others[11].

Despite the methodological difficulties involved in physical activity assesment[12], results of studies with preschool children showed a low level of physical activity in this population[13,14]. But there is a lack of data regarding the prevalence of low physical activity in preschoolers and even less data on convergent evidence concerning the factors that are associated to this condition in this subgroup. For instance, the study by Grøntved et al.[15] revealed that the socio-economic status is not associated to the level of physical activity, but Batty and Leon[16] conducted a systematic review which demonstrated the opposite.

Despite all the efforts of the scientific community, there are few studies describing the level of physical activity and associated factors in preschoolers, particularly, in developing countries like Brazil. The study of Romaldine, Issler et al.[17] was the only publication so far found to make a standard measure of physical activity in preschool children in Brazil (municipality of São Paulo). However, the study covered a sample of 109 subjects, quite heterogeneous regarding age (2 to 20 years) and whose measure of physical activity was based only on the weekly frequency of structured physical activity.

Given the above, the aim of the present study was to identify the prevalence and the demographic, socioeconomic and environmental factors related to the low level of physical activity in preschool children.

METHODS

School-based cross-sectional study conducted in the municipality of Olinda, state of Pernambuco. Data collection was performed between October

and December 2004. The protocol of the present investigation was approved by the Research Ethics Committee of the Universidade Federal de Santa Catarina (project n. 062/2004).

The population of the study was limited to children attending private schools in the municipality of Olinda, with age range from 4 to 6 years, estimated, at the time, in around 9,500 children distributed in 128 pre-schools. For the selection of subjects, the technique of two-stage random sampling was used. Initially, 19 schools were selected, representing, approximately 15% of total education units. The definition of this quantitative of schools was due to logistical limitations to conduct the fieldwork within the period of 3 months. Schools that have not authorized the study (n=6) were replaced by the immediately preceding on the numbered list used in the selection process. The reasons for refusal were the existence of school rules which were contrary to the conduction of research or because the conduction of work of this nature could interfere in the dynamics of school activities.

In the following stage, after contacting the schools and obtaining permission to conduct the study, 10 children were randomly selected per shift (morning and afternoon) in each of the selected schools. In full-time schools, 20 children were randomly selected. For instance, in a school with four classes, two in the morning shift and two in the afternoon shift, five children were randomly selected from each class, hypothetically totaling 20 subjects in this school. The selection of children was made considering the order of names presented in teachers' roll calls. Following these sample procedures and the number of preschool classes existing in the selected schools, it would be possible to achieve a sample of up to 310 subjects.

For data collection, we used a questionnaire answered by parents in the form of face-to-face interviews. The instrument containing 38 closed questions was constructed by adapting the questionnaire proposed by the team responsible for the project "Study of Childhood Obesity in Florianópolis"[18]. The adjustments made included the review of question wording, which went from a self-report format to face-to-face interview, and the inclusion of a section related to the physical activity measurement of the instrument proposed by Burdette et al.[19]. The interviews were answered only by the father or the mother of the selected children.

Validity of the instrument used specifically for obtaining measurements of physical activity was tested against direct measurement of physical activity obtained through motion sensors[19]. Additionally, parents of 20 children (10 boys and e 10 girls) of a private school on the outskirts of the metropolitan area of Recife were interviewed individually in two separate occasions, one week apart. It was observed that the questions were easily answered by interviewees. The time to answer the entire interview ranged from 8 to 15 minutes, and the mean time was around 12 minutes. Regarding the consistency of the test-retest measures, reproducibility coefficients (Spearman correlation coefficient) of 0.51 and 0.48 were found for the

measurement of at home and outdoor playtime, respectively. Identification data, as well as demographic and behavioral variables obtained through the questionnaire presented coefficients of test-retest reliability always higher than 0.85.

Four questions of the instrument concerned the time spent in games and sports. Each question allowed tracing the place (garden/backyard or outside the household), period of the week (weekday, weekend day) and period of the day (from the time the child wakes up until noon; from noon to 6; from 6 until bedtime) in which the activities were performed. The amount of time spent in physical activities was classified by the parents, who had five answer options (0, 1-15, 16-30, 31-60, >60 minutes). To analyze the data, the classification made by parents, considering the five categories of time, was converted to an ordinal scale from 0 to 4 points (0=0 minutes, 1=1-15 minutes, 2=16-30 minutes, 3=31-60 minutes, 4=more than 60 minutes). From the answers, we proceeded to identify the children who performed less than 60 minutes/day in outdoor playtime, and these cases were classified as 'low level of physical activity' (outcome).

The following variables were considered as potential associated factors: sex; age; parents marital status (single, married, other); maternal and paternal education; number of children (1, 2 or more); firstborn son (yes, no); breastfed (yes, no); practice of physical activity by parents; type of housing (apartment, house); space for outdoor play at home (yes, no); shift (morning, afternoon, full-time); active transportation from home to school (yes, no); participation in sports outside the school (yes, no). The data on maternal and paternal education level was collected through the following questions: "until what grade did you study?" and "until what grade did your partner or spouse study?" The answers were then classified into three categories: incomplete high school or lower, complete high school or higher. Similarly, the data related to parents physical activity levels were obtained through the following questions: "do you practice physical activity?" and does your partner or spouse practice physical activity?" The responses were recorded as dichotomous (yes, no) responses by the interviewers.

The data collected in the investigation were entered in a database by using the EpiData 2.0 software and later processed and analyzed by using the SPSS (version 11). The analysis covered the use of descriptive procedures, chi-square test and binary logistic regression. In logistic regression the backward stepwise conditional method was used, adopting p>0.20 as exclusion criteria for the model variables.

A posteriori sample calculations were performed to estimate the statistical power of the analysis. To identify the prevalence of low physical activity levels, without resorting to the correction for the sample design effect, it was verified that this sample size would allow to identify estimated prevalence of 30%, with 80% power, 95% confidence interval and sampling error of five percentage points. For the association analysis, it was found

that it would be possible to detect as significant OR values that were equal or greater than 2, considering 80% power, 95% confidence interval and 65% outcome prevalence among the non-exposed.

RESULTS

The final sample had 265 subjects (response rate of 85.5% compared to the sample originally projected). Parents of 35 children could not be reached in school because they used a private service of transportation, thus the interviews were not possible. Other two refused to participate and decided to discontinue participation during the interview. Eight questionnaires were excluded after the phase of entering data, because the age of subjects was less than 4 years old.

The characteristics of the children included in the study are presented in Table 1. The mean age was 4.9±0.8 years, significantly higher (p=0.04) among girls (5.0±0.9 years) when compared to boys (4.8±0.8 years). There were no statistically significant differences between boys and girls in relation to any of the independent variables under analysis in this study, except in relation to age, as previously mentioned.

Time spent commuting to school was significantly higher (p=0.01) for children who traveled by motor vehicles (~14 minutes), compared to children who performed the journey on foot (~11 minutes). It was also found that 89% (n=231) of children did not practice any sports outside the school. Most of the remaining children (11%; n=29), practiced sports outside the school up to twice a week. Swimming was the most common form of activity among children of this age group. At school, in addition to Physical Education and recreation, it was verified that some children participate in other types of structured sports activities: martial arts, dancing and basketball. Combining the data on participation in structured sports activities in and outside school, it was found that 32 children (12.3%) participated in at least one activity.

It was verified that 65.3% (95%CI: 59.4-70.8) of children were classified as exposed to 'low level of physical activity', and it was observed that this proportion did not differ significantly ($\chi 2=0.80$; p=0.37) among boys (67.8%; 95%CI: 59.1-75.6) and girls (62.5%; 95%CI: 54.4-70.1). In bivariate analysis, we found that only two factors were associated to the level of physical activity: the shift the child attends school (p<0.01) and the availability of physical spaces for participation in outdoor play at home (p<0.01). These results are presented in Figure 1.

Analysis of bivariate binary logistic regression between each of the independent variables and the outcome under analysis (low level of physical activity) are presented in Table 2. In multivariate analysis (binary logistic regression), it was found that four factors are associated with low level of physical education in this group: paternal education, number of offspring, availability of physical spaces for outdoor play at home and the shift in which the child attends school. The final regression model is

Table 1. Absolute and relative distribution (%) of subjects in relation to demographic, socioeconomic, parental, neonatal and environmental characteristics of the sample stratified by sex

Variable	Categories	Both		Girls		Boys		p Value*
		n	%	n	%	n	%	
Age	4	111	41.9	54	44.6	57	39.6	0.04
	5	73	27.5	41	33.9	32	22.2	
	6	81	30.6	26	21.5	55	38.2	
Maternal marital status	Single	64	24.2	26	21.5	38	26.4	0.60
	Married	178	67.2	85	70.2	93	64.6	
	Other	23	8.7	10	8.3	13	9.0	
Maternal education level**	Incomplete HS	72	27.2	32	26.4	40	27.8	0.81
	Incomplete HS or higher	193	72.8	89	73.6	104	72.2	
Paternal education level	Incomplete HS	58	21.9	26	21.5	32	22.2	0.89
	Incomplete HS or higher	207	78.1	95	78.5	112	77.8	
Number of children	1	108	40.8	50	41.3	58	40.3	0.86
	2+	157	59.2	71	58.7	86	59.7	
Firstborn son	Yes	150	56.6	70	57.9	80	55.6	0.71
	No	115	43.4	51	42.1	64	44.4	
Breastfed	Yes	235	88.7	109	90.1	126	87.5	0.51
	No	30	11.3	12	9.9	18	12.5	
Mother practices PA	Yes	75	28.5	34	28.3	41	28.7	0.95
	No	188	71.5	86	71.7	102	71.3	
Father practices PA	Yes	83	32.6	40	37.0	43	35.5	0.81
	No	146	63.8	68	63.0	78	64.5	
Type of residence	Apartment	61	23.0	27	22.3	34	23.6	0.80
	House	204	77.0	94	77.7	110	76.4	
Space for outdoor play	Yes	184	69.4	86	71.1	98	68.1	0.60
	No	81	30.6	35	28.9	46	31.9	
School shift	Morning	87	32.8	43	35.5	44	30.6	0.56
	Afternoon	141	53.2	60	49.6	81	56.3	
	Full-time	37	14.0	18	14.9	19	13.1	
Active transportation to school	Yes	190	71.7	83	68.6	107	74.3	0.30
	No	75	28.3	38	31.4	37	25.7	
Sports out of school	Yes	29	11.2	18	15.0	11	7.9	0.07
	No	231	88.8	102	85.0	129	92.1	

* p Value is relative to the comparisons between boys and girls; ** HS=high school
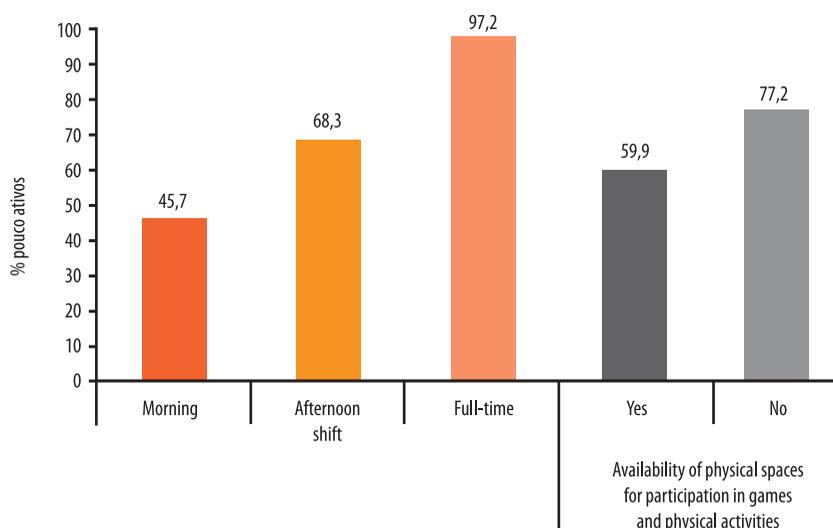

Figure 1. Proportion of children with low levels of physical activity per shift and availability of physical spaces for participation in games and activities.

Table 2. Bivariate binary logistic between the independent variables and the low level of physical activity (outcome) in preschool-aged children

Variable	Categories	β	Wald	P Value	OR	95%CI
Sex	Boys				1	
	Girls	0.41	1.53	0.22	1.50	0.79-2.87
Age	4				1	
	5	0.29	0.47	0.50	1.33	0.59-3.01
	6	-0.55	2.06	0.15	0.58	0.27-1.23
Maternal marital status	Single				1	
	Married	0.13	0.07	0.79	1.13	0.46-2.78
	Other	0.89	1.41	0.24	2.43	0.57-10.5
Maternal education level*	Incomplete HS				1	
	Incomplete HS or higher	0.09	0.04	0.84	1.09	0.46-2.62
Paternal education level	Incomplete HS				1	
	Incomplete HS or higher	0.85	4.09	0.04	2.34	1.02-5.34
Number of children	1				1	
	2+	-0.63	1.90	0.17	0.53	0.22-1.30
Firstborn son	Yes				1	
	No	-0.27	0.35	0.55	0.76	0.31-1.85
Breastfed	Yes				1	
	No	-0.13	0.06	0.82	0.88	0.30-2.59
Mother practices PA	Yes				1	
	No	0.16	0.21	0.65	1.17	0.60-2.29
Father practices PA	Yes				1	
	No	-0.29	0.70	0.40	0.75	0.38-1.48
Type of residence	Apartment				1	
	House	0.50	1.41	0.24	1.64	0.72-3.74
Space for outdoor play	Yes				1	
	No	0.94	5.34	0.02	2.56	1.15-5.66
School Shift	Morning				1	
	Afternoon	1.16	11.05	0.00	3.18	1.60-2.28
	Full-time	4.17	13.07	0.00	64.92	6.76-623.4
Active transportation to school	Yes				1	
	No	0.27	0.52	0.47	1.31	0.63-2.70
Sports out of school	Yes				1	
	No	-0.02	0.00	0.97	0.98	0.31-3.08

* HS=high school

Table 3. Final model of logistic regression to low level of physical activity in preschool children

Variable	Categories	β	Wald	P Value	OR	95%CI
Paternal level of education	Incomplete HS	[reference category]			1	
	Incomplete HS or higher	0.88	5.22	0.02	2.41	1.13-5.10
Number of children	1	[reference category]			1	
	2+	-0.71	4.86	0.03	0.49	0.26-0.93
Space for outdoor play	Yes	[reference category]			1	
	No	0.86	5.69	0.02	2.36	1.17-4.78
Shift	Morning	[reference category]			1	
	Afternoon	1.07	11.03	<0.01	2.92	1.55-5.49
	Full-time	4.05	13.44	<0.01	57.1	6.57-496.2

capable of explaining, approximately, 23% of the variability in physical activity behavior in this group of subjects. The results are presented in Table 3.

DISCUSSION

The development of the present study provided some important findings: the prevalence of preschool children exposed to low level of physical activity is high, affecting, approximately, two out of three children; two parental factors (number of offspring and parental education level) are significantly associated with the level of physical activity of the children; lack of outdoor play areas at home is a risk factor for low level of physical activity; and the children studying in the afternoon or full-time are exposed to greater risk compared to those studying in the morning.

On the other hand, while providing interesting evidence, caution is recommended in generalizing the results of this study due to some possible limitations. First, the operational difficulty in conducting face-to-face interviews outside the school environment was the main reason for the exclusion of 35 participants, implying a sample loss of 13%, which, though small, does not exclude the possibility of selection bias. However, participants were selected through random sampling and this procedure may have reduced the occurrence of this type of bias.

The use of measures reported by parents instead of adopting an objective measure or a combination of measures (e.g. questionnaire and direct monitoring) might also have been a source of bias. We tried to avoid this problem by using a previously tested instrument that was applied by personnel who have been trained for this activity.

The quantitative definition of schools to 15% of the total existing in the municipality where the study was conducted resulted from logistics and timing conditions (three months) for completion of the fieldwork (data collection). This methodological approach may have limited the sample size and the precision of prevalence estimates. In addition, some factors may not have been identified as being associated with low activity level due lack of statistical power.

The lack of population-based or school-based studies focusing on the practice of physical activities in Brazilian preschool children does not allow the comparison of the results obtained in this study with others. Regarding international studies, Kagamimori et al.[20] took the time children spend on outdoor play and sports as a measure of the level of physical activity, adopting time inferior to 60 minutes as the cutoff point to classify subjects with low level of physical activity. The results of an investigation with a cohort of almost 10 thousand 3-year-old Japanese children, showed a prevalence of 58.1% subjects classified with low level of physical activity. Despite a difference of 7.1 percentage points in relation to the verified in the present study, the results converge to alert to the low level of physical activity to which Brazilian preschool children may be exposed nowadays.

Although there is evidence that both paternal and maternal factors may be correlated to the level of physical activity in preschool-aged children[21], the education level of the mothers and not that of the fathers seem to be associated with behavior regarding the practice of physical activities, as reported by Van Rossem et al.[22]. However, in the present study, the opposite was observed. The explanation for this discrepancy in results may lie in the fact that cultural characteristics that change from one social group to another may act as mediators of the association between parental factors and children's behavior. Thus, in certain social groups, maternal education may have a more important role and in others, as observed in the present study, paternal schooling may explain more about the variability in children's behavior regarding the practice of physical activities. Another possible explanation for the differences in studies results lies in the greater heterogeneity of education levels observed in the Brazilian population as a whole compared to that observed in countries with high economic development.

The results of the present study indicate that preschool-aged children from families with two or more children have, approximately, 50% lower likelihood of being exposed to low levels of physical activity compared to those who are only children. The association between the number of children in the family and level of physical activity is an almost unexplored topic[23], particularly, in preschool-aged children[24]. However, it is plausible to suggest that a greater number of children and, therefore, siblings, increase the chance that the child participates in games and activities more physically active.

One line of investigation that has received much attention in recent years is the analysis of how the environmental characteristics (physical and social) may influence the level of physical education[25]. In the present study, it was verified that the children who lived in a place where there was no physical space for outdoor play had a 136% higher chance of having a low level of physical activity, converging to the findings reported by Timperio et al.[26]. Despite pointing in the same direction, only around 30% of studies conducted with subjects aged 3-12 years found evidence of association between the recreational environment and the level of physical activity of the subjects[25].

Another important finding of the present study was the identification of the fact that the children who study in the afternoon or full-time had higher likelihood of presenting low level of physical activity. Possibly, children who study in the morning may perform outdoor physical activities in the afternoon because the conditions of temperature and solar exposition allow these practices after 4 p.m. However, those who study in the afternoon, would need to have their parents or caregivers availability to perform this activities in the first hours of the day, once after 8 a.m. the exposure to sunlight and the temperature are not recommended or tolerable for children in this age group, particularly, in the region where this study was conducted (northeastern Brazil).

Considering the results of this study, it was concluded that the proportion of children exposed to low levels of PA (approximately two out of three) is high in comparison to the similar studies. It was also found that both parental (paternal education and number of children) and environmental factors (availability of physical space for playing at home) are associated with the level of physical activity in preschool-aged children.

Actions should be developed to inform teachers, parents, directors of education units and public sectors about the importance of physical activity for preschool-aged children. Within the school, actions should be conducted in order to encourage the creation of more and better opportunities to perform physical activities (games and sports), particularly, for those studying full-time. Finally, during the development of this study, new knowledge gaps were found, thus further investigation will be necessary to expand the body of knowledge about the "physical activity-health" interrelation in the context of early childhood education. The association between environmental factors and physical activity levels observed in the present study suggests that the promotion of physical activity in this age group may occur through physical environmental modification, but this hypothesis will need to be tested in intervention studies. There is also a need to develop prospective studies in order to identify determinants of physical activity behavior within this population subset.

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