



ORIGINAL ARTICLE

# Adolescents' physical activity is associated with previous and current physical activity practice by their parents<sup>☆</sup>



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## KEYWORDS

Current physical activity;  
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## Abstract

**Objective:** The purpose of this study was to determine whether parents' current and previous physical activity practice is associated with adolescents' physical activity.

**Methods:** The sample was composed of 1231 adolescents (14–17 years), and 1202 mothers and 871 fathers were interviewed. Weight and height of the adolescents were measured. Self-reported parents' weight and height were obtained. The current and previous physical activity levels (Baecke's questionnaire) of parents (during childhood and adolescence) and adolescents' physical activity levels were obtained using a questionnaire. The magnitude of the associations between parent and adolescent physical activity levels was determined by binary logistic regression (adjusted by sex, age, and socioeconomic level of adolescents and education level of parents).

**Results:** The current physical activity practice by parents was associated with adolescents' physical activity ( $p < 0.001$ ). The physical activities reported by parents in their childhood and adolescence were also associated with higher physical activity levels among adolescents. Adolescents whose parents were both physically active in the past and present were six times ( $OR = 6.67$  [ $CI = 1.94–22.79$ ]) more likely to be physically active compared to adolescents with no parents who were physically active in the past.

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**PALAVRAS-CHAVE**

Atividade física atual;  
Atividade física anterior;  
Pais;  
Adolescentes;  
Apoio social;  
Modelo

**Conclusions:** The current and previous physical activities of parents were associated with higher levels of physical activity in adolescents, even after controlling for confounding factors.

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### A atividade física de adolescentes está associada à prática de atividade física anterior e atual por seus pais

**Resumo**

**Objetivo:** A finalidade deste estudo foi determinar se a prática de atividade física atual e anterior dos pais está associada à atividade física dos adolescentes.

**Métodos:** A mostra foi composta por 1.231 adolescentes (14-17 anos), e foram entrevistados 1.202 mães e 871 pais. Foram medidos o peso e a altura dos adolescentes. Foram obtidos o peso e a altura autorrelatados dos pais. Os níveis de atividade física atual e anterior (questionário de Baecke) dos pais (durante a infância e adolescência) e os níveis de atividade física dos adolescentes foram obtidos utilizando um questionário. A magnitude das associações entre os níveis de atividade física dos pais e adolescentes foi determinada por regressão logística binária (ajustada por sexo, idade e nível socioeconômico dos adolescentes e nível de escolaridade dos pais).

**Resultados:** A prática atual de atividade física pelos pais foi associada à prática de atividade dos adolescentes ( $p < 0,001$ ). As atividades físicas relatadas pelos pais em sua infância e adolescência também foram associadas aos maiores níveis de atividade física entre os adolescentes. Os adolescentes cujos pais eram fisicamente ativos no passado e atualmente foram seis vezes ( $RC = 6,67$  [ $IC = 1,94-22,79$ ]) mais propensos a ser fisicamente ativos em comparação aos adolescentes cujos pais não eram fisicamente ativos no passado.

**Conclusões:** As atividades físicas atuais e anteriores dos pais foram associadas aos maiores níveis de atividade física nos adolescentes, mesmo após o controle de fatores de confusão.

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**Introduction**

Physical inactivity in young people has increased in both developing and developed countries. In Brazil, almost 80% of children and adolescents were insufficiently active.<sup>1</sup> Given that physical inactivity in youth has been associated with increased cardiovascular risk,<sup>2,3</sup> understanding the factors associated with physical inactivity in this age group has been considered important for public health actions.

Studies have shown a modeling (imitation of behavior of a person who is considered an example) influence of friends in adolescents' physical activity practice.<sup>4</sup> In addition, the parents' current physical activity has also been shown to be a model for children's physical activity levels.<sup>5-7</sup> For example, a longitudinal study including 13,000 students observed that parents' physical activity was associated with children's physical activity.<sup>8</sup> Other investigators<sup>9</sup> have also reported associations between parents and children's physical activity. However, this is not a universal finding,<sup>10</sup> which can be explained by the different social and cultural contexts of the studies. Thereby, studies in different countries are needed to understand the modeling of parents on their offspring's physical activity levels.

Modeling parent physical activity has been explained by several factors, including the examples observed by their children in adopting physical activity habits.<sup>5</sup> In addition,

factors that are independent of parents' current physical activity levels, such as encouraging children to be physically active and providing transportation to physical activity practices,<sup>5</sup> have also been proposed to explain the associations between the physical activity of parents and children. Thus, it is plausible that parents who practiced sports in childhood and adolescence are more likely to provide this social support, even if they are not currently physically active.

Therefore, the objective of this study was to determine whether previous and current physical activity practice by parents is associated with adolescent's physical activity. The hypothesis was that adolescents whose parents practiced physical activity throughout their lives are more likely to be physically active.

**Methods****Sample**

The sample consisted of adolescents aged 14–17 years from the six largest schools in the center of the city of Londrina-PR, located in southern Brazil, selected by convenience. These schools receive students from all regions of the city and, therefore, present a profile of students that represents

the entire city. Sample size was estimated with a prevalence of 50% of physical activity, a confidence interval of 95%, a maximum error of 4%, and a design effect (deff) of 1.5, adding 20% due to possible losses ( $n=1044$  subjects). The schools participating in this study served approximate 4850 students (data provided by the departments of schools), of whom 1495 students initially agreed to participate in the study. Those who agreed took home to their parents both an informed consent and a questionnaire on lifestyle habits. However, only 1267 returned with the consent form signed by parents. The final sample consisted of 1231 young people, since 36 did not return the questionnaires completed by one or both parents. If the adolescent had a guardian instead of parents, they were allowed to participate in the study. The parents who agreed to participate filled in a questionnaire at their home with socio-demographic and physical activity information.

The students answered their own questionnaires in school and participated in anthropometric measurements. Details of the collected variables are presented below. Informed consent was obtained from all students and permission for students to participate in this study was provided by their parents or guardians. This study was approved by the Ethics Committee of the Universidade Estadual de Londrina (process No.: 203/10).

### Physical activity and anthropometric measures

Parents' self-reported weight and height were obtained, and body mass index (BMI) was calculated by dividing weight by the square of height. Parents with a BMI  $> 24.99$  kg/m<sup>2</sup> were considered overweight.

Current physical activity of parents was obtained using the Baecke's questionnaire,<sup>11</sup> previously validated for the Brazilian adult population.<sup>12</sup> This questionnaire assesses current physical activity according to three different domains: work, leisure time, and practice of sports. In the present study, only leisure time and practice of sports were considered. Parents classified in the highest quartile for physical activity (Q4) were considered sufficiently active, while those in the lower quartiles (Q1, Q2, and Q3) were considered insufficiently active.

Previous physical activity practice of parents was determined by two questions<sup>13</sup>: "When you were 7 to 10 years old, did you engage in any supervised sports activity for at least one uninterrupted year out of school (considering the holiday periods in the middle and end of the year)?" and "When you were 11 to 17 years old, did you engage in any supervised sports activity for at least one uninterrupted year of school (considering the holiday periods in the middle and end of the year)?" School physical education classes were excluded, but participation in training teams in school was considered. The possible answers for each question were 'yes' or 'no.'

Adolescent's physical activity was assessed by the Baecke's questionnaire,<sup>11</sup> validated for Brazilian adolescents.<sup>14</sup> After calculating the Baecke score, the adolescents were divided into quartiles. Those situated in the highest quartile (Q4) were considered sufficiently active. Adolescents ranked in the lower quartiles (Q1, Q2, and Q3) were classified as insufficiently active.

Weight was measured using an electronic scale (Plenna<sup>®</sup>, Acqua model, São Paulo, SP, Brazil) with an accuracy of 0.1 kg and maximum capacity of 150 kg. The adolescents were bare footed, and stood in the center of the scale platform wearing light clothing. Height was measured using a portable stadiometer with an accuracy of 0.1 cm, and maximum length of 2 m. Using the values of body weight and height, the BMI was calculated and, according to criteria for sex and age proposed in the literature,<sup>15</sup> adolescents were classified overweight or eutrophic.

### Socioeconomic level

The Economic Classification Criteria of Brazil<sup>16</sup> was used to define the economic status classification of the families into classes A1, A2, B1, B2, C1, C2, D, and E. The families were further divided into: high economic class (A1, A2, and B1), middle economic class (B2 and C1), and low socioeconomic class (C2, D, and E).

### Reproducibility

The reproducibility of the questionnaires was obtained in a pilot study with 30 adolescents and their parents of both genders. The questionnaire was answered twice with an interval of two weeks between the first and second assessment. The reproducibility of the questionnaire was evaluated by the intraclass correlation coefficient (ICC) for continuous variables and Kappa coefficient for the categorical variables. In the analysis, the minimum values obtained were 0.83 and 0.85 for the ICC and Kappa, respectively.

### Statistical analyses

The Kolmogorov–Smirnov test was performed to verify the normality of the data. Descriptive statistics were presented as median and interquartile range. The comparison of the sample characteristics among physically active and insufficiently active adolescents was performed using the Mann–Whitney test. The associations between parents/guardians physical activity (main independent variables) and adolescent's physical activity were obtained using the chi-squared test and binary logistic regression analyses were performed adjusting for adolescent's sex, age, socioeconomic level, and parents' educational level. Interactions between the main independent variables with sex and age groups of the adolescents were tested adding interaction terms to the models; however, no results presented statistical significance and these were therefore excluded from the models.

### Results

A total of 1231 (515 boys and 716 girls) adolescents participated in the present study. The sample included 1202 mothers and 871 fathers. Of the 1231 families who participated, 802 provided answers from both parents. Active adolescents were heavier and taller than insufficiently active adolescents. Currently physically active fathers or

**Table 1** Characteristics of the sample.

	Active <sup>a</sup> Median (IQR)	Insufficiently active Median (IQR)	<i>p</i>
<i>Adolescents</i>			
Age, years	16.00 (2.00)	16.00 (1.00)	0.138
Weight, kg	63.00 (17.30)	56.05 (14.55)	0.001
Height, cm	171.00 (12.50)	164.50 (11.50)	0.001
BMI, kg/m <sup>2</sup>	21.30 (4.05)	20.61 (4.41)	0.014
<i>Fathers</i>			
Age, years	45.00 (9.00)	45.00 (9.00)	0.987
Weight, kg	80.00 (16.50)	80.00 (17.80)	0.273
Height, cm	173.00 (9.00)	172.00 (10.00)	0.149
BMI, kg/m <sup>2</sup>	26.51 (4.49)	26.87 (5.40)	0.047
<i>Mothers</i>			
Age, years	43.00 (9.00)	42.00 (9.00)	0.177
Weight, kg	65.00 (14.00)	67.00 (17.00)	0.018
Height, cm	162.00 (10.00)	161.00 (8.00)	0.357
BMI, kg/m <sup>2</sup>	24.77 (5.26)	25.48 (6.25)	0.004

IQR, interquartile range.

<sup>a</sup>According to current physical activity.

mothers had a lower BMI compared to those who were insufficiently active (Table 1).

The prevalence of active adolescents whose neither parent was currently active was 18.5%, and 30.9% among those who had at least one parent who was currently active. The results of the multivariate analysis showed that adolescents whose both parents were currently active were twice (OR = 1.91 [1.37–2.36];  $p < 0.001$ ) as likely to present similar behavior when compared with adolescents whose parents were insufficiently active, controlling for sex. These odds increased when both parents reported current physical activity practice (OR = 3.53 [1.96–6.35];  $p < 0.001$ ).

When fathers were currently active, 34.3% of the adolescents reported the same behavior, compared with 21.7% of adolescents with fathers that were currently insufficiently active ( $p < 0.001$ ). When mothers were currently active, 37.7% of adolescents reported the same behavior, compared with 20.6% of adolescents with mothers that were currently insufficiently active ( $p < 0.001$ ). When both parents were currently active, the prevalence of active adolescents increased to 40.8% (Fig. 1; Panel A).

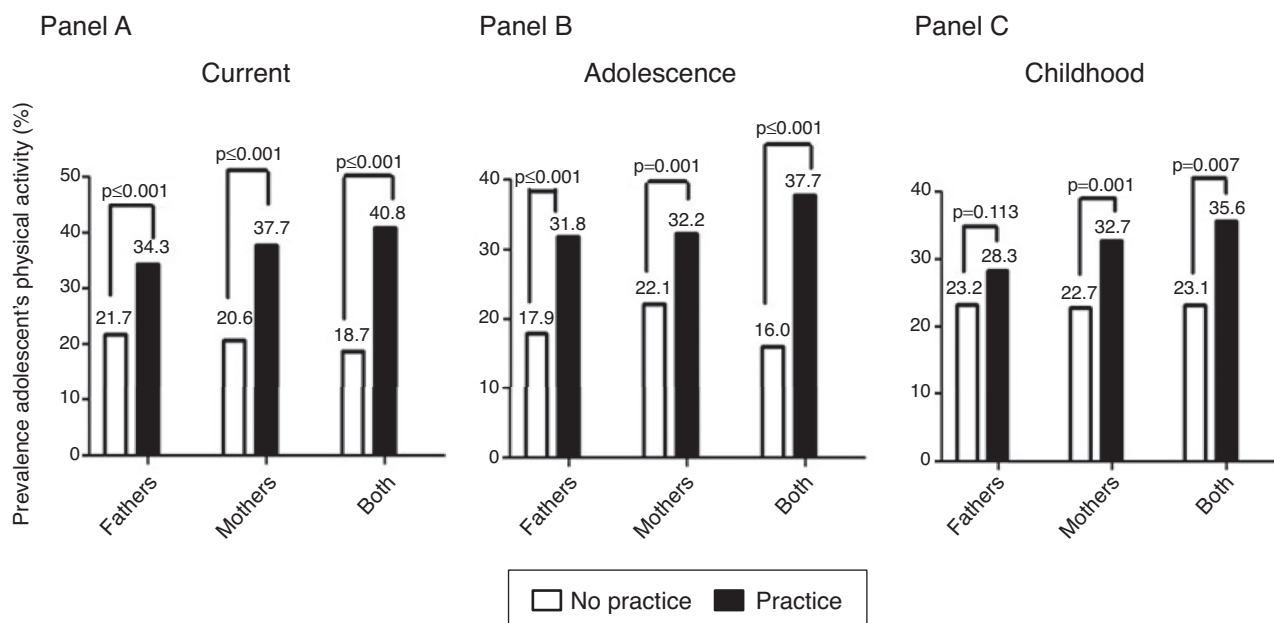
Physical activity through sports practice in childhood and adolescence reported by parents was also associated with current physical activity by their adolescent offspring. The prevalence of active adolescents was higher when fathers had practiced sports during their adolescence (31.8%) when compared with adolescents whose fathers did not report this practice (17.9%;  $p < 0.001$ ). A similar relationship was found for adolescents whose mothers had practiced sports during their adolescence (32.2% versus 22.1% [ $p = 0.001$ ]; Fig. 1, Panel B). When both parents reported practicing sports in adolescence, 37.7% of adolescents reported physical activity, versus 16.0% of adolescents of whose neither parent reported this practice [ $p = 0.001$ ].

Adolescents whose fathers reported practicing sports activities in childhood were as active as adolescents whose fathers did not report this practice (28.3% versus 23.2%

[ $p = 0.113$ ]). Adolescents whose mothers reported practicing sports activities in childhood were more active when compared with adolescents whose mothers did not report this practice (32.7% versus 22.7% [ $p = 0.001$ ]; Fig. 1, Panel C). When both parents reported playing sports in childhood, 35.6% of adolescents were active, versus 23.1% of adolescents whose neither parent reported this practice ( $p = 0.007$ ).

Table 2 shows the information considering the previous practice of sports by fathers (childhood and adolescence) and its relationship with adolescents' physical activity. Adolescents whose fathers had practiced sports in adolescence ( $p < 0.001$ ) or adolescence and childhood ( $p = 0.002$ ) were more likely to be physically active when compared with adolescents whose fathers did not practice sports during childhood. Adolescents whose mothers reported having practiced sports in childhood ( $p = 0.014$ ), adolescence ( $p < 0.001$ ), or both ( $p = 0.003$ ) were more likely to be physically active when compared with adolescents whose mothers did not report this practice. These associations remained after controlling for confounding variables such as gender, age, socioeconomic level, and parents' education level.

The prevalence of active adolescents according to the number of periods in which parents remained practicing physical activity (practice of sports in childhood, adolescence, and current physical activity) is presented in Table 3. For both parents, a higher number of physical activity periods were associated with a higher prevalence of active adolescents ( $p < 0.001$ ). Adolescents whose fathers practiced physical activity in two ( $p = 0.004$ ) or three periods ( $p = 0.002$ ) during their life were more likely to be active. Adolescents whose mothers practiced physical activity in one ( $p < 0.001$ ), two ( $p < 0.001$ ), or three periods ( $p < 0.001$ ) during their life were more likely to be active. Moreover, adolescents whose both parents practiced physical activity in one, two or, three periods during their life were more likely to be active ( $p < 0.001$ ; Table 3).



**Figure 1** Prevalence of current physical activity of adolescents according to parents' physical activity in different periods of life.

**Table 2** Association between sufficient physical activity in adolescents and previous physical activity of parents.

	Unadjusted		Adjusted <sup>a</sup>		p-Value
	OR	95% CI	OR	95% CI	
<i>Fathers</i>					
None	1.00	-	-	-	-
Childhood	1.30	0.93–1.81	1.32	0.91–1.80	0.113
Adolescence	2.57	1.52–3.06	2.19	1.49–3.22	≤0.001
Childhood or adolescence	1.51	0.95–2.40	1.52	0.92–2.52	0.100
Both	1.91	1.30–2.81	1.95	1.28–2.99	0.002
<i>Mothers</i>					
None	1.00	-	-	-	-
Childhood	1.58	1.17–2.11	1.49	1.08–2.06	0.014
Adolescence	1.67	1.25–2.23	1.62	1.18–2.24	≤0.001
Childhood or adolescence	1.58	1.12–2.22	1.62	1.11–2.35	0.012
Both	1.90	1.34–2.69	1.80	1.22–2.64	0.003

OR, odds ratio; CI, confidence interval.

<sup>a</sup>Adjusted for sex, age, and socioeconomic level of adolescents and education level of parents.

## Discussion

The main results of this study were: (i) both current and previous parental physical activity were associated with adolescents' physical activity levels; (ii) adolescents whose parents had practiced sports in both childhood and adolescence were more likely to be physically active; and (iii) the prevalence of active adolescents was greater when both parents were currently active and/or active in the past.

The association between parents' current physical activity practice and adolescents' physical activity has also been observed in other studies.<sup>8,9</sup> This association has been explained by adolescents replication of parent's behavior and by parents' stimulus and support for their children to practice physical activity, including financial support (for

example, providing sports equipment or paying for different sports classes), encouragement (motivating adolescents through verbal or other incentives), transportation (for young people to go to places to practice of physical activity), practicing physical activity together, and accompanying the children in sports competitions.<sup>6,17–19</sup> Another aspect to be considered is that physically active parents could contribute to a higher socialization of their children through sports.<sup>20</sup>

The novelty of this study is the analysis of the association between parents' physical activity in both childhood and adolescence with their adolescent offspring's physical activity. The results showed a positive relationship after adjustment for confounding variables such as gender and educational level of parents. Interestingly, this association remained significant after adjustment for parents' current

**Table 3** Association between physical activity level in adolescents in periods of parent's physical activity (childhood, adolescence, and current physical activity).

	Unadjusted		Adjusted		p-Value
	OR	95% CI	OR	95% CI	
<i>Fathers<sup>a</sup></i>					
None	1.00	-	-	-	-
One	1.28	0.78–2.10	1.30	0.76–2.23	0.329
Two	1.90	1.25–2.90	1.98	1.24–3.15	0.004
Three	2.54	1.51–4.27	2.47	1.38–4.42	0.002
<i>Mothers<sup>a</sup></i>					
None	1.00	-	-	-	-
One	1.86	1.31–2.64	2.20	1.37–2.97	≤0.001
Two	2.48	1.71–3.58	2.56	1.70–3.85	≤0.001
Three	3.33	1.93–5.77	3.58	1.95–6.58	≤0.001
<i>Both<sup>b</sup></i>					
None	1.00	-	-	-	-
One	2.30	1.22–4.34	2.11	1.06–4.20	0.033
Two	2.02	1.09–3.74	2.04	1.04–3.99	0.037
Three	2.48	1.30–4.72	3.11	1.53–6.32	0.002
Four	4.12	2.18–7.78	3.83	1.89–7.78	≤0.001
Five	5.29	2.41–11.60	6.85	2.80–16.77	≤0.001
Six	6.27	2.14–18.33	6.67	1.94–22.79	≤0.001

OR, odds ratio; CI, confidence interval.

<sup>a</sup> Adjusted for sex, age and socioeconomic level of adolescents and education level of parents.

<sup>b</sup> Sum of the period of physical activity during the life of both parents.

physical activity. A possible explanation for this result is that parents who practiced sports in childhood and adolescence have positive thoughts about this experience and encourage their children to have active behaviors, stimulating them to practice physical activity, even if they are no longer physically active themselves.

Another important finding is that adolescents whose parents practiced physical activity in a larger number of periods (childhood, adolescence, and currently) were more likely to be physically active. This result highlights the importance of previous and current physical activity of parents for the physical activity of their children, indicating that the maintenance of physical activity from childhood to adulthood can provide beneficial effects for their children. A possible explanation is that when parents practiced physical activity during childhood/adolescence, they are aware of more specific activities for each age group, directing their children to more appropriate physical activities. This association probably becomes stronger when parents are still active, since not only they provide incentive, but they are also an example. Another factor is that parents' physical activity in childhood and adolescence could contribute to the maintenance of a healthy lifestyle in adulthood,<sup>21,22</sup> and that these habits would be more easily transferred to their adolescents.

The influence of parent's gender on children's physical activity levels is controversial in the literature. In the present study, both fathers and mothers influenced their children's physical activity. In turn, a study with 887 young Americans found that only current father's physical activity was associated with adolescents' physical activity,<sup>23</sup> while another reported that only mother's current physical

activities were related to those of Australian male children.<sup>24</sup> Considering the relationships between gender of the parents and gender of the children is also necessary. A study revealed strong relationships between mothers and both daughters and sons, but mainly for daughters,<sup>25</sup> which could be explained by the longer time mothers stay with their children. However, Craig et al.<sup>26</sup> observed positive relationships between fathers and children, fathers and daughters, and mothers and children's physical activity, but not between mothers and daughters. Future studies designed to study these relationships should consider a sample size large enough to detect associations, taking into account both the genders of parents and their children.

Furthermore, this controversy could be explained by the different methodological procedures employed. It is also possible that the influence of fathers and mothers on the physical activity levels of their children differ between countries due to socio-cultural factors, which could be addressed in future studies. Another hypothesis is that physically active parents have greater interest in completing the questionnaire, which could have contributed to the results found in the present study. Moreover, parents answered the questionnaire in their homes, while the students answered face to face. However, this was an alternative chosen to avoid possible biases if adolescents answered questions about their parents.

Another novelty of this study is that, when both parents reported sufficient physical activity practice, the chance of adolescents reporting the same behavior was higher. Interestingly, this association was evident for both parents' current and past physical activity practice. In fact, when

both parents reported the practice of physical activity in the three periods, their adolescent offspring were six times more likely to be physically active when compared with adolescents whose parents did not report physical activity practice at any time. Studies have shown that when at least one parent practices physical activity, healthy behaviors are more likely to be adopted by their children.<sup>27,28</sup> Both parents perhaps more significantly influence the practice of physical activity among adolescents, especially outside school and on weekends, considering that the instrument used to measure physical activity in this study also considered the sports activities of locomotion, e.g., cycling. These results show that both parents served as models and different types of physical activity could be facilitated in family environments.<sup>8,9</sup>

In practical terms, the results of this study bring some points to be considered in future public health actions. First, it is important to engage parents in physical activity programs in order to increase their influence on the physical activity levels of their children, and this effect will probably be greater if both parents participate. Second, as adolescents whose parents did not practice physical activity in their childhood are more likely to be inactive, more intense strategies to stimulate physical activity in this sub-group are needed. Finally, as a long-term target, incentive to exercise should be conducted at early ages in order to be passed to future generations.

The assessment of self-reported physical activity is clearly a limitation of this study. Another limitation is the assessment of previous physical activity by parents, given no scale has been previously validated for this purpose. Thus, simple questions were asked, in order to reduce recall bias. The cross-sectional design of this study also limits the establishment of causal relationships, so it was not possible to evaluate whether an increase in physical activity by parents over time would increase physical activity in adolescents. Furthermore, a non-probabilistic sample was selected, although the schools chosen for the study receive students from all regions of the city. The strengths of the study were the relatively large sample, the assessment of physical activity in different periods of the life of the parents, and the detailed investigation of this practice in relation to their adolescents' physical activity.

In summary, the present study observed that there was a relationship between physical activity between parents and adolescents. Adolescents whose parents had practiced physical activity during childhood and adolescence were more likely to be physically active. In this sense, the promotion of physical activity should consider the family unit and not just the adolescents in isolation.

## Conflicts of interest

The authors declare no conflicts of interest.

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