



ORIGINAL ARTICLE

## Association between physical activity, participation in Physical Education classes, and social isolation in adolescents<sup>☆,☆☆</sup>



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### KEYWORDS

Social isolation;  
Friends;  
Physical activity;  
Physical Education;  
Adolescent

### Abstract

**Objective:** To analyze the association between physical activity, participation in Physical Education classes, and indicators of social isolation among adolescents.

**Methods:** This was an epidemiological study based on secondary analysis of data from a representative sample of students (14–19 years) from public high schools ( $n=4,207$ ). Data were collected through the questionnaire *Global School-based Student Health Survey*. The independent variables were the level of physical activity and enrollment in Physical Education classes, while the dependent variables were two indicators of social isolation (feeling of loneliness and having few friends). Descriptive and inferential procedures were used in the statistical analysis. **Results:** Most of the adolescents were classified as insufficiently active (65.1%) and reported not attending Physical Education classes (64.9%). Approximately two in each ten participants reported feeling of loneliness (15.8%) and, in addition, about one in each five adolescents reported have only one friend (19.5%). In the bivariate analysis, a significantly lower proportion of individuals reporting social isolation was observed among adolescents who referred higher enrollment in Physical Education classes. After adjustment for confounding variables, binary logistic regression showed that attending Physical Education classes was identified as a protective factor in relation to the indicator of social isolation ‘having few friends,’ but only for girls.

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**PALAVRAS-CHAVE**

Isolamento social;  
Amigos;  
Atividade física;  
Educação física;  
Adolescente

**Conclusions:** It was concluded that participation in Physical Education classes is associated with reduced social isolation among female adolescents.

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## Associação entre prática de atividades físicas, participação nas aulas de Educação Física e isolamento social em adolescentes

### Resumo

**Objetivo:** analisar a associação entre a prática de atividades físicas, a participação nas aulas de Educação Física e indicadores de isolamento social em adolescentes.

**Métodos:** Trata-se de um estudo epidemiológico transversal, baseado na análise secundária de dados, a partir de uma amostra representativa de estudantes (14-19 anos) do ensino médio da rede pública estadual ( $n = 4.207$ ). Os dados foram coletados através do questionário *Global School-based Student Health Survey*. As variáveis independentes foram o nível de atividade física e a participação nas aulas de Educação Física, enquanto as variáveis dependentes foram dois indicadores de isolamento social (sentimento de solidão e ter poucos amigos). Na análise estatística, recorreu-se a procedimentos descritivos e inferenciais.

**Resultados:** A maioria dos sujeitos foi classificada como insuficientemente ativa (65,1%) e relatou não participar das aulas de Educação Física (64,9%). Aproximadamente dois em cada dez participantes (15,8%) referiram sentimento de solidão e cerca de um em cada cinco (19,5%) reportaram ter até um amigo. Na análise bivariada, verificou-se uma proporção significativamente inferior de isolamento social entre os adolescentes que participavam das aulas de Educação Física. Na regressão logística binária, após ajustamento de variáveis, verificou-se que a participação nas aulas de Educação Física foi identificada como fator de proteção em relação ao indicador de isolamento social "ter poucos amigos", mas somente entre as moças.

**Conclusões:** Concluiu-se que a participação nas aulas de Educação Física está associada à menor isolamento social em adolescentes do sexo feminino.

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## Introduction

Social isolation is the state in which the individual has little contact with other individuals, has a minimum amount of social contacts, as well as difficulty maintaining these relationships, whose quality is also a problem.<sup>1</sup> Social isolation is particularly seen as a problem of the elderly;<sup>2-5</sup> however, it is also observed that social isolation can negatively affect the lifestyle of adolescents.<sup>6</sup>

A longitudinal study carried out in 2006 with New Zealand children ( $n = 1,037$ ), followed from birth to adulthood, found that exposure to social isolation in young individuals can be a predictor of chronic degenerative diseases in adult life.<sup>7</sup> Moreover, there is evidence in the literature that socially isolated adolescents may adopt health risk behaviors, such as excessive exposure to a sedentary lifestyle and reduced physical activity levels.<sup>8,9</sup> The study conducted by Gonçalves et al.<sup>10</sup> with adolescents indicated that physical activity levels were greater with the increasing frequency of meetings with friends after school.

Physical activity can directly affect social development;<sup>11</sup> however, social isolation is considered one of the main barriers to physical activity among adolescents.<sup>12</sup> Additionally, available studies concurrently indicate that adolescents who are physically active also tend to have active friends.<sup>13-15</sup>

In the international literature, few studies have focused on the association between physical activity analysis and participation in Physical Education classes with social isolation indicators<sup>16,17</sup> and those available were performed in adults; in the national literature, the available data is still scarce.<sup>12</sup>

Despite the existing knowledge gap, it is plausible to admit that physical activity and Physical Education classes can be an opportunity to increase social interaction and reduce social isolation, but this hypothesis needs to be further investigated.

Considering the above, the aim of the study was to analyze the association between the practice of physical activity, participation in Physical Education classes, and social isolation indicators in adolescents.

## Methods

### Design

This was a cross-sectional, epidemiological study, based on the secondary analysis of data from a statewide and school-based survey entitled "Lifestyles and Health Risk Behaviors in High School Students in the State of Pernambuco."

## Target-population and sample

Considering all the administrative regions (federal, state, municipal, and private), students enrolled in public schools represented approximately 80% of the total in the entire state at the time.

The following parameters were used to calculate sample size: population estimated at 353,000 students; confidence interval of 95%; statistical power of 80%; maximum tolerable error of 3%; and, as the extent of the assessed problems in the population under investigation was not precisely known, the estimated prevalence was settled at 50%. The sample calculation allows the statistical tests applied as association measures to detect statistically significant OR values of 1.75 or higher, considering a 95% confidence level. Analyses were limited to high school students from public state schools in Pernambuco ( $n=4,207$ , 14–19 years).

It was sought to ensure that the sample represented the target population, considering their distribution according to geographic region, school shift (daytime and nighttime), and size of the school (small, with fewer than 200 students; medium, with 200–499 students; and large, with 500 or more students). Students attending school in the morning and afternoon were grouped into a single category (daytime students). The regional distribution was observed by the number of schools in each of the 17 Regional Management Departments of Education Secretariat of the State of Pernambuco.

Sample selection was performed using the conglomerate sampling method in two stages, in which the “school” and the “class” represented, respectively, the sample units in the first and second stage. All public state schools that offered regular high school education were eligible for inclusion in the study. In the first stage, the density of the schools in each state micro-region according to school size was used as stratification criterion; thus, more schools were proportionally drawn in the microregions where the density was also higher. In the second stage, the density of classes in the selected schools, per school shift, (daytime and nighttime) was considered a criterion to draw those in which the questionnaires would be applied. All students from drawn classes were asked to participate in the study, regardless of age. After they were applied, the questionnaires answered by students older than 19 and younger than 14 years were excluded.

The study was conducted from April to October 2006. Data collection was performed by a previously trained team, consisting of six graduate students, following a standardized data collection protocol. The questionnaires were applied in the classroom and the subjects were continuously assisted by two supervisors who clarified doubts and assisted the students with completing the information.

## Tool and measurements

The questionnaire used was a translated and adapted version of the Global School-based Student Health Survey, proposed by the World Health Organization (WHO), in collaboration with other entities. The tool was previously tested in two municipal schools in the city of Recife, with a sample of 122 adolescents. Reproducibility indicators (consistency of test-

retest measures) were moderate to high in most items of the tool and the agreement coefficient (kappa) varied from 0.52 to 1.00.<sup>18</sup>

## Study variables

Data on social isolation indicators were obtained through two questions from the “feelings and relationships” module of the tool: “Over the last 12 months, how often did you feel alone?” (Answer options = never, rarely, sometimes, most of the time, and always) and “How many close friends (people you can count on if you need them) do you have?” (Answer options = 0, 1, 2, 3 or more friends). The first indicator of social isolation, called “feeling of loneliness”, was derived from the first question and those participants who reported feeling alone “most of the time or always” were considered exposed to this indicator. The second indicator was “having few friends” and those participants who reported having “none and up to one friend (0–1) were considered as having few friends.

The level of physical activity was determined by the number of days a week on which students reported practicing moderate to vigorous physical activities, for at least 60 min. Students who reported participating in physical activities at least five days in a typical week were classified as physically active, while the others were classified as insufficiently active.<sup>19</sup>

As for participation in Physical Education (PE) classes, subjects were classified into two groups (participants/non-participants); the participants were those who reported participating in at least one PE class per week.<sup>20</sup>

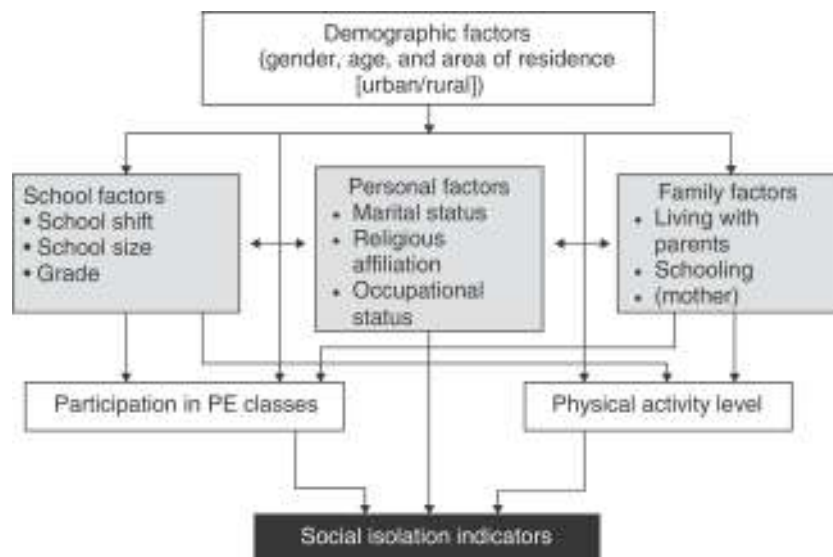
The following variables were considered as potential intervening factors (confounding factors and effect modifiers): gender (boys and girls), age (14–16 years, 17–19 years), area of residence (urban, rural), ethnicity (white, non-white), maternal educational level ( $\leq 8$  years, 9–11 years, and 12 years or more of schooling), school shift (daytime, nighttime), and excess weight (yes, no).

## Data tabulation and analysis

The tabulation procedure was performed using EpiData software (Data Management and basic Statistical Analysis System, version 3.1, Odense, Denmark), using electronic procedures for amplitude control and consistency in data entry. Double entry was used to provide data entry consistency. All identified typos were corrected.

Data analysis was performed using SPSS for Windows (SPSS Inc, 2007, SPSS for Windows, version 16.0. Chicago, USA), using descriptive and inferential statistical procedures. The bivariate analysis used the chi-squared test and the chi-squared test for trend (in case of variables in ordinal scale). This procedure was used to compare the prevalence of social isolation indicators in relation to the category of the independent variables.

Binary logistic regression was used in the multivariate analysis stage, considering as outcomes: (1) feelings of loneliness (most of the time or always); (2) having few friends (0–1 friends). Data were adjusted for ethnicity, age range, maternal educational level, area of residence, school shift, and excess weight, as well as for other factors included



**Figure 1** Theoretical model of association between variables. PE, Physical Education.

in the study as independent variables, stratified by gender. A hierarchical model of association between variables was used to establish the entry order of the variables (Fig. 1). In the final regression model, factors whose  $p$ -value was  $<0.05$  were considered significantly associated.

### Ethical aspects

The study protocol was approved in 2005 by the Ethics Committee on Human Research of Hospital Agamenon Magalhães (Recife, PE, Brazil). All guidelines established in resolutions 196/96 of the National Health Council were observed in the development of this study. The passive parental consent form was obtained from the parents or guardians of students younger than 18 years and directly from the students aged 18 or older; personal data confidentiality was assured.

### Results

A total of 76 schools were visited (approximately 11% of state public schools) in 44 municipalities in the state of Pernambuco, Brazil (approximately 23% of all municipalities). Of the total number of students who were enrolled and present in the classes drawn at the time of the visit for data collection (6,114), 83 refused to participate (1.9% of refusals) and 1,824 were excluded because they were outside the age group.

Therefore, the final sample ( $n=4,207$ ) represents 99.8% of the initially predicted number ( $n=4,217$ ) and had the following demographic characteristics: 59.8% were females, 58% were aged between 17 and 19 years (mean 16.8 years;  $SD=1.4$ ), 74.8% were non-white, and 78.9% lived in urban areas. Table 1 shows other demographic and socioeconomic characteristics of the sample segmented by gender.

Of the total study participants, in relation to physical activity practice, 65.1% (95% CI: 63.7% to 66.58%) of the

adolescents were classified as insufficiently active and 64.9% (95% CI: 63.42% to 66.31%) reported not participating in PE classes.

Regarding the social isolation indicators, of the total participants, 15.8% (95% CI: 14.7 to 16.9) of the adolescents reported feeling lonely and 19.5% (95% CI: 18.3 to 20.7) reported having few friends. The proportion of adolescents, when separated by gender, who reported feelings of loneliness was significantly higher ( $p=0.001$ ) among girls (18.7%; 95% CI: 17.2% to 20.3%) when compared to boys (11.4%; 95% CI: 9.95% to 13.0%). Similarly, the distribution of subjects who reported having few friends was statistically superior ( $p=0.045$ ) among girls (20.5%; 95% CI: 18.9% to 22.1%) when compared to boys (17.9%; 95% CI: 16.1% to 19.8%).

In the bivariate analysis, it was observed that the “feeling of loneliness” was associated with participation in Physical Education classes ( $p=0.012$ ), but seems to be an independent factor from the physical activity level ( $p=0.913$ ) among girls. It was also identified that the “having few friends” indicator was also associated with participation in Physical Education classes for both genders ( $p=0.001$ ) and a higher proportion of adolescents that reported “having few friends” was found among those who did not attend PE classes, as shown in Table 2.

In the binary logistic regression, the crude analysis of variables showed that the “feeling of loneliness” indicator was associated with participation in Physical Education classes ( $p=0.010$ ) among girls. The crude analysis also showed that the “having few friends” indicator was associated with participation in Physical Education classes ( $p<0.05$ ). After adjusting for potential confounders and effect modifiers (intervening variables), it was observed that the “having few friends” outcome remained associated with participation in Physical Education classes ( $p=0.025$ ), but only among girls. Participation in Physical Education classes was identified as a factor associated with a 24% lower chance of having few friends (Table 3).

**Table 1** Description of demographics, socioeconomics, physical activity levels, and participation in Physical Education classes, stratified by gender.

Variable	Boys		Girls		p
	%	n	%	n	
<i>Age range (years)</i>					
14 to 16	35.4	598	46.4	1,165	<0.001 <sup>a</sup>
17 to 19	64.6	1,089	53.6	1,346	
<i>Area of residence</i>					
Urban	78.1	1,311	79.5	1,983	0.289 <sup>a</sup>
Rural	21.9	367	20.5	510	
<i>Ethnicity</i>					
Caucasian (a)	24.8	417	25.5	639	0.649 <sup>a</sup>
Non-caucasian (a)	75.2	1,262	74.5	1,866	
<i>Maternal educational level (years of schooling)</i>					
≤8	69.4	1,086	74.5	1,771	<0.001 <sup>b</sup>
9–11	22.5	352	20.2	480	
≥12	8.1	127	5.3	126	
<i>School shift</i>					
Daytime (morning/afternoon)	53.9	908	60.0	1,506	<0.001 <sup>a</sup>
Nighttime	46.1	778	40.0	1,002	
<i>Excess weight</i>					
Yes	8.9	147	10.4	253	0.148 <sup>a</sup>
No	91.1	1,497	89.6	2,188	
<i>Physical activity level</i>					
Active	42.3	713	29.8	745	<0.001 <sup>a</sup>
Insufficiently active	57.7	971	70.2	1,754	
<i>Participation in Physical Education classes</i>					
Yes	39.5	664	32.2	805	<0.001 <sup>a</sup>
No	60.5	1,018	67.8	1,695	

<sup>a</sup> Chi-squared test for heterogeneity.

<sup>b</sup> Chi-squared test for trend.

## Discussion

The main finding of this study was to identify that participation in Physical Education classes is associated with lower social isolation in female adolescents. Girls who participated in one or more Physical Education classes a week, when compared to those not participating, were less likely to have few friends.

The findings reported in this study should be interpreted in view of some methodological limitations that must be considered. The variables expressing social isolation were obtained from self-reported measures and, thus, are subject to response bias. This limitation was attenuated by using a tool that has been previously tested (pilot) and showed good test-retest consistency indicators.

Another limitation that needs to be emphasized is the time lag between data collection and study completion (approximately eight years). The abovementioned time gap requires that the prevalence reported in this study be interpreted with caution. However, it is emphasized that the primary objective of this investigation was not to describe the prevalence of the factors of interest, but to analyze the association between them. In this sense, it is believed

that any fluctuations in the prevalence measures that might have occurred during this period in no way affect the quality of the data toward supporting the proposed association analysis.

It is also noteworthy that most similar studies have been carried out with the elderly.<sup>1–5</sup> The emphasis on studies assessing the elderly is due to the hypothesis that aging is a process that leads to decreased social ties.<sup>21</sup> In this sense, few studies have been performed to investigate social isolation in adolescents,<sup>6–8,12,22</sup> as this is a more contemporary phenomenon that only now has started to attract the interest of the academic community, due to the potential effect on young individuals' health.

In spite of the limitations, it is important to observe some positive aspects regarding the data used to carry out this study. In this sense, the statewide survey characteristic and the inclusion of adolescents living in both urban and rural areas is emphasized. Another fact worth mentioning is the inclusion of a sample of students enrolled in both daytime and nighttime school shifts.

The school is seen as the ideal environment for the incentive and intervention associated with physical activity, and Physical Education classes seem to have a key role in this

**Table 2** Bivariate analysis of social isolation indicators associated with physical activity level and participation in Physical Education classes.

Group	Independent variables	Categories	%	n	p
<b>Boys</b>	Physical activity level	<b>Outcome: feelings of loneliness (most of the time or always)</b>			
		Insufficiently active	11.9	115	0.567
	Participation in Physical Education classes	Active	10.8	77	
		No	12.0	122	0.348
		Yes	10.4	69	
		<b>Outcome: having few friends (0–1 friends)</b>			
	Physical activity level	Insufficiently active	19.1	185	0.187
		Active	16.4	117	
Participation in Physical Education classes	No	20.3	207	0.001 <sup>a</sup>	
	Yes	14.0	93		
<b>Girls</b>	Physical activity level	<b>Outcome: feelings of loneliness (most of the time or always)</b>			
		Insufficiently active	18.7	328	0.913
	Participation in Physical Education classes	Active	18.4	137	
		No	20.1	340	0.012 <sup>a</sup>
		Yes	15.8	127	
		<b>Outcome: having few friends (0–1 friends)</b>			
	Physical activity level	Insufficiently active	21.0	368	0.306
		Active	19.1	142	
Participation in Physical Education classes	No	22.0	373	0.006 <sup>a</sup>	
	Yes	17.2	138		

<sup>a</sup>  $p < 0.05$ .

**Table 3** Logistic regression analysis to identify factors associated with social isolation indicators with physical activity level and participation in Physical Education classes.

Group	Independent variables	Categories	Crude OR	p	Adjusted OR <sup>a</sup>	p
<b>Boys</b> (n = 1,687)	Physical activity level <sup>b</sup>	<b>Outcome: feelings of loneliness (most of the time or always)</b>				
		Insufficiently active	1		1	
	Participation in Physical Education classes <sup>c</sup>	Active	1.11 (0.81–1.50)	0.515	0.87 (0.63–1.21)	0.411
		No	1		1	
		Yes	0.85 (0.62–1.16)	0.310	0.80 (0.57–1.13)	0.212
		<b>Outcome: having few friends (0–1 friends)</b>				
	Physical activity level <sup>b</sup>	Insufficiently active	1		1	
		Active	0.84 (0.65–1.08)	0.167	0.85 (0.64–1.11)	0.237
Participation in Physical Education classes <sup>c</sup>	No	1		1		
	Yes	0.64 (0.49–0.83)	0.001	0.75 (0.56–1.01)	0.055	
<b>Girls</b> (n = 2,511)	Physical activity level <sup>b</sup>	<b>Outcome: feelings of loneliness (most of the time or always)</b>				
		Insufficiently active	1		1	
	Participation in Physical Education classes <sup>c</sup>	Active	1.02 (0.82–1.27)	0.868	0.99 (0.78–1.25)	0.918
		No	1		1	
		Yes	0.75 (0.60–0.93)	0.010	0.80 (0.62–1.02)	0.077
		<b>Outcome: having few friends (0–1 friends)</b>				
	Physical activity level <sup>b</sup>	Insufficiently active	1		1	
		Active	0.89 (0.71–1.10)	0.281	0.91 (0.72–1.14)	0.414
Participation in Physical Education classes <sup>c</sup>	No	1		1		
	Yes	0.73 (0.59–0.91)	0.005	0.76 (0.60–0.97)	0.025 <sup>d</sup>	

<sup>a</sup> Adjusted for ethnicity, age, maternal education, area of residence, school shift, and excess weight.

<sup>b</sup> Also adjusted for physical activity level.

<sup>c</sup> Also adjusted for participation in Physical Education classes.

<sup>d</sup>  $p < 0.05$ .

scenario. Although they spend much of their daily time at school,<sup>23,24</sup> studies indicate that most adolescents do not participate in PE classes.<sup>20,25,26</sup> One possible explanation for this low level of participation may be the dissatisfaction related to the activities offered in class and/or students' lack of interest in relation to the contents that are taught.<sup>23</sup>

Regarding the association between participation in PE classes and social isolation indicators, there are few similar studies whose results can be compared to those reported in this study. What is the mechanism that would explain the lower chance of having few friends among adolescents that reported participating in PE classes? Although the possibility of reverse causality bias cannot be ruled out, one explanation for this finding may lie in the fact that the classes constitute an opportunity for social interaction and formation of friendship ties. Another potential explanation was shown in the study by Marzineck<sup>27</sup> with adolescents from the third year of elementary school and high school, which showed that the main motivation for participating in Physical Education classes reported by the adolescents was that it was a time to "be with friends."

Santos et al.<sup>12</sup> observed that among participants selected from Physical Education classes, social isolation was one of the main reported factors for not engaging in physical activities. In a longitudinal study carried out in Michigan (United States), with 900 high school students, it was observed that those who were involved with sports practices – a typical and quite frequent content of PE classes – showed lower levels of social isolation,<sup>28</sup> consistent with the findings reported in this study.

It is also emphasized that, in the present investigation, physical activity practice was not identified as a factor associated with social isolation indicators, a finding that differs from the results reported in some studies. For instance, Sallis et al.<sup>29</sup> indicated the existence of a strong association between physical activity and friends' social support. This evidence was confirmed in the longitudinal study carried out with adolescents in Pelotas, which showed there is an inverse association between physical inactivity prevalence and the number of days a week when the adolescents meet friends.<sup>10</sup>

In adolescents, social isolation is associated with internet overuse,<sup>8</sup> body dissatisfaction due to overweight or obesity,<sup>22</sup> and few opportunities for social interaction.<sup>6</sup> Therefore, it is not implausible that greater participation in Physical Education classes and more physical activity practice can reduce social isolation. However, the findings reported in this study only partially support this hypothesis.

It is necessary that the practice of physical activity within the school environment be considered an important mechanism for this specific population and an inseparable part of the overall educational process, as the effective participation of adolescents in Physical Education classes allow them to decrease exposure to health risk behaviors<sup>30</sup> and attenuates social isolation at this phase of life.

The present study concluded that participation in Physical Education classes was identified as a protective factor for social isolation (having few friends) among girls. Regardless of gender, the level of significance and the amplitude the confidence intervals of the association measures suggest that participation in Physical Education classes seems to be a factor associated with social isolation indicators among

adolescents. Considering the possibility of bias inherent to cross-sectional studies, a cause-and-effect association cannot be inferred, which is why it is believed that prospective studies should seek to confirm whether participation in Physical Education classes is effective in reducing social isolation.

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## Conflicts of interest

The authors declare no conflicts of interest.

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