



Factors associated with inadequate physical or sports activity during Physical Education classes among Brazilian adolescents

Factores asociados a la práctica inadecuada de actividad física o deportiva en las clases de Educación Física entre adolescentes brasileños

Authors

Cleidison Machado Santana¹
Rodrigo Sudatti Delevatti¹
Eurides Lima de Paula²
Julio Cesar da Silva Bispo¹
Jean de Souza dos Santos¹
Iago Bruno de Souza¹
Luiz Guilherme Antonacci
Guglielmo¹

¹ Federal University of Santa Catarina (Brazil)

² University of the State of Bahia (Brazil)

Corresponding author:
Cleidison Machado Santana
cleidison.santana@enova.
educacao.ba.gov.br

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Abstract

Introduction: School Physical Education classes constitute a strategic environment for promoting physical activity, sports, and health.

Objective: To analyze the factors associated with inadequate physical activity or sports practice in Physical Education classes among Brazilian adolescents.

Methodology: Cross-sectional study, in which the information that characterized and composed the variables was obtained from the educational database of the National School Health Survey. The sample consisted of 95,126 adolescents, aged 13 to 17 years, from public and private schools in all regions of Brazil. The data were analyzed using descriptive statistics and binary logistic regression, with a significance level of 0.05. The analyses were performed using Jamovi® software for Windows, version 2.6.

Results: Female adolescents (OR = 2.70; 95%CI = 2.43; 3.00), older adolescents (OR = 1.29; 95%CI = 1.18; 1.42), classified as non-white (OR = 1.24; 95%CI = 1.12; 1.36), with low levels of physical activity outside of school (OR = 2.02; 95%CI = 1.81; 2.26), cigarette users (OR = 1.17; 95%CI = 1.05; 1.30), alcohol users (OR = 0.75; 95%CI = 0.67; 0.83), those who reported a lack of close friends (OR = 1.30; 95%CI = 1.02; 1.65) and reported miscellaneous concerns (OR = 0.77; 95%CI = 0.70; 0.85), had statistically significant associations with inadequate physical activity in Physical Education or sports classes at school.

Conclusions: It is concluded that sociodemographic, lifestyle, behavioral, and psychosocial factors were associated with inadequate physical or sporting activity during Physical Education classes.

Keywords

Adolescents; mental health; physical activity; physical education; risk behaviors.

Resumen

Introducción: Las clases de Educación Física escolar constituyen un entorno estratégico para promover la actividad física, el deporte y la salud.

Objetivo: Analizar los factores asociados a la práctica inadecuada de actividad física o deporte en las clases de Educación Física entre adolescentes brasileños.

Metodología: Estudio transversal, cuya información para caracterizar y componer las variables se obtuvo de la base de datos educativa de la Encuesta Nacional de Salud Escolar. La muestra estuvo compuesta por 95,126 adolescentes de 13 a 17 años, provenientes de escuelas públicas y privadas de todas las regiones de Brasil. Los datos se analizaron mediante estadística descriptiva y regresión logística binaria, con un nivel de significancia de 0,05. Los análisis se realizaron con el software Jamovi® para Windows, versión 2.6.

Resultados: Adolescentes femeninas (OR = 2.70; IC 95% = 2.43; 3.00), adolescentes mayores (OR = 1.29; IC 95% = 1.18; 1.42), clasificados como no blancos (OR = 1.24; IC 95% = 1.12; 1.36), con bajos niveles de actividad física fuera de la escuela (OR = 2.02; IC 95% = 1.81; 2.26), usuarios de cigarrillos (OR = 1.17; IC 95% = 1.05; 1.30), usuarios de alcohol (OR = 0.75; IC 95% = 0.67; 0.83), aquellos que informaron falta de amigos cercanos (OR = 1.30; IC 95% = 1.02; 1.65) e informaron preocupaciones diversas (OR = 0.77; IC 95% = 0.70; 0.85) mostraron asociaciones estadísticamente significativas con la actividad física insuficiente en las clases de Educación Física o deportes en la escuela.

Conclusiones: Se concluye que los factores sociodemográficos, relacionados con el estilo de vida, conductuales y psicosociales se asociaron con una actividad física o deportiva insuficiente durante las clases de Educación Física.

Palabras clave

Adolescentes; salud mental; actividad física; educación física; conductas de riesgo.

Introduction

Adolescence is a critical stage of human development, characterized by profound biological, cognitive, emotional, and social changes that contribute to both the emergence and the consolidation of behaviors that can affect health throughout life (Patton et al., 2016; Sawyer et al., 2018). During this period, there is a gradual increase in autonomy in decision-making, accompanied by greater exposure to risky behaviors and potentially dangerous experiences, such as the use of illicit substances (Steinberg, 2008; Crone & Dahl, 2012). Evidence suggests that these behaviors have significant impacts, with alcohol and drug use accounting for a considerable number of deaths among young people, which highlights the magnitude of the problem on a global scale (Li, J. et al., 2025).

At the same time, there is a high prevalence of physical inactivity in this population. It is estimated that approximately 81% of individuals aged 11 to 17 do not meet the minimum recommendations for physical activity (Guthold et al., 2020; WHO, 2020), while about three-quarters of school time is spent in sedentary behavior (Contardo Ayala et al., 2024). Furthermore, mental health disorders, especially depression and anxiety, have intensified in this age group (Erskine et al., 2015; Kielsing et al., 2011). It is estimated that, worldwide, one in seven people (14%) between the ages of 10 and 19 has mental health issues, with adolescence being the stage of life most vulnerable to situations that can affect and exacerbate these issues (Campos et al., 2014; Machado Santana, 2024; WHO, 2022).

In this context, physical inactivity stands out as one of the main modifiable risk factors for chronic noncommunicable diseases, in addition to having significant economic impacts on a global scale (Ding et al., 2016; Kohl et al., 2012). In view of this, international organizations such as the Lancet Commission and the World Health Organization (WHO) emphasize that investments in adolescent health yield immediate benefits, have positive repercussions in adulthood, and produce intergenerational impacts (Patton et al., 2016; WHO, 2023).

The school, through Physical Education classes, constitutes a strategic environment for the promotion of physical and sporting activities and the increase of social interaction (Bernate & Fonseca, 2025; Simões et al., 2023). Evidence suggests that adolescents who regularly participate in these classes are more likely to achieve adequate levels of physical activity (Uddin et al., 2020). However, the effectiveness of this curricular component is often limited by low levels of active engagement and insufficient moderate-to-vigorous physical activity during classes (Hollis et al., 2016; Mayorga-Vega et al., 2018). In addition, barriers related to infrastructure, pedagogical organization, and individual and contextual factors may further reduce students' participation in Physical Education classes (da Silva et al., 2022; van Sluijs et al., 2021). This situation highlights the need to comprehensively understand the factors associated with inadequate physical or sporting activity during Physical Education classes.

In Brazil, the National Survey of School Health (PeNSE) has played a key role in monitoring risk and protective behaviors among adolescents (Brasil, 2021; Malta et al., 2024; Oliveira et al., 2017). However, studies that use this database still have significant limitations, as they analyze Physical Education classes based on indirect indicators, such as attendance or participation in weekly classes, without considering the actual time spent on physical activity during each class (Machado Santana, 2024; Santana et al., 2023; Simões et al., 2023). Examining this aspect is particularly important, given that international guidelines recommend that at least 50% of Physical Education class time should be devoted to moderate- to vigorous-intensity physical activity (CDC, 2010; SHAPE America, 2015; AHA et al., 2016). Accordingly, the actual duration of physical activity performed during Physical Education classes provides a relevant indicator of students' adherence to these recommendations. Despite its relevance, few studies have examined inadequate physical or sporting activity during Physical Education classes based on the actual duration of physical activity performed during class, particularly regarding the factors associated with this behavior. Furthermore, although the literature points to complex relationships between physical activity, risk behaviors, and mental health indicators, these interactions remain underexplored in the school setting (de Victo et al., 2024; El Kazdough et al., 2018; Kwan et al., 2014).

Therefore, the aim of this study was to analyze the factors associated with inadequate physical or sporting activity during Physical Education classes among Brazilian adolescents, taking into account sociodemographic, lifestyle, and behavioral variables, as well as mental health indicators, based on data from the PeNSE. We hypothesized that sociodemographic, lifestyle, behavioral, and mental health

factors would be significantly associated with inadequate physical or sporting activity during Physical Education classes.

Method

Study design

This study employed a cross-sectional design, based on an analysis of data from the fourth edition of PeNSE, whose microdata have been publicly available since 2022 (Brasil, 2022). The PeNSE was conducted by the Brazilian Institute of Geography and Statistics (IBGE) in partnership with the Brazilian Ministries of Health and Education. The study was approved by the National Research Ethics Commission (CONEP) under opinion No. 3,249,268. Its main results are published in official reports, which are available for consultation even before the microdata are released (Brasil, 2021).

The PeNSE sample was designed to estimate representative population proportions and prevalences among students enrolled in public and private schools across all regions of Brazil. The sampling plan followed a two-stage clustering procedure: in the first stage, schools were selected; in the second, classes of enrolled students were randomly selected. This process ensured the sample's national representativeness, in accordance with the technical parameters defined by the IBGE (Brasil, 2021).

The data collection instrument used by IBGE was a self-explanatory questionnaire, answered by students on a mobile data collection device, in the form of a smartphone. The final version of the questionnaire was developed based on important international research focused on school health surveillance, such as: the Global School-Based Student Health Survey, the Health Behaviour in School-Aged Children, and the Youth Risk Behavior Surveillance System, whose instruments demonstrate adequate validity and reliability for the school context (Malta et al., 2024; Oliveira et al., 2017).

All editions of PeNSE have undergone successive stages of questionnaire design and refinement. In the most recent edition, the instrument was tested in two phases during the second half of 2018, with the aim of assessing response time and students' understanding of the questions, under the supervision of the Health Surveillance Secretariat of the Brazilian Ministry of Health. Data collection was conducted between April and September 2019 by properly trained IBGE technicians, covering 1,288 Brazilian municipalities. Complete information on the sampling design, methodological procedures, and instruments used is described in the study's technical report (Brasil, 2021).

Participants

The study included adolescents enrolled in and regularly attending school during the final years of Middle School (7th to 9th grade) and throughout High School (1st to 3rd year), across morning, afternoon, and evening shifts in public and private schools in Brazil. According to the methodological criteria adopted by the IBGE, schools with fewer than 20 enrolled students were excluded. The total PeNSE 2019 sample consisted of 189,857 students, of whom 159,245 had regular school attendance, constituting the validated database for analysis (Brasil, 2021). For this study, only adolescents aged 13 to 17 were included, totaling 124,898 participants, which corresponded to 78.45% of the validated sample. The age criterion adopted was based on the legal definition of adolescence in Brazil, and individuals classified as children or adults were excluded (Brasil, 1990). Among the eligible adolescents, 95,126 provided valid responses to the study's dependent variable and constituted the final analytical sample. Adolescents with missing or invalid responses for the dependent variable were excluded from the analyses, as the study aimed to investigate factors associated with this outcome. Analyses were conducted using available-case data; therefore, the total number of observations may vary across independent variables due to missing or incomplete responses.

Procedure and instruments

The dependent variable of the study was the time spent on physical activities or sports during Physical Education classes. To this end, the following question from the PeNSE questionnaire was used: "How much time per day did you dedicate to physical activities or sports during physical education classes at school? Do not include time spent on theoretical activities in the classroom" (question code: B03005b). The responses were dichotomized into two categories: adequate physical activity or sports (≥ 30

minutes per day) and inadequate physical activity or sports (< 30 minutes per day) per class.

The 30-minute threshold was operationally defined based on international recommendations that at least 50% of Physical Education class time should be devoted to moderate-to-vigorous physical activity (CDC, 2010; SHAPE America, 2015; AHA et al., 2016). Considering that a standard Physical Education class in Brazilian schools lasts approximately 50 minutes and that previous Brazilian evidence suggests an average of approximately 35 minutes of physical activity during class (Belsky et al., 2003; Guedes & Guedes, 2001), the ≥ 30 -minute cutoff was considered a feasible criterion for classifying adequate participation in the national educational context. Although the PeNSE questionnaire assesses the duration of physical activity or sports performed during Physical Education classes rather than its intensity, the 30-minute cutoff was adopted as an operational proxy consistent with these recommendations.

Despite the fact that Physical Education is required by law in Brazilian schools, there are no uniform regulations defining the minimum number of class hours or the number of required classes, which leads to significant differences among school systems and regions across the country (Brasil, 2023; Coledam et al., 2018). Thus, the categorization of the dependent variable sought to follow international guidelines regarding the actual duration of physical activity that should take place in Physical Education classes, while also taking into account the diversity of the country's educational context.

Among the independent variables, Model 1 included sociodemographic indicators: sex, age group, and ethnicity/skin color. The "sex" variable was defined according to the biological criteria used by the IBGE. Model 2 included lifestyle and body image indicators: physical activity outside of school, sedentary behavior, and body satisfaction. Both the sociodemographic variables and the lifestyle indicators were dichotomized according to criteria widely used in previous studies with PeNSE data (Gomes et al., 2021; Machado Santana, 2024; Santana et al., 2023).

Model 3, which focuses on risky behaviors, included the following variables: cigarette use, alcohol use, and illicit drug use. All were dichotomized based on self-reported frequency in the past 30 days: "none" and "one or more days," consistent with the approach used in previous studies (Freitas & Espinosa, 2024; Machado Santana, 2024).

Finally, Model 4 included mental health indicators. The variable related to social isolation was dichotomized into: "no close friends" and "one or more close friends." The remaining mental health indicators were derived from single-item questions available in the original PeNSE questionnaire. Their response categories were dichotomized according to the original questionnaire structure to preserve comparability with previous studies using the PeNSE database (Antunes et al., 2022; Machado Santana, 2024).

The categorization matrix for the variables used, including the dichotomization criteria and the corresponding questionnaire codes, is presented in Frame 1.

Frame 1. Analytical matrix of questions included in the statistical models of the study

Dependent Variable		
Indicator	Code – Question	Categorized groups
Physical activity or sports in Physical Education classes	B03005b - How much time per day did you do physical activity or play sports during Physical Education classes at school? Do not include the time spent on theoretical activities in the classroom.	1 - Adequate physical activity or sports: 30 to 39 minutes per day; 40 to 49 minutes per day; 50 to 59 minutes per day; 1 hour to 1 hour and 19 minutes per day; 1 hour and 20 minutes or more per day.
		2 - Inadequate physical activity or sports: Did not participate in physical activity in physical education class at school in the last 7 days; Less than 10 minutes per day; 10 to 19 minutes per day; 20 to 29 minutes per day.
Independent variables		
Model 1 – Sociodemographic		
Indicator	Code – Question	Categorized groups
Sex	B01001a - What is your sex?	1 - Male: Man;
		2 - Female: Woman.
Age Group	B01003 - How old are you?	1 - Younger teenagers: 13 to 15 years old;
		2 - Older teenagers: 16 or 17 years old.

Ethnicity	B01002 – What is your color or race?	1 - White: White; 2 - Non-white: Black; Asian; Brown; Indigenous
Model 2 – Lifestyle and body perception indicators		
Indicator	Code – Question	Categorized groups
Physical activity outside of school	B03006b - IN THE LAST 7 DAYS, excluding school physical education classes, on how many days did you do any physical activity?	1 - Below recommended: No days in the last 7 days; 1 day; 2 days. 2 - Within the recommended range: 3 days; 4 days; 5 days; 5 days plus Saturday; 5 days plus Saturday and Sunday.
Sedentary Behavior	B03010b - How many hours a day do you usually spend sitting, watching television, playing video games, using a computer, cell phone, tablet or doing other activities while sitting? (do not count Saturdays, Sundays, holidays or time spent sitting at school).	1 - Acceptable sedentary behavior: Up to 1 hour per day; More than 1 hour up to 2 hours per day; More than 2 hours up to 3 hours a day; More than 3 hours up to 4 hours a day. 2 - Excessive sedentary behavior: More than 4 hours up to 5 hours a day; More than 5 to 6 hours a day; More than 6 hours to 7 hours a day; More than 7 hours to 8 hours a day; More than 8 hours a day.
Body image	B11007 - How do you feel about your body?	1 - Satisfied: Very satisfied; Satisfied; 2 - Dissatisfied: Indifferent; Dissatisfied; Very dissatisfied.
Model 3 – Indicators of risky behavior		
Indicator	Code – Question	Categorized groups
Use of cigarettes	B04003 - IN THE LAST 30 DAYS, how many days did you smoke cigarettes?	1 - No days: No days in the last 30 days. 2 - One or more days: 1 or 2 days; 3 to 5 days; 6 to 9 days; 10 to 19 days; 20 to 29 days; Every day.
Use of alcoholic beverages	B05004a - IN THE LAST 30 DAYS, on how many days did you have at least one glass or one serving of alcohol?	1 - No days: No days in the last 30 days. 2 - One or more days: 1 or 2 days; 3 to 5 days; 6 to 9 days; 10 to 19 days; 20 to 29 days; Every day.
Use of illicit drugs	B06003b - IN THE LAST 30 DAYS, how many days did you use drugs?	1 - No days: No days in the last 30 days. 2 - One or more days: 1 or 2 days; 3 to 5 days; 6 to 9 days; 10 or more days.
Model 4 - Mental Health Indicator		
Indicator	Code – Question	Categorized groups
Having friends	B12003- How many close friends do you have?	1 - No close friends: No friends. 2 - One or more close friends: 1 friend; 2 friends; 3 or more friends.
Various concerns	B12004 - IN THE LAST 30 DAYS, how often have you felt very worried about the ordinary things in your day-to-day life such as school activities, competitions, sports, homework, etc.?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Feelings of sadness	B12005 - IN THE LAST 30 DAYS, how often have you felt sad?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Perceived indifference	B12006 - IN THE LAST 30 DAYS, how often have you felt that no one cares about you?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Feeling of irritation	B12007 - IN THE LAST 30 DAYS, how often have you felt irritable, nervous or moody because of something?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.
Suicidal ideation indicator	B12008 - IN THE LAST 30 DAYS, how often have you felt that life is not worth living?	1 - Never/rarely/sometimes: Never; Rarely; Sometimes. 2 - Most of the time/always: Most of the time; Always.

Data analysis

The analyses were conducted using descriptive statistics and binary logistic regression, with odds ratios and their respective confidence intervals calculated. The analytical model was structured in successive explanatory blocks: Model 1, with sociodemographic variables (gender, age group, and ethnicity); Model 2, with lifestyle and body image indicators (physical activity outside of school, sedentary behavior, and

body image perception), in addition to the statistically significant variables from Model 1; Model 3, composed of variables related to risk behaviors (cigarette use, alcohol use, and illicit drug use), in addition to the significant variables from the previous model; and Model 4, which incorporated mental health indicators (social isolation [having friends], various concerns, self-reported sadness, perceived indifference, feelings of irritation, and an indicator of suicidal ideation), in addition to the significant variables from the previous models. Variables with a p-value <0.05 were retained in the final models. Model fit for each hierarchical model was assessed using deviance, the Akaike Information Criterion (AIC), and McFadden's pseudo- R^2 . In addition, multicollinearity among the independent variables was evaluated using collinearity statistics before fitting the regression models. All analyses were performed using Jamovi software for Windows, version 2.6.

Results

This study includes a sample of 95,126 adolescents, all of whom provided valid responses for the dependent variable. With regard to the dependent variable in this study, 52.80% of the adolescents were classified as engaging in “adequate physical activity or sports during physical education classes” at school. Table 1 describes the general characteristics of the sample, as well as its categorizations, based on the responses obtained through the data collection instrument administered by the IBGE. The other variables selected for possible associations with “inadequate physical or sporting activity during Physical Education classes,” in accordance with the objectives of this study, are presented in Table 1.

Table 1. General characteristics of the sample

Variables considered			Confidence Interval 95%
			Lower limit Upper limit
Sex	n*	%	
Male	47.642	50.20	49.88 50.52
Female	47.262	49.80	49.48 50.12
Age group			
Younger adolescents	64.403	69.81	69.51 70.10
Older adolescents	28.723	30.19	29.90 30.49
Ethnicity			
White	36.603	39.24	38.93 39.56
Non-white	56.674	60.76	60.44 61.07
Physical activity outside of school			
Within the recommended range	21.887	23.04	22.77 23.31
Below recommended	73.110	76.96	76.69 77.23
Sedentary Behavior			
Acceptable sedentary behavior	53.412	56.90	56.59 57.22
Excessive sedentary behavior	40.452	43.10	42.78 43.41
Body image			
Satisfied	59.622	63.26	62.95 63.57
Dissatisfied	34.625	36.74	36.43 37.05
Use of cigarettes			
No days	13.297	71.57	70.92 72.22
One or more days	5.282	28.43	27.78 29.08
Use of alcoholic beverages			
No days	33.809	58.50	58.10 58.91
One or more days	23.981	41.50	41.09 41.90
Use of illicit drugs			
No days	6.670	61.53	60.61 62.45
One or more days	4.170	38.47	37.55 39.39
Teenagers with close friends			
One or more close friends	91.944	96.87	96.52 96.73
No close friends	2.966	3.13	3.27 3.48
Teenagers with worries about everyday things			
Never, rarely, sometimes	41.411	43.70	43.39 44.02
Most of the time, always	53.341	56.30	55.98 56.61
Teenagers with feelings of sadness			
Never, rarely, sometimes	65.451	69.04	68.74 69.33
Most of the time, always	29.357	30.96	30.67 31.26
Teenagers with feelings that nobody cared about them			
Never, rarely, sometimes	67.545	71.27	70.98 71.56
Most of the time, always	27.225	28.73	28.44 29.02
Teenagers irritable, nervous and moody			
Never, rarely, sometimes	59.935	59.02	58.71 59.33

Most of the time, always	38.839	40.98	40.67 41.29
Teenagers with feelings that life is not worth living			
Never, rarely, sometimes	75.746	80.01	79.75 80.26
Most of the time, always	18.929	19.99	19.74 20.25
Dependent variable: Physical or sports activity in Physical Education classes			
Adequate physical activity or sports	50.225	52.80	52.48 53.12
Inadequate physical activity or sports	44.901	47.20	46.88 47.52

*n: Total number.

Table 2 presents the associations between the dependent variable “inadequate physical or sporting activity during Physical Education classes” and the independent variables considered, which were hierarchically included in the analytical models. The interpretation of the results is based on Model 4, which incorporates all adjustments from the previous hierarchical models.

Table 2. Association between independent predictors and “inadequate practice of physical activity or sports in Physical Education classes”

Variables considered/ Reference	Model 1			Model 2			Model 3			Model 4		
	Sociodemographic			Lifestyle and body image indicators			Indicators of risky behavior			Mental health indicators		
	OR*	CI** 95 %	p***	OR	CI 95 %	p	OR	CI 95%	p	OR	CI 95%	p
Sex												
Female	2.97	2.71 3.26	<.001	2.56	2.32 2.82	<.001	2.61	2.37 2.88	<.001	2.70#	2.43 3.00	<.001
Age Group												
Older	1.25	1.14 1.37	<.001	1.23	1.12 1.35	<.001	1.25	1.14 1.38	<.001	1.29#	1.18 1.42	<.001
Ethnicity												
Non-white	1.28	1.17 1.41	<.001	1.28	1.17 1.41	<.001	1.26	1.14 1.38	<.001	1.24#	1.12 1.36	<.001
Physical Activity outside school				2.07	1.86 2.32	<.001	2.06	1.84 2.30	<.001	2.02#	1.81 2.26	<.001
Below recommended												
Sedentary Behavior												
Excessive sedentary behavior				0.99	0.90 1.09	0.823	1.00	0.92 1.10	0.918	1.00	0.91 1.09	0.939
Body Image												
Dissatisfied				1.11	1.01 1.22	0.037	1.11	1.01 1.22	0.038	1.10	0.99 1.22	0.073
Use of cigarettes							1.19	1.07 1.33	0.001	1.17#	1.05 1.30	0.005
One or more days												
Use of alcoholic beverages							0.74	0.66 0.82	<.001	0.75#	0.67 0.83	<.001
One or more days												
Use of illicit drugs							1.07	0.96 1.19	0.203	1.06	0.95 1.18	0.297
One or more days												
Teenagers with close friends										1.30#	1.02 1.65	0.031
No close friends												
Teenagers worried about common everyday things										0.77#	0.70 0.85	<.001
Most of the time, always												
Teenagers with feelings of sadness										1.01	0.89 1.14	0.918
Most of the time, always												
Teenagers with feelings that nobody cared about them										1.07	0.95 1.21	0.235
Most of the time, always												
Teenagers angry, nervous and moody										0.98	0.88 1.09	0.736
Most of the time, always												
Teenagers with feelings that life is not worth living										1.06	0.94 1.20	0.335
Most of the time, always												

*OR: Odds Ratio; **CI: Confidence Interval 95%; ***p: Probability; #: Statistically Significant Difference.

In block 1, "Sociodemographic," included in Model 1, female adolescents (OR = 2.70; 95% CI = 2.43; 3.00), "older" adolescents (OR = 1.29; 95% CI = 1.18; 1.42), and "non-white" adolescents (OR = 1.24; 95% CI = 1.12; 1.36) had higher chances of inadequate physical or sporting activity during Physical Education classes. In block 2, "Lifestyle and body image indicators," included in Model 2, adolescents who engage in "less than the recommended amount of physical activity outside of school" are twice as likely to engage in inadequate physical activity or sports during class (OR = 2.02; 95% CI = 1.81; 2.26). In Block 3, "Indicators of risky behavior," included in Model 3, adolescents who reported having smoked "one or more days" in the past 30 days were 17% more likely to engage in inadequate physical activity compared with those who did not smoke during the same period (OR = 1.17; 95% CI = 1.05; 1.30). On the other hand, those who reported alcohol consumption during the same period showed an inverse association (OR = 0.75; 95% CI = 0.67; 0.83) compared to those who did not consume alcohol. Finally, in Block 4, "Mental health indicators," included in Model 4, adolescents who do not have close friends are 30% more likely to engage in insufficient physical activity compared to those who have "one or more close friends" (OR = 1.30; 95% CI = 1.02; 1.65). However, those who report feeling worried about daily activities "most of the time or always" show an inverse relationship (OR = 0.77; 95% CI = 0.70; 0.85).

Discussion

The aim of this study was to analyze the associations between inadequate physical activity or sports practice in physical education classes and sociodemographic, lifestyle, behavioral and psychosocial factors in Brazilian adolescents. The results show that a higher risk is associated with being female, older age, non-white ethnicity, insufficient physical activity outside of school, cigarette smoking, and a lack of close friends; conversely, an inverse association was observed among adolescents who consumed alcohol and who frequently expressed concerns about daily activities.

Among the sociodemographic variables analyzed, female adolescents have 170% higher odds of inadequate physical or sporting activity during Physical Education classes (OR = 2.70; 95% CI = 2.43; 3.00) when compared to male adolescents. In Brazil, overall, approximately 84% of adolescent girls do not meet the minimum recommended level of physical activity (Salvo et al., 2020), and evidence from Latin American countries indicates that girls are about half as likely to meet these recommendations as boys (da Silva et al., 2022). This disparity is observed in various geographical contexts and has been associated with social norms and gender stereotypes that associate sports with masculine identities, thereby reducing women's motivation and engagement (Aguilar-Farias et al., 2018; Bauman et al., 2012; Telford et al., 2016). In addition, biological factors, such as maturation and differences in body composition, may partially explain participation in higher-intensity physical activities (Pereira et al., 2020), which may contribute to the widening of inequalities in adolescent girls' participation.

The results also indicate that older adolescents are more likely to engage in inadequate physical or sporting activity (OR = 1.29; 95% CI = 1.18; 1.42), suggesting a decline in engagement throughout adolescence. This pattern can be explained by institutional factors, such as differences in class hours and the way classes are conducted, associated with individual changes, including a decline in attitudes toward physical activity and in perceived health (Diamant et al., 2011; Martins et al., 2020). Furthermore, advancing age is associated with an increase in sedentary behaviors, particularly prolonged use of technology, which competes with active participation in class (Dos Santos et al., 2019; Lourenço et al., 2018). Sociocultural factors also contribute to this situation, such as a decline in enjoyment of activities, reduced social support, and gender inequalities (Dos Santos et al., 2019).

With regard to race/ethnicity, students categorized as non-white are more likely to engage in inadequate physical or sporting activity (OR = 1.24; 95% CI = 1.12; 1.36). The amount of time actually spent on physical or sporting activities during Physical Education classes may be influenced by a "movement stratification" structure, in which "non-white" youth - especially Black students and those attending public schools - face greater barriers to accessing safe and structured spaces for physical activity, which may contribute to fewer weekly hours of physical activity in these classes (Martins et al., 2023). This situation may be exacerbated by the uneven distribution of sports infrastructure across Brazil. A study using data from PeNSE suggests that the prevalence of obesity-promoting behaviors and physical inactivity is significantly higher among black and brown adolescents, reflecting the lack of sports facilities in schools located in areas of greater social vulnerability which are attended, for the

most part, by black and brown students (da Silva et al., 2022a). Furthermore, public policies aimed at promoting school health have not been effective in counteracting the structural racism that may shape opportunities for physical activity in Brazil (Soares et al., 2023).

With regard to lifestyle indicators, adolescents who engage in less than the recommended amount of physical activity outside of school are twice as likely to engage in inadequate physical or sporting activity during Physical Education classes (OR = 2.02; 95% CI = 1.81; 2.26). This result is consistent with another study suggesting a positive association between greater engagement in Physical Education and higher levels of outside school physical activity, indicating that active behaviors tend to coexist across different domains (Dias et al., 2025; Silva & Menezes, 2016; Uddin et al., 2020). In this regard, lower levels of extracurricular activity appear to reflect a broader pattern of inactivity, associated with lower engagement in class and more sedentary behavioral patterns (Dias et al., 2025; Li, H. et al., 2025). However, the literature does not support a direct causal relationship, and there is evidence that higher attendance in class may coexist with sedentary behaviors during leisure time (Silva et al., 2023).

In terms of indicators of health-risk behaviors, adolescents who reported smoking had an increased likelihood of inadequate physical or sporting activity during Physical Education classes (OR = 1.17; 95% CI = 1.05; 1.30). On the other hand, adolescents who reported drinking alcohol were more likely to meet recommended levels of physical activity (OR = 0.75; 95% CI = 0.67; 0.83).

In general, a study examining adolescents from various South American countries concludes that those who consume alcohol are more likely to be physically inactive, while the association between smoking and physical activity is not consistent in the scientific literature (Ywgne et al., 2025). In addition, it is well known that alcohol and cigarette use during adolescence is associated with various risky behaviors, such as unprotected sex, drug use, aggressive behavior, and suicidal ideation (Farnia et al., 2024). A Brazilian study identifies a negative association between smoking and overall physical activity, and a positive association between alcohol consumption and total physical activity among adolescents, consistent with the findings of this study (da Costa et al., 2021). The literature also indicates that harmful behaviors, such as smoking and alcohol consumption, are risk factors associated with lower participation in school physical activities (Dumith et al., 2012; Peixoto et al., 2021; Tassitano et al., 2014). In contrast, active participation in Physical Education classes and sports may be linked to a broader social network and a desire to belong to groups, in which alcohol often acts as a social lubricant in post-activity social settings (Motta et al., 2025). Furthermore, regular physical activity, combined with healthy behaviors, a balanced diet, and effective stress management, is consistently associated with lower rates of alcohol, tobacco, and drug use, as well as better indicators of physical and mental well-being (Lerma Castaño et al., 2021). Additionally, a study suggests that participation in physical and recreational activities is associated with a lower likelihood of initiating or continuing the use of harmful substances, highlighting the preventive potential of active lifestyles from the earliest stages of life (Dias et al., 2025).

Finally, regarding mental health indicators, adolescents who do not have close friends are more likely to present inadequate physical or sporting activity during Physical Education classes (OR = 1.30; 95% CI = 1.02; 1.65), while those who reported feeling worried about their daily activities “most of the time or always” have lower odds (OR = 0.77; 95% CI = 0.70; 0.85). A Brazilian study suggests that non-participation in Physical Education classes is associated with poorer mental health outcomes, indicating that factors such as social isolation and everyday stressors simultaneously influence psychological well-being and participation in school physical activities (Espírito Santo et al., 2025; Tonaco et al., 2026). Another study found that physically inactive adolescents and those who do not participate in Physical Education classes are more likely to feel lonely (Pinto et al., 2021). Loneliness is a contributing factor that is becoming increasingly common in the daily lives of adolescents, with harmful effects on both physical and mental health (Antunes et al., 2022). Having friends provides emotional support, motivation, and opportunities for shared participation, which may facilitate the maintenance of physical activity or participation in sports (Matias et al., 2023). In this context, the lack of close friends may reduce social support and opportunities for group participation, which can undermine motivation and class attendance, and is also associated with a higher incidence of common mental health disorders (Espírito Santo et al., 2025; Matias et al., 2023).

However, the inverse association between concern about daily activities and inadequate physical activity suggests a more complex relationship. Adolescents who are more concerned may exhibit greater

self-regulation and engagement with the school environment - including participation in Physical Education classes - or use these activities as a strategy for coping with stress (Santos Jesus et al., 2025; Tonaco et al., 2026). In addition, contextual factors such as academic demands, interpersonal relationships, and gender are recognized as significant determinants of mental health in adolescents and may indirectly influence their participation in physical activity or sports (Santos Jesus et al., 2025; Tonaco et al., 2026; Yáñez-Sepúlveda et al., 2025).

Although several associations identified in this study were statistically significant, their magnitude should be interpreted with caution. Given the large sample size of the present study, relatively modest effect sizes may have achieved statistical significance because of the high statistical power. Therefore, the observed odds ratios should be interpreted in light of both their statistical significance and their practical relevance to adolescent health and school-based Physical Education.

This study has limitations, such as the use of self-reported data, which are subject to recall bias, social desirability bias, and possible misinterpretations of the questionnaire. In addition, the dependent variable was obtained from a single self-reported questionnaire item, and no objective measure, such as accelerometry, was available to validate the reported duration of physical activity during Physical Education classes. The cross-sectional design does not allow the establishment of causal relationships. Furthermore, only adolescents with valid responses to the dependent variable were included in the analytical sample, which may have introduced some degree of selection bias related to missing data. It is also noted that the sample included only adolescents enrolled in and attending school, which limits the generalizability of the findings to the overall adolescent population, as potentially more vulnerable individuals who were out of school were not represented. Furthermore, the questionnaire did not assess the use of e-cigarettes, a currently relevant variable. A key strength of this study is the large sample size and the national representativeness of the PeNSE survey, which enhance the robustness and external validity of the findings. Future studies should adopt longitudinal designs to improve the understanding of factors associated with inadequate physical or sporting activity during Physical Education classes, while also considering the quality and intensity of the physical activity performed.

Conclusions

The results of this study indicated that inadequate physical or sporting activity during Physical Education classes among Brazilian adolescents was associated with all the sociodemographic factors analyzed in this study, as well as with lifestyle, behavioral, and psychosocial factors. A higher probability of this outcome was observed among female adolescents, older adolescents, non-white adolescents, those who were physically inactive outside of school, and cigarette users, as well as among those without close friends. On the other hand, alcohol consumption and frequent preoccupation with daily activities were inversely associated with inadequate participation. These findings expanded our understanding of the factors related to effective engagement in physical activity during Physical Education or sports classes in the Brazilian school context. It was recommended that future research employ longitudinal designs and explore other factors, such as the intensity and quality of the activities performed. Finally, the identified associations may help inform future school-based approaches aimed at increasing active engagement in physical or sporting activities during Physical Education classes, particularly among groups with a higher probability of inadequate engagement identified in this study.

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Authors and translators' details:

Cleidison Machado Santana	cleidison.santana@enova.educacao.ba.gov.br	Author & Translator
Rodrigo Sudatti Delevatti	rodrigo.delevatti@ufsc.br	Author
Eurides Lima de Paula	eurideslima262@gmail.com	Author
Julio Cesar da Silva Bispo	juliobispo7777@gmail.com	Author
Jean de Souza dos Santos	jean.souza.com@gmail.com	Author
Iago Bruno de Souza	000.bruno1996@gmail.com	Author
Luiz Guilherme Antonacci Guglielmo	luiz.guilherme@ufsc.br	Author