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Prevalence of physical activity and association with sociodemographic factors among teachers in Macapá-Amapá, Brazil

Prevalência de atividade física e associação com fatores sociodemográficos em docentes de Macapá-Amapá, Brasil

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ABSTRACT

Objective: To analyze the prevalence of sufficient levels of leisure physical activity and active transportation, and its association with sociodemographic factors among teachers in the basic and higher education systems in Macapá, Amapá, Brazil. Methods: This was a cross-sectional study conducted with 968 teachers (mean age 43 years, 41% men). Data were collected using a questionnaire on sociodemographic aspects, leisure-time physical activity, and commuting (International Physical Activity Questionnaire - long version). Descriptive, bivariate, and multivariate analyses were performed using Poisson regression. Results: The prevalence of sufficient physical activity (>=150 min/week) in leisure and commuting was 57.2% (95% CI: 54.10 – 60.35) and 16.32% (95% CI: 13.99 – 8.65), respectively. Men demonstrated greater physical activity during leisure time and commuting compared to women. Teachers without children who lived in condominiums were more active during leisure time, while having three or more children was associated with lower levels of physical activity. Teachers with doctorates were more active in all domains. A positive association was found between teachers who identified themselves as Asian and greater physical activity during commuting. Teachers aged 60 years or older demonstrated greater physical activity during commuting, although this difference was not statistically significant. Similarly, income, teaching level (basic or higher education), marital status, and participation in ongoing graduate studies also showed no statistically significant differences. Conclusion: Teachers showed satisfactory levels of physical activity, but their commuting scores remained low. It was concluded that teachers were more active during leisure time than when commuting, with a higher prevalence among men, those without children, and those with doctorates. The findings underscore the importance of policies that promote physical activity among teachers.

Keywords: Teachers; Physical activity; Sociodemographic factors.

RESUMO

Objetivo: Analisar a prevalência de níveis de atividade física de lazer e deslocamento ativo e sua associação com fatores sociodemográficos entre docentes da rede básica e superior de ensino de Macapá, Amapá, Brasil. Métodos: Trata-se de estudo transversal, conduzido com 968 docentes (média idade 43 anos e 41% homens). Os dados foram coletados com questionário sobre aspectos sociodemográficos, atividade física de lazer e deslocamento (Questionário Internacional de Atividade Física, versão longa). Foram realizadas análises descritivas, bivariadas e multivariável pela regressão de Poisson. Resultados: A prevalência de atividade física suficiente (>=150min/semana) no lazer e deslocamento foi de 57,2% (IC 95%: 54,10 – 60,35) e 16,3% (IC 95%: 13,99 – 18,65), respectivamente. Homens demonstraram maior atividade física de lazer e deslocamento comparado às mulheres. Docentes sem filhos e que moram em condomínios foram mais ativos no lazer, enquanto ter três ou mais filhos esteve associado a níveis mais baixos de atividade física. Professores com doutorado foram mais ativos em todos os domínios. Houve associação positiva entre professores que se declararam de raça/cor amarela e maior atividade física no deslocamento. Docentes com 60 anos ou mais apresentaram maior atividade física no deslocamento, porém, sem significância estatística, assim como renda, esfera de ensino (rede básica ou superior), estado civil e pós-graduação em curso Docentes apresentaram níveis de atividade física satisfatório, porém, no deslocamento mantiveram-se com escores baixos. Conclusão: Os docentes foram mais ativos no lazer do que no deslocamento, com maior prevalência entre homens, sem filhos e doutores. Os achados reforçam a necessidade de políticas que incentivem a atividade física na categoria docente.

Palavras-chave: *Professores; Atividade física; Fatores sociodemográficos.*

Introduction

Physical activity (PA) is essential for promoting health and quality of life. Engaging in PA can prevent and treat chronic diseases such as hypertension, type 2

diabetes, and obesity[1]. Furthermore, it contributes to mental health by reducing symptoms of stress, anxiety, and depression[2]. In Brazil, there are approximately 178,000 schools and 112 public universities, including around 2.4 million teachers. Teaching is characterized by high physical and mental strain, lack of resources and insufficient training, inadequate working environments, and low remuneration.

These factors hinder the adoption of healthy habits, even among teachers who recognize the health benefits of PA[3]. The demands of the educational system impose high workloads on teachers, which can negatively affect their health[4,5]. On the other hand, lifestyle habits can directly influence teachers' performance and quality of work[6-7].

Despite its relevance, the level of PA among teachers has been little investigated. Few studies have examined PA among higher education faculty, and those that did reported prevalence ranging from 11.9% to 47.9%[8-12]. Studies exploring the association between commuting-related PA and sociodemographic factors are also scarce[13,14]. Public school teachers show high rates of work-related morbidity, including musculoskeletal disorders, chronic fatigue, anxiety, depression, and burnout[15]. It has been shown that PA can improve teaching performance and occupational health by enhancing concentration, memory, motivation, and cognition[16].

According to the World Health Organization[17], all adults should engage in at least 150 minutes of moderate-intensity PA per week, 75 minutes of vigorous-intensity PA, or an equivalent combination. PA may occur across different domains: occupational, domestic, leisure, and commuting[18]. Nonetheless, there are gaps in the literature, particularly in the Northern region of Brazil. Studies addressing demographic profile, living and working conditions are scarce among teachers from both basic and higher public education. Demographic, socioeconomic, and family characteristics are seldom studied and are often analyzed without taken into account confounding factors and the different domains of PA.

Investigating leisure and commuting PA domains is especially important, as they are more modifiable within teachers' daily routines, because teaching work may reduce opportunities for occupational or domestic PA. Analyzing domains separately allows for the identification of specific barriers[19]: leisure depends on motivation and free time, while commuting is also related to infrastructure and the environment.

In Northern Brazil, contextual factors may further limit PA practice. In Macapá, the hot and humid climate, combined with frequent rainfall, hinders outdoor activities. Moreover, precarious urban infrastructure — marked by the absence of sidewalks and bike paths, the presence of rivers and canals interrupting routes, and forest areas within the urban perimeter — compromises mobility and safety.

Comparing basic and higher education teachers is justified by the distinct institutional and organizational contexts in which they work. Basic education teachers handle multiple classes, heavy workloads, and employment in more than one school. In contrast, higher education faculty benefit from greater schedule flexibility and institutional support for health, which favors active behaviors[20].

Given the scarcity of studies in the Amazon region on the relationship between PA and sociodemographic factors, this study aimed to analyze the prevalence of basic and higher education teachers meeting PA recommendations in the leisure and commuting domains, and its association with sociodemographic factors.

Methods

This was a cross-sectional, school- and university-based study with a quantitative approach, conducted between August and December 2024, in Macapá (population: 440,000), the capital of Amapá, located in the Amazon region, Northern Brazil.

The target population consisted of 4,968 teachers from state public schools and 582 faculty members from the Federal University of Amapá based on the main campus. Inclusion criteria for basic education teachers were being permanent staff and currently teaching in classrooms at any level: elementary, high school, or Youth and Adult Education. Exclusion criteria included teachers working exclusively in administrative positions (such as principals, supervisors, or coordinators) or holding temporary contracts. University faculty had to be permanent staff and engaged in teaching, research, or extension at undergraduate or graduate levels, regardless of workload. Those on medical leave that prevented participation were not eligible.

A total of 28 state schools were selected according to the following criteria: (a) offering elementary education (6th to 9th grade), high school (1st to 3rd year), and/or Youth and Adult Education; (b) enrolling between 600 and 2,000 students; (c) employing at least 20 teachers with regular workloads of up to 24 teaching hours per week; and (d) not being exclusive institutions for special education, technical training,

music, or language instruction. Schools also had to be located within a 30 km radius from the urban center, encompassing most of the urban and rural areas. These criteria ensured logistical feasibility, minimum standardization of the school environment, and representativeness of the urban teaching context in Macapá. The aim was to allow comparability among schools and to represent medium-sized institutions, which predominate in both urban and rural state networks of Macapá. Schools with more than 2,000 students were excluded because of atypical characteristics, such as greater administrative complexity and higher concentration of temporary teachers.

Sampling was stratified by urban and rural schools, and for university faculty, by academic departments. After formal authorization from the school principals and the university, complete lists of teachers were obtained. Based on the number of eligible participants in each school and department, a stratified random proportional sampling procedure was carried out.

The study was approved by the Human Research Ethics Committee of the Federal University of Pelotas (CAAE: 81450324.1.0000.5313). Following institutional authorization, all randomly selected teachers were invited to participate and signed an informed consent form, in accordance with Resolution No. 466/2012, ensuring anonymity, confidentiality, and participants' rights.

Considering an estimated prevalence of sufficient PA of 40%, a 4-percentage-point margin of error, a design effect of 1.5, and 29 clusters (28 schools and one cluster corresponding to the university) (CDC, Atlanta, USA), the required sample size was 951 teachers. Additionally, sample size calculations were performed for associated factors, with 80% power and a 5% alpha level. The sample size was calculated using Epi Info 7.2. To account for possible losses and refusals, a 10% increase was applied, as well as 15% for adjustment of confounding factors in multivariable analyses. Prior to data collection, the questionnaire was pilot-tested with 23 teachers not included in the final sample to evaluate clarity and duration. The average completion time was approximately 15 minutes.

The International Physical Activity Questionnaire[17] (domains leisure-time and commuting of the long version) was administered in face-to-face interviews by the principal investigator, from Monday to Friday, during morning and afternoon shifts. At the university, the questionnaire was applied during faculty board meetings; in schools, data collection followed a schedule agreed upon with each institution. Only these two domains were used because they are more modifiable in teachers' routines, allowing for the assessment of PA related to free time and mobility, which are potential targets for interventions.

PA time calculations followed the psychometric properties of the International Physical Activity Questionnaire[21,22], summing weekly minutes of moderate-intensity activities and twice the minutes of vigorous-intensity activities to account for higher energy expenditure. Only active commuting (walking or cycling) was included, excluding passive transport as it does not constitute PA.

The covariates analyzed were: gender, age (in age groups), race/ethnicity, marital status, presence and number of children, gross monthly income, housing type, completed academic degree, level of employment (basic or higher education), and ongoing postgraduate studies. Income was assessed using predefined ranges (BRL 1,320–3,960; BRL 3,961–6,600; BRL 6,601–9,240; BRL 9,240 or more) and subsequently categorized into tertiles (low, medium, high). Sociodemographic factors were defined based on previous studies with teachers[8-12].

For the outcome, teachers were classified as active if they achieved ≥150 minutes per week in leisure or commuting domains, separately and combined, creating a "total PA" variable. Participants were categorized as active (sufficient PA) or inactive (insufficient PA)[18]. It should be noted that this categorization does not necessarily represent meeting the PA recommendations of the World Health Organization, but rather only those related to the two selected domains.

Data collected were double-entered and checked in Epi Info 7.2.6. Data analysis was performed using Stata 12. Descriptive analysis was conducted for sociodemographic variables and PA (leisure, commuting, and combined). Associations between sociodemographic factors and PA practice were tested using chi-square tests and linear trend tests for ordinal variables.

Multivariable analysis of crude and adjusted associations with potential sociodemographic determinants was conducted using Poisson regression models with robust variance. All variables significant in the bivariate analysis were included in the model, adjusted for their respective hierarchical level or more distal levels. The hierarchical model considered three levels: distal (demographic characteristics), intermediate (socioeco-

nomic and housing conditions), and proximal (family and academic situation). No collinearity was identified among independent variables. The significance level was set at 5%.

Results

A total of 107 university faculty members and 886 public school teachers were sampled. Six university faculty and 20 school teachers declined participation (12 refusals and 8 withdrawals during questionnaire completion). Thus, the final sample consisted of 968 teachers, including 101 from the university and 867 from schools (response rate = 97.5%). Regarding sociodemographic characteristics (Table 1), 58.2% were female, and 63.3% self-identified as mixed-race (*pardo*). The most frequent age group was 40–49 years (40.6%). Most teachers reported having a partner or spouse (54.4%) and children (72%), with one child being the most common (27.8%) (Table 1).

Table 1 – Description of the sample of state basic education and federal higher education teachers, according to sociodemographic variables, leisure-time physical activity, commuting physical activity, and combined physical activity

Variables	n (%)
Gender	
Male	405 (41.8)
Female	562 (58.2)
Race/ethnicity	
Brown	613 (63.3)
Black	119 (12.4)
White	216 (22.3)
Yellow	13 (1.3)
Indigenous	7 (0.7)
Age (years)	
21-29	66 (6.8)
30-39	235 (24.3)
40-49	393 (40.6)
50-59	222 (22.9)
60+	52 (5.4)
Marital status	
With partner or spouse	527 (54.4)
Without partner or spouse	441 (45.6)
Has Children	
No	271 (28.0)
Yes	697 (72.0)
Number of children	
None	271 (28.0)
1st tercile	269 (27.8)
2nd tercile	249 (25.7)
3 or more children	179 (18.5)
Household income	
1st tercil	356 (36.8)
2nd tercil	313 (32.3)
3rd tercile	299 (30.9)
Type of housing	
House/Apartment in gated community	172 (17.8)
House/Apartment outside gated community	796 (82.2)
Highest complete education	
Undergraduate degree	190 (19.6)
Especialization	607 (62.7)
Master's degree	119 (12.3)
Doctoral degree	52 (5.4)
Teaching sector	
Higher education	101 (10.4)
Basic education	867 (89.6)
Ongoing postgraduate education	
Not enrolled in postgraduate studies	790 (81.6)
Especialization	107 (11.1)
Master's degree	51 (5.2)
Doctoral degree	20 (2.1)
Leisure time physical activity	
Active[a]	554 (57.2)
Inactive[b]	414 (42.8)
Commuting physical activity	
Active[a]	158 (16.3)
Inactive[b]	810 (83.7)
Total physical activity	
Active[a]	604 (62.4)
Inactive[b]	364 (37.6)

a = Active: Meet the World Health Organization recommendations regarding leisure-time or commuting physical activity; b = Inactive: Do not meet the World Health Organization recommendations regarding leisure-time and commuting physical activity.

In terms of housing, 82.2% lived in a house or apartment outside a condominium. Most had a specialization degree (62.7%), and 81.6% were not currently enrolled in postgraduate studies. The prevalence of sufficient PA in the leisure domain was 57.2% overall, 56.6% among school teachers, and 62.4% among university faculty. In the commuting domain, only 16.3% engaged in sufficient PA. When considering both domains combined, the prevalence of sufficient PA was 62.4% (Table 1).

Table 2 shows that men were more likely to practice sufficient PA in leisure ($p < 0.001$), commuting ($p = 0.023$), and combined PA ($p < 0.001$). Teachers aged 60 years or older also had higher prevalence of sufficient commuting PA compared with younger teachers ($p = 0.004$).

Teachers without children showed higher preva-

Table 2 – Prevalence of leisure-time, commuting, and combineda physical activity associated with sociodemographic factors of teachers from basic and higher education in Macapá. Amapá, Brazil

Variáveis	Leisure-time physical activity (n %)	p-value	Commuting physical activity (n %)	p-value	Combined physical activity (n %)	p-value
Gender*		< 0.001		0.023		< 0.001
Male	261 (64.5)		79 (19.7)		282 (69.6)	
Female	293 (52.0)		79 (13.9)		322 (57.2)	
Race/ethnicity		0.334		0.051		0.338
Brown	348 (56.8)		106 (17.3)		379 (61.8)	
Black	71 (59.7)		20 (16.8)		80 (67.2)	
White	120 (55.7)		25 (11.6)		130 (60.2)	
Yellow	11 (84.6)		5 (38.5)		11 (84.6)	
Indigenous	4 (57.1)		2 (28.6)		4 (57.1)	
Age (years)[b]		0.423		0.004		0.626
21-29	40 (60.6)		14 (21.2)		46 (69.7)	
30-39	142 (60.4)		24 (10.2)		150 (63.8)	
40-49	228 (58.0)		59 (15.0)		244 (62.1)	
50-59	116 (52.3)		48 (21.6)		134 (60.4)	
60+	28 (53.9)		13 (25.0)		30 (57.7)	
Marital status*		0.389		0.598		0.437
With partner or spouse	295 (56.0)		83 (15.8)		323 (61.3)	
Without partner or spouse	259 (58.7)		75 (17.0)		281 (63.7)	
Has Children*		0.010		0.466		0.019
No	173 (63.8)		48 (17.7)		419 (60.1)	
Yes	381 (54.7)		110 (15.8)		185 (68.3)	
Number of children		< 0.001		0.810		< 0.001
None	176 (64.7)		48 (17.6)		187 (68.5)	
1st tercile	143 (53.4)		39 (14.5)		161 (60.1)	
2nd tercile	153 (61.7)		41 (16.5)		164 (66.1)	
3 or more children	82 (45.8)		30 (16.8)		92 (51.4)	
Household income		0.213		0.401		0.146
1st tercil	191 (53.6)		65 (18.26)		208 (58.43)	
2nd tercil	188 (60.1)		50 (15.97)		203 (65.18)	
3rd tercile	175 (58.5)		43 (14.38)		192 (64.21)	
Type of housing*		0.043		0.434		0.324
House/Apartment in gated community	109 (63.4)		26 (15.1)		113 (65.7)	
House/Apartment outside gated community	445 (55.9)		132 (16.6)		491 (61.7)	
Highest complete education*		0.032		0.074		0.021
Undergraduate degree	107 (56.3)		33 (17.4)		117 (61.6)	
Especialization	332 (54.7)		93 (15.3)		364 (60.0)	
Master's degree	79 (66.7)		17 (14.3)		82 (68.9)	
Doctoral degree	36 (69.2)		15 (28.9)		41 (78.9)	
Teaching sector*		0.269		0.884		0.280
Higher education	63 (62.4)		17 (16.8)		68 (67.3)	
Basic education	491 (56.6)		141 (16.3)		536 (61.8)	
Ongoing postgraduate education*		0.263		0.835		0.674
Not enrolled in postgraduate studies	452 (54.2)		131 (16.6)		495 (62.7)	
Especialization	55 (51.4)		18 (16.8)		14 (70.0)	
Master's degree	33 (64.7)		6 (11.8)		33 (64.7)	
Doctoral degree	14 (70.0)		3 (15.0)		62 (57.9)	

a = combined physical activity (leisure-time physical activity + commuting physical activity).
b = linear trend test. *Chi-square test.

lence of PA in the leisure (p < 0.001) and combined domains (p = 0.019) compared with those with three or more children. Combined PA was more prevalent among teachers with doctoral degrees (p = 0.021) and in leisure (p = 0.032), as well as among those living in a house or apartment within a condominium (p = 0.043). Teaching level (basic or higher education) was not significantly associated with PA practice, although higher education faculty showed slightly higher prevalence across all domains.

In Table 3, crude and adjusted analyses showed that men (p < 0.001) and teachers without children (p = 0.012) had a higher prevalence of leisure-time PA. Table 4 shows that women had lower prevalence of commuting PA, both in crude (PR = 0.71; 95% CI: 0.53 – 0.94) and adjusted analyses (PR = 0.72; 95% CI: 0.54 – 0.96). Teachers who self-identified as Asian had approximately three times higher prevalence of sufficient PA compared with mixed-race teachers (PR = 3.18; 95% CI: 1.53 – 6.62).

Table 3 – Crude and adjusted analysis of the association between teachers physically active during leisure-time and sociodemographic factors.

Variables	Crude analysis		Adjusted analysis
	Prevalence ratio (95% CI)[a]	p-value	Prevalence ratio (95% CI)[a]
Gender		<0.001	
Male	1		1
Female	0.80 (0.72; 0.90)		0.81(0.72; 0.91)
Race/ethnicity		0.784	
Brown	1		1
Black	1.05 (0.90; 1.24)		1.02 (0.87; 1.20)
White	0.98 (0.85; 1.12)		0.97 (0.85; 1.11)
Yellow	1.49 (1.17; 1.90)		1.40 (1.09; 1.80)
Indigenous	1.00 (0.52; 1.91)		0.92 (0.50; 1.69)
Age (years)		0.449	
21-29	1		1
30-39	1.00 (0.80; 1.24)		0.98 (0.78; 1.23)
40-49	0.96 (0.77; 1.18)		0.99 (0.79; 1.25)
50-59	0.86 (0.68; 1.09)		0.92 (0.71; 1.18)
60+	0.89 (0.65; 1.22)		0.93 (0.66; 1.31)
Marital status		0.387	
With partner or spouse	1		1
Without partner or spouse	1.05 (0.94; 1.17)		1.04 (0.93; 1.17)
Has Children		0.007	
No	1		1
Yes	0.86 (0.77; 0.96)		1.06 (0.74; 1.50)
Number of children		0.006	
None	1		1
1st tercile	0.83 (0.72; 0.95)		0.80 (0.55; 1.16)
2nd tercile	0.96 (0.84; 1.09)		0.93 (0.65; 1.33)
3 or more children	0.71 (0.59; 0.85)		0.69 (0.48; 1.01)
Household income		0.224	
1st tercile	1		1
2nd tercile	1.12 (0.98; 1.28)		1.08 (0.95; 1.25)
3rd tercile	1.09 (0.95; 1.25)		1.00 (0.86; 1.15)
Type of housing		0.057	
House/Apartment in gated community	1		1
House/Apartment outside gated community	0.88 (0.78; 1.00)		0.89 (0.78; 1.01)
Highest complete education		0.013	
Undergraduate degree	1		1
Especialization	0.97 (0.84; 1.12)		0.96 (0.83; 1.10)
Master's degree	1.18 (0.98; 1.41)		1.12 (0.99; 1.35)
Doctoral degree	1.23 (0.99; 1.53)		1.19 (0.90; 1.57)
Teaching sector		0.243	
Higher education	1		1
Basic education	0.91 (0.77; 1.07)		0.94 (0.80; 1.11)
Ongoing postgraduate education		0.208	
Not enrolled in postgraduate studies	1		1
Especialization	1.26 (0.96; 1.66)		1.26 (0.95; 1.66)
Master's degree	1.36 (0.97; 1.92)		1.27 (0.91; 1.77)
Doctoral degree	1.11 (0.92; 1.35)		1.12 (0.80; 1.11)

* Prevalence ratio (95% CI): Poisson regression with robust variance. a = Adjusted for age, marital status, housing, income tertiles, number of children, educational degree, and postgraduate enrollment; b = Adjusted for gender, race/ethnicity color, housing, income tertiles, number of children, educational degree, postgraduate enrollment, and teaching sphere; c = Adjusted for gender, race/ethnicity color, housing, educational degree, postgraduate enrollment, and teaching sphere; d = Adjusted for gender, race/ethnicity color, age, and income.

Although teachers aged 60 years or older had an 18% higher prevalence of commuting PA (PR = 1.18; 95% CI: 0.61 – 2.28) compared with those aged 21–29 years, this result was not statistically significant. In addition, teachers with doctoral degrees had a 2.5-fold higher prevalence of commuting PA compared with those with undergraduate degrees (PR = 2.51; 95% CI: 1.36 – 4.62) (Table 4).

Table 5 presents crude and adjusted results for the association between total (combined) PA and demographic variables. In the adjusted analysis, women showed lower prevalence (PR = 0.81; 95% CI: 0.74 – 0.90) of total PA compared to men. Teachers with three or more children (PR = 0.80; 95% CI: 0.55 – 1.15) had lower prevalence of total PA compared with

Table 4 – Crude and adjusted analysis of the association between teachers physically active in commuting and sociodemographic factors

Variables	Crude analysis		Adjusted analysis	
	Prevalence ratio (95% CI)*	p-value	Prevalence ratio (95% CI)*	p-value
Gender		0.019		0.027[a]
Male	1		1	
Female	0.71 (0.53; 0.94)		0.72 (0.54; 0.96)	
Race/ethnicity		0.034		0.006[a]
Brown	1		1	
Black	0.97 (0.63; 1.50)		0.94 (0.61; 1.47)	
White	0.66 (0.44; 1.00)		0.70 (0.46; 1.04)	
Yellow	2.22 (1.09; 4.52)		3.18 (1.53; 6.62)	
Indigenous	1.65 (0.50; 5.40)		1.35 (0.37; 4.92)	
Age (years)		0.004		<0.001[b]
21-29	1		1	
30-39	0.48 (0.26; 0.88)		0.50 (0.26; 0.94)	
40-49	0.71 (0.42; 1.19)		0.83 (0.46; 1.49)	
50-59	1.02 (0.60; 1.73)		1.25 (0.70; 2.26)	
60+	1.18 (0.61; 2.28)		1.40 (0.69; 2.84)	
Marital status		0.598		0.592[b]
With partner/ spouse	1		1	
Without partner/spouse	1.07 (0.81; 1.43)		1.08 (0.80; 1.47)	
Has children		0.464		0.639[c]
No	1		1	
Yes	0.89 (0.65; 1.21)		0.77 (0.26; 2.30)	
Number of children		0.812		0.942[c]
No children	1		1	
1 child	0.82 (0.56; 1.21)		1.02 (0.32; 3.25)	
2 children	0.94 (0.64; 1.37)		1.13 (0.36; 3.57)	
3 or more children	0.95 (0.63; 1.44)		1.00 (0.32; 3.11)	
Income		0.379		0.029[c]
1st tercile	1		1	
2nd tercile	0.86 (0.61; 1.20)		0.71 (0.50; 1.00)	
3rd tercile	0.78 (0.55; 1.11)		0.62 (0.43; 0.90)	
Housing		0.639		0.757[d]
House/ Apartment in condominium	1		1	
House/ Apartment outside condominium	1.10 (0.74; 1.61)		0.94 (0.64; 1.39)	
Highest degree completed		0.053		<0.001[c]
Undergraduate	1		1	
Specialization	0.88 (0.61; 1.27)		0.95 (0.64; 1.39)	
Master's	0.82 (0.48; 1.40)		0.94 (0.52; 1.67)	
Doctorate	1.66 (0.98; 2.81)		2.51 (1.36; 4.62)	
Level of teaching		0.243		0.291[d]
Higher education	1		1	
Basic education	0.97 (0.61; 1.52)		1.32 (0.78; 2.23)	
Currently enrolled in graduate studies		0.847		0.949[d]
Not enrolled	1		1	
Specialization	0.70 (0.30; 1.66)		0.78 (0.33; 1.83)	
Master's	0.89 (0.29; 2.75)		1.01 (0.35; 2.90)	
Doctorate	0.99 (0.63; 1.54)		0.95 (0.61; 1.48)	

* Prevalence Ratio (95% CI): Poisson regression with robust variance; a = Adjusted for age, marital status, housing, income in terciles, number of children, educational attainment, and current enrollment in graduate studies; b = Adjusted for gender, race/ethnicity, housing, income in terciles, number of children, educational attainment, current enrollment in graduate studies, and level of teaching; c = Adjusted for gender, race/ethnicity housing, educational attainment, current enrollment in graduate studies, and level of teaching; d = Adjusted for gender, race/ethnicity, age, and income.

Table 5 – Crude and adjusted analysis of the association between combined physical activity* and sociodemographic factors

Variables	Crude analysis		Adjusted analysis	
	Prevalence ratio (95% CI)#	p-value	Prevalence ratio (95% CI)#	p-value
Gender		<0.001		<0.001[a]
Male	1		1	
Female	0.82 (0.74; 0.90)		0.81(0.74; 0.90)	
Race/ethnicity		0.784		0.103[a]
Brown	1		1	
Black	1.09 (0.95; 1.25)		1.08 (0.94; 1.24)	
White	0.97 (0.86; 1.10)		0.98 (0.86; 1.10)	
Yellow	1.37 (1.08; 1.74)		1.37 (1.09; 1.74)	
Indigenous	0.92 (0.48; 1.76)		0.86 (0.46; 1.60)	
Age (years)		0.580		0.065[b]
21-29	1		1	
30-39	0.91 (0.76; 1.10)		0.91 (0.76; 1.10)	
40-49	0.89 (0.75; 1.06)		0.92 (0.76; 1.10)	
50-59	0.87 (0.72; 1.04)		0.89 (0.74; 1.09)	
60+	0.83 (0.62; 1.10)		0.83 (0.63; 1.11)	
Marital status		0.436		0.354[b]
With partner/ spouse	1		1	
Without partner/spouse	1.04 (0.94; 1.15)		1.04 (0.94; 1.16)	
Has children		0.013		0.851[c]
No	1		1	
Yes	0.88 (0.80; 0.97)		0.97 (0.69; 1.37)	
Number of children		0.006		0.012[c]
No children	1		1	
1 child	0.88 (0.77; 0.95)		0.93 (0.65; 1.33)	
2 children	0.96 (0.84; 1.09)		1.02 (0.72; 1.47)	
3 or more children	0.71 (0.59; 0.85)		0.80 (0.55; 1.15)	
Income		0.182		0.192[c]
1st tercile	1		1	

Continue…

Continue of **Table 5 –** Crude and adjusted analysis of the association between combined physical activity* and sociodemographic factors

2nd tercile	1.11 (0.98; 1.25)		1.11 (0.99; 1.26)	
3rd tercile	1.10 (0.97; 1.23)		1.08 (0.96; 1.22)	
Housing		0.307		0.396[d]
House/ Apartment in condominium	1		1	
House/ Apartment outside condominium	0.94 (0.83; 1.06)		0.95 (0.84; 1.07)	
Highest degree completed		0.002		0.035[c]
Undergraduate	1		1	
Specialization	0.97 (0.86; 1.11)		0.99 (0.87; 1.13)	
Master's	1.12 (0.95; 1.32)		1.07 (0.90; 1.27)	
Doctorate	1.28 (1.07; 1.53)		1.25 (1.03; 1.51)	
Level of teaching		0.251		0.396[d]
Higher education	1		1	
Basic education	0.92 (0.79; 1.06)		0.94 (0.80; 1.11)	
Currently enrolled in graduate studies		0.667		0.852[d]
Not enrolled	1		1	
Specialization	1.12 (0.86; 1.44)		1.13 (0.86; 1.47)	
Master's	1.20 (0.87; 1.70)		1.07 (0.76; 1.50)	
Doctorate	1.08 (0.91; 1.28)		1.06 (0.89; 1.25)	

*combined physical activity (leisure-time physical activity + commuting physical activity);
#Prevalence ratio (95% CI): Poisson regression with robust variance;
a = Adjusted for age, marital status, housing, income in terciles, number of children, education, and current enrollment in graduate studies;
b = Adjusted for gender, race/ethnicity, housing, income in terciles, number of children, education, current enrollment in graduate studies, and teaching sphere;
c = Adjusted for gender, race/ethnicity, housing, education, current enrollment in graduate studies, and teaching sphere;
d = Adjusted for gender, race/ethnicity, age, and income.

those without children, although this association was not statistically significant.

Regarding academic degree, teachers with doctorates had higher prevalence (PR = 1.25; 95% CI: 1.03 – 1.51), indicating a statistically significant association, while specialists (PR = 0.99; 95% CI: 0.87 – 1.13) and master's degree holders (PR = 1.07; 95% CI: 0.90 – 1.27) did not show significant associations. Other variables were not significantly associated.

Interaction analyses showed no joint effects between gender and having children (p = 0.932), gender and academic degree (χ^2 (3) = 2.06; p = 0.561), or age and marital status (χ^2 = 4.84; p = 0.304). On the other hand, there was an interaction between age group and enrollment in postgraduate studies (χ^2 [11] = 28.08; p = 0.0031), indicating that the relationship between ongoing postgraduate education and PA varied by age. In addition, the number of children interacted with marital status (χ^2 = 18.49; p = 0.010) in relation to PA practice.

Discussion

The study aimed to analyze the prevalence of basic and higher education teachers who meet current recommendations[18] for leisure and commuting physical activity (PA) and its association with sociodemographic factors. The study identified a predominance of women in teaching, consistent with findings from epidemiological studies on PA among teachers[13,23-25]. This profile reinforces the importance of addressing women's health within the Brazilian educational context, both in basic and higher education[23].

Most teachers self-identified as mixed-race (pardo)[26], reflecting the population profile of Amapá, where this group predominates, in a context marked by Indigenous, quilombola, and riverside miscegenation. The sociodemographic profile identified — aged 40–49 years, with a partner, without children, living outside a condominium, holding a specialization degree, and not pursuing postgraduate studies — is similar to that described in previous studies[13-15,22,23,27]. However, regional, occupational, and methodological differences across those studies limit direct comparisons, such as in one study[14] that focused specifically on medical school professors, a context distinct from Amapá.

The prevalence of teachers in Macapá who practiced sufficient leisure-time PA (57.2%) is comparable to other regions, such as Pelotas/Rio Grande do Sul[27] (56.4%), Viçosa/Minas Gerais[28] (70% by the International Physical Activity Questionnaire), and Belo Horizonte/Minas Gerais[29] (45.5% during the pandemic). Nonetheless, variations were observed depending on contextual factors such as the impact of the COVID-19 pandemic, measurement tools used, and differences in sociodemographic characteristics of the samples[30]. Moreover, other studies were conducted in more urbanized regions with greater infrastructure for PA, which may influence the results. Although this study did not directly assess the effects of the COVID-19 pandemic or the adoption of remote/hybrid teaching on teachers' PA levels, it is plausible that such changes in the educational work environment influenced PA patterns, especially in commuting.

In the present study, female teachers were 19% less

likely to be physically active in leisure compared to male teachers. This finding corroborates other research with teachers indicating that women are 35% less likely to engage in leisure-time PA than men[31]. Double work shifts and domestic responsibilities may reduce women's motivation and opportunities to practice PA, in addition to the low availability of sports facilities, often dominated by men in football, contributing to lower PA levels among female teachers[31].

Teachers with three or more children tended to engage less in PA, even after adjusting for variables such as gender, race/ethnicity housing, teaching level, and education. Similarly, another study[32] showed lower PA percentages among adults with three children. The domain with the lowest PA levels was commuting (16.3%). In multivariable analysis, women were 29% less likely to be physically active in commuting.

A temporal trend study among Northern capitals showed that active commuting prevalence decreased from 21.8% in 2009 to 12.2% in 2013[33]. Another study[34] also showed low levels of sufficient PA in this domain. When comparing cycling lane mileage between capitals, Macapá, with only 3.45 km, ranked third to last, ahead only of Manaus (1.55 km) and São Luiz (3.23 km), which discourages commuting PA[14]. However, that study analyzed a period prior to recent urban mobility policies and did not specifically focus on teachers, which may limit its direct applicability in the context of the current study. Although no multivariable analyses were found regarding commuting among basic and higher education teachers, VIGITEL[33] data with 54,369 adults indicated that men were 26% more likely than women to engage in sufficient PA in this domain.

Regarding race/ethnicity, even after adjusting for other variables, individuals self-identified as "yellow" (East Asian descent) practiced more sufficient commuting PA. This finding may provide insights into inequalities in access and PA engagement among teachers of different ethnic backgrounds. There are no national studies reporting specific data on commuting PA prevalence among Asian individuals in Brazil, especially among teachers[34]. Most studies aggregate the categories Asian and "Indigenous," making specific analyses for this racial group difficult[35].

Regarding age, many studies[13,34-36] indicate a higher prevalence of PA among younger individuals. However, the present study did not confirm this finding. This divergence may be explained by methodological and contextual differences. While our study focused on teachers — a group with a more homogeneous educational and occupational profile and possibly greater awareness of the benefits of PA — the other studies analyzed broader population groups with greater occupational heterogeneity.

There was no association between place of residence and PA levels among teachers after adjusting for gender, race/ethnicity, age, and income. A possible explanation is that the socioeconomic level of teachers, regardless of type of housing, may be similar and therefore not significantly influence PA levels.

Teachers holding a doctoral degree were 23% more likely to practice sufficient leisure-time PA. They were also more likely to engage in sufficient commuting and combined PA, even after adjustment for potential confounders. Although Amapá has fewer doctoral-level teachers compared to other regions, data suggest that individuals with higher education levels are more likely to practice PA. This may be related to factors such as greater health awareness, access to resources and opportunities, and differences in social environments.

The study has some limitations that should be considered. Being a cross-sectional study, it is not possible to determine causal relationships between some variables. Data were collected via self-administered questionnaire, which may be subject to recall or information bias, such as social desirability bias — the tendency of participants to present themselves as engaging in sufficient PA more than they actually do. Furthermore, the study did not explore urban environmental factors such as safety or infrastructure, which may influence PA, especially in commuting. It also did not assess the routines of older teachers or access to leisure areas in condominiums. It is also worth noting that the International Physical Activity Questionnaire may overestimate self-reported PA levels.

Despite these limitations, this study makes important contributions to the literature. It is the first to conduct a multivariable analysis of leisure and commuting PA levels among teachers in Macapá/Amapá, a region historically lacking data on this topic. The representative sampling process strengthens the results and helps to address the data gap on teachers in Northern Brazil. The study highlights which domains teachers are more active in, facilitating the understanding of challenges in promoting PA. Improvements in urban infrastructure might benefit active commuting, while specific PA programs support active leisure.

Conclusion

Teachers showed satisfactory levels of leisure-time PA but low levels of commuting PA. Male teachers, those without children, those holding a doctoral degree, and those self-identified as "yellow" were more likely to engage in sufficient PA. Future studies should further explore barriers and facilitators of PA practice in different demographic groups of teachers, considering the cultural and environmental characteristics of the Amazon region.

Findings indicate that many teachers engage in sufficient commuting PA but not in leisure PA, which may suggest that their activity is limited to functional demands of daily routines. Conversely, the prevalence of leisure-time PA among teachers may be related to choices linked to free-time use.

There is also a reinforced need for institutional strategies to promote active lifestyles among teachers, with an emphasis on adequate infrastructure for PA and initiatives that reconcile work and personal life. Developing specific policies for female teachers and those with children — such as investments in urban infrastructure, active mobility programs, and offering PA opportunities within institutions — may facilitate PA practice in this group.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Costa DJS: Conceptualization; Methodology; Validation of data and experiments; Data analysis; Investigation; Data curation; Project administration; Data presentation design; Writing – original draft preparation; Writing – review and editing; Approval of the final version of the manuscript. Reichert FF: Data analysis; Supervision; Project administration; Data presentation design; Writing – review and editing; Approval of the final version of the manuscript.

Declaration regarding the use of artificial intelligence tools in the article writing process

The authors did not use artificial intelligence tools for preparation of the manuscript.

Availability of research data and other materials

The contents underlying the research text are contained in the manuscript.

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Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer B

Aluísio Andrade-Lima
Universidade Federal de Sergipe, Brasil.

Format

- Does the article comply with the manuscript preparation guidelines for submission to the Revista Brasileira de Atividade Física e Saúde?
  Partially
- Regarding formal aspects, is the manuscript well structured, containing the sections: Introduction, Methods, Results, and Discussion (with the Conclusion as part of the Discussion)?
  Partially
- Is the language appropriate, with clear, precise, and objective writing?
  No
- Was any indication of plagiarism observed in the manuscript?
  No

Suggestions/comments:

- Overall, the manuscript presents grammatical and fluency issues, with long and poorly punctuated sentences, excessive use of connectors, repetitions, and spelling errors. Furthermore, the logical structure is not very cohesive, and there is a tendency for generalizations and lack of theoretical precision.

Abstract

- Are the abstract and resumo appropriate (including: objective, information about the study participants, variables studied, main results, and a conclusion) and do they reflect the manuscript content?
  Yes

Suggestions/comments:

- N/A

Introduction

- Is the research problem clearly stated and defined?
  Partially
- Is the research problem adequately contextualized in relation to the existing knowledge, moving from general to specific?
  Partially
- Are the reasons justifying the need for the study (including the authors' assumptions about the problem) well established in the writing?
  Partially
- Are the references used to support the presentation of the research problem current and relevant to the topic?
  No
- Is the objective clearly presented?
  Yes

Suggestions/comments:

- The introduction needs better writing. Indeed, there are very long and poorly punctuated sentences, excessive use of connectors, repetitions, and spelling errors such as: "regulamente," "ciêntifica," and "faixa-etaria." Additionally, the logical structure of the argument is weak. The development of ideas (PA – teachers – Brazil – Amazon) could be better articulated, and some paragraphs mix data, arguments, and justifications with no clear structure.
- There are many generalizations and a lack of precision in terms such as "physical activity," "healthy habits," and "insufficient profile," which are used without clear definitions or contextualization with recognized recommendations, such as those from WHO and ACSM. The authors also fail to clearly state the criteria used to define who "meets the recommendations" (how many minutes? What intensity? Which guideline?). What physical activity recommendations were used as reference?
- The percentages regarding PA practice are presented unclearly (missing authors, years, population context, or study design).
- The justification for comparing education networks was not well developed. Although the study compares basic and higher education teachers, the authors do not clarify why this comparison is relevant or what they expect to find. What justifies the comparison between basic and higher education teachers?
- The final paragraph lists several research gaps in a disorganized way, mixing variables, regions, and possible objectives without clear hierarchy or development throughout the introduction.
- How might specific factors of the northern region

(climate, urbanization, transportation, safety, urban infrastructure) influence PA and its determinants?
- The transportation domain is mentioned but not explained. What are the definitions of the different PA domains? Why are leisure and transportation particularly important for this population? Why is it relevant to analyze these domains separately?
- The impact of PA on teaching performance or occupational health needs more emphasis and practical justification.
- What is the originality of the present study compared to existing ones? What does it intend to add?
- How were the sociodemographic factors defined or selected?

Methods

- Are the methodological procedures, in general, appropriate for the research problem?
  Yes
- Are the methodological procedures adopted for conducting the study sufficiently detailed?
  Partially
- Was the procedure for selecting or recruiting participants appropriate for the research problem and described in a clear and objective way?
  Yes
- Were details provided on the instruments used for data collection, their psychometric qualities (e.g., reproducibility, internal consistency, and validity), and, when relevant, on the operational definitions of variables?
  Partially
- Is the data analysis plan appropriate and adequately described?
  Yes
- Were the inclusion and/or exclusion criteria for participants described and appropriate for the study?
  Partially
- Did the authors provide information on the ethical procedures adopted for conducting the research?
  Partially
  Suggestions/comments:
- Similar to the introduction, there are problems with writing and clarity, with long and confusing passages and punctuation issues (e.g., "cujos alguns critérios para escolhas foram estabelecidos"). Also, excessive and unnecessary use of double gender forms such as "os/as professores/as"; it would be better to use "teachers" or "docents."
- No mention was made of ethical or logistical control of data collection (institutional approval, formal consent, anonymity, etc.).
- Why were schools with fewer than 600 students or more than 2000 excluded? Does this affect representativeness?
- Why were the following criteria used to select schools: minimum of 20 teachers, 30 km from the urban center, and workload up to 24 teaching hours?
- Were teachers in multiple roles (e.g., coordination, management, teaching) included? Was this controlled for?
- It is not mentioned who administered the questionnaires, how consent was obtained, or whether quality control measures were used.
- The use of Poisson regression with robust variance is appropriate for prevalence ratios, but the authors failed to indicate whether multicollinearity between variables was assessed.

Results

- Is the use of tables and figures appropriate and does it aid in conveying the study results clearly?
  Yes
- Is the number of illustrations in accordance with the journal's submission guidelines?
  Yes
- Is the number of participants at each stage of the study, as well as reasons for losses and refusals, presented?
  Yes
- Are the participants' characteristics presented and sufficient?
  Yes
- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?
  Partially
  Suggestions/comments:
- Many numerical data are presented in large blocks of text, making reading difficult. It is recommended to separate them by subtopics or thematic paragraphs.
- In some adjusted analyses, such as active transportation in those ≥60 years, 95% CIs are wide and include 1, yet still described as positive associations. Some comparisons are labeled "associated" without p-values or 95% CIs to support them. Example: "60 years or older showed 18% higher prevalence...," but

95% CI (0.61–2.28) does not indicate significance.
- Were there significant differences between basic and higher education teachers? This is important since the comparison was part of the study aim.
- Was there any control for possible interactions between variables (e.g., gender × children; age × graduate degree)?

Discussion

- Are the main findings of the study presented?
- Partially
- Are the strengths and limitations of the study presented and discussed?
- Partially
- Are the results discussed in light of the study's limitations and existing knowledge on the topic?
- Partially
- Do the authors discuss the potential contributions of the study's main findings to scientific development, innovation, or real-world intervention?
- Partially
- **Suggestions/comments:**
- In the discussion, the authors interpret non-significant results as "associations." Example: "showed 18% greater chance..." with 95% CI that includes 1. They also mention post hoc tests that were not described in Methods or Results.
- There is concern regarding extrapolating results without direct measurement, such as routines of older teachers or access to leisure spaces in condominiums.
- Some relevant studies are cited but not critically integrated (e.g., differences in findings, methodologies, or limitations are not addressed).
- What does it mean in practical terms for a teacher to be physically active only through transportation or only during leisure time?
- How do the findings from Amapá compare with other regions of the North or with national averages?
- What local public policies could be encouraged based on the findings?
- What practical implications do the findings have for educational institutions regarding teacher health?
- How might the recent pandemic and hybrid or remote teaching models impact these behaviors (even if not part of the study, this could be mentioned as a future implication)?

Conclusion

- Was the study conclusion presented appropriately and is it consistent with the study objective?
  Yes
- Is the study conclusion original?
  Yes
  Suggestions/comments:
- N/A

References

- Are the references up to date and sufficient?
  Partially
- Are most references composed of original research articles?
  Yes
- Do the references meet the journal's formatting requirements (quantity and style)?
  Partially
- Are in-text citations appropriate, i.e., do the statements cite references that actually support them?
  Partially
  Suggestions/comments:
- Many references lack consistency in formatting.

Final decision

- **Reject**

Reviewer B

Did not authorize publication.