

What is the contribution of each physical activity domain to total physical activity in adolescents?

Qual a contribuição de cada domínio da atividade física para atividade física total em adolescentes?

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Abstract – The present study aimed to verify the contribution of different physical activity domains to “total physical activity” in Brazilian adolescents. This is a cross-sectional study using secondary data from the third edition of the National School Health Survey – PeNSE, 2015. The sample consisted of 100,497 adolescents of both sexes enrolled in the 9th grade of elementary schools. A linear regression model was used to verify how much each domain contributed to total physical activity, considering gender, type of municipality and region. The domain with the largest contribution to “total physical activity” regardless of sociodemographic and environmental variables was “extra-school physical activity” ($R^2 = 0.60$), followed by “active commuting” ($R^2 = 0.34$), and finally “Physical Education classes” ($R^2 = 0.23$). The contribution of the different domains varied by gender, type of municipality and region, and it was concluded that “extra-school physical activity” make the greatest contribution to “total physical activity”, followed by “active commuting” and “Physical Education classes”. In addition, variation was observed in the contribution of domains by gender, type of municipality and region.

Key words: Adolescent behavior; Physical activity; Physical Education.

Resumo – O presente estudo teve como objetivo verificar a contribuição dos diferentes domínios da atividade física na “atividade física total” em adolescentes brasileiros. Trata-se de estudo transversal utilizando dados secundários oriundos da terceira edição da Pesquisa Nacional de Saúde do Escolar – PeNSE, 2015. A amostra foi constituída por 100.497 adolescentes de ambos os sexos cursando o 9º ano do Ensino Fundamental. Utilizou-se um modelo de regressão linear a fim de averiguar o quanto cada domínio contribuiu para a atividade física total, considerando o sexo, tipo de município e região. O domínio que apresentou maior contribuição para “atividade física total” independentemente das variáveis sociodemográficas e ambientais foram as “atividades físicas extraescolares” ($R^2 = 0,60$), seguido do “deslocamento ativo” ($R^2 = 0,34$), e por fim as “aulas de Educação Física” ($R^2 = 0,23$). A contribuição dos diferentes domínios apresentou variações por sexo, tipo de município e região. Conclui-se que as “atividades extraescolares” apresentam a maior contribuição para a “atividade física total”, seguido do “deslocamento ativo” e das “aulas de Educação Física”. Além disso, verifica-se uma variação na contribuição dos domínios por sexo, tipo de município e região.

Palavras-chave: Atividade física; Comportamento do adolescente; Educação física.

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INTRODUCTION

The regular practice of physical activity provides health improvements and acts preventing diseases at all stages of life^{1,2}. In adolescence, the adoption of an active lifestyle can estimate the involvement in physical activity in adulthood³.

Despite this evidence, it appears that between 11 and 17 years of age, regardless of country, less than 20% of adolescents meet the recommendations of 60 daily minutes of physical activity⁴, however, when analyzing data from Brazil, a prevalence of 30.7% is estimated⁵.

Aiming at increasing the level of physical activity in adolescents, action plans were developed considering the different physical activity domains (leisure, work / school, domestic and commuting) and the context in which they are and can be developed⁴. In this sense, the different domains in which adolescents will engage may make different contributions to total physical activity.

In adolescence, actions and investigations have shown that the main focus is Physical Education classes⁶, extra-school physical activity⁷ and active commuting⁸, since there is greater engagement in these domains during this phase of life. However, it is observed that there is variation in the time spent among these domains⁹, indicating the need to verify the contribution of each of these in total physical activity in adolescents.

In this sense, understanding the contribution of the different domains that make up the total physical activity construct is essential for the development of interventions in which behavior change is one of the concerns, in a more responsive way, considering the needs of adolescents. In addition, there are few studies addressing these domains together during adolescence¹⁰.

Given the above, the present study aimed to verify the contribution of different physical activity domains to total physical activity in Brazilian adolescents.

METHOD

Study Design

This is a cross-sectional study using secondary data from the third edition of the National School Health Survey - PeNSE, 2015. This edition was developed between April and September 2015 in order to identify risk factors and health protection of Brazilian adolescents regularly attending school in the day shift^{11,12}.

This study used data referring to the sample named “number one” of PeNSE, 2015. This sample consists of representative data of Brazilian adolescents enrolled in the 9th grade of elementary school in 2015^{11,12}. Fifty-three geographic strata were used, consisting of capitals and non-capital municipalities of each Federation Unit. In capitals, school and class sampling units were used; however, in non-capital municipalities, in

addition to these, the IBGE agency was added^{11,12}.

PeNSE 2015 was approved by the National Research Ethics Committee - Conep No. 1.006.467, of 03/30/2015.

Participants

The survey was conducted with 3040 schools, 4159 classes and 102,301 students answered the survey questionnaire¹¹. All students present in the selected classes were invited to participate in the research, but only those who agreed with the Free and Informed Consent Term, participated in the research¹¹.

Instruments

Data were collected using an electronic questionnaire and the Personal Digital Assistant (PDA). To complete the questionnaire, students were instructed to consider the last seven days prior to the survey. Further information on PeNSE and its methodological aspects can be obtained from previous publication^{11,12}.

Variables

For “active commuting”, the average daily time accumulated by the student was used, with commuting to and from school on foot or bicycle. For physical activities performed in “Physical Education classes”, the accumulated average duration in which the student practiced physical activity or sport during the period of Physical Education classes at school was used. For “extra-school physical activity”, the average daily time accumulated by the student with some physical activity performed during the extra-school period was considered. “Total physical activity” was estimated based on the product between the number of days and the average time spent by students in physical activities in commuting, physical education classes and extra-school physical activity domains, considering the seven days prior to the survey¹¹.

Sociodemographic (gender, age and race) and environmental (type of municipality, regions and study shift) variables were used. The characterization and cutoff points of variables used are presented in Box 1.

Statistical analysis

For data interpretation, descriptive analysis and confidence interval (95% CI) were used. Linear regression model was used to verify how much each domain contributed to “total physical activity”, considering gender, type of municipality and region. Data are presented with their respective determination coefficient, beta estimator and confidence interval values, and throughout the analysis, 5% significance level ($p \leq 0.05$) was considered. In all analyses, sample weights were used as weighting procedure considering instructions available for the PeNSE 2015 survey. Statistical treatment was performed using STATA version 15.0 software.

Box 1. Characterization and cutoff points of variables used in this study

Variables	Categorization	Criterion / Characterization
Gender ^a	Female	Biological Classification
	Male	
Age group ^b	≤ 14 years	Distribution Median
	> 14 years	
Race/Color ^c	Non white	Race / Color: black, yellow, brown and indigenous
	White	All white
Regions	Northern	Federation Units groups
	Northeastern	
	Southeastern	
	Southern	
	Mid-western	
Type of Municipality	Non capital	Location
	Capital	
Study shift ^d	Part time	Graded according to length of school stay “Part time” considered morning or afternoon; “Full time” only full time
	Full time	
Total Physical Activity Time	Continuous Data	In Minutes
Active commuting	Continuous Data	In Minutes
Physical activity in physical education classes	Continuous Data	In Minutes
Extra-School Physical Activity	Continuous Data	In Minutes

Note: ^a Question VB01001; ^b Question VB01003; ^c Question VB01002; ^d Question VB01022

RESULTS

A total of 102,301 adolescents were interviewed, but 1,804 were excluded due to the lack of important information such as age and / or gender, in addition to data from those who did not attend the 9th grade of elementary school, resulting in a sample with 100,497 participants.

The sample consisted of adolescents of both sexes, mostly composed of females aged “≤ 14 years”, “non-white”, living in capitals and studying in a “part time” system (Table 1).

The domain that made the greatest contribution to “total physical activity” was “extra-school physical activity”, followed by “active commuting” and “physical education classes”, respectively (Table 2).

Table 3 shows the contribution of “extra-school physical activity” to the total physical activity of adolescents. For female adolescents living in capitals, “total physical activity” was best explained by “extra-school physical activity” in the Mid-western region, with 56% ($R^2 = 0.56$), followed by the Southern region, with 54% ($R^2 = 0.54$). However, for those who do not live in capitals, this domain presented the largest contribution in the Southern region, with 60% ($R^2 = 0.60$), followed by the Northern region, with 53% ($R^2 = 0.53$).

Regarding males, regardless of type of municipality, the largest contribution of “extra-school physical activity” to total physical activity occurred in the Southern region, with 67% ($R^2 = 0.67$) and 68% ($R^2 = 0.68$) for “capital” and “non-capital”, respectively.

Table 1. Characteristics of sample participants.

Variables	N	%	95% CI
Gender			
Female	51.998	51.7	51.4 - 52.1
Male	48.499	48.3	47.9 - 48.6
Age group			
≤ 14 years	68.097	67.8	67.5 - 68.0
> 14 years	32.400	32.2	32.0 - 32.5
Race/Color			
Non white	67.034	66.8	66.5 - 67.1
White	33.359	33.2	32.9 - 33.5
Type of municipality			
Non capital	50.055	49.8	49.5 - 50.1
Capital	50.442	50.2	49.9 - 50.5
Study shift			
Part time	98.544	98.3	98.2 - 98.4
Full time	1.718	1.7	1.6 - 1.8

Note: 95% CI = confidence interval

Table 2. Contribution of different physical activity domains to total physical activity.

Variables	R ²	P	B	CI (95%)
Extra-school physical activity	0.60	<0.001	1.12	1.11 - 1.13
Active commuting	0.34	<0.001	1.06	1.04 - 1.08
Physical education classes	0.23	<0.001	1.70	1.65 - 1.75

Note: R² = determination coefficient; B = estimator B; 95% CI = confidence interval

Table 3. Contribution of “extra-school physical activity” to “total physical activity” in Brazilian adolescents, 2015

	Female							
	Capital				Non capital			
	R ²	p	B	CI (95%)	R ²	p	B	CI (95%)
Brazil	0.52	<0.001	1.07	1.05 - 1.09	0.52	<0.001	1.11	1.09 - 1.13
Northern	0.50	<0.001	1.06	1.02 - 1.10	0.53	<0.001	1.13	1.08 - 1.17
Northeastern	0.49	<0.001	1.06	1.03 - 1.09	0.47	<0.001	1.11	1.08 - 1.14
Southeastern	0.53	<0.001	1.05	1.01 - 1.09	0.52	<0.001	1.09	1.05 - 1.13
Southern	0.54	<0.001	1.08	1.02 - 1.13	0.60	<0.001	1.14	1.10 - 1.18
Mid-western	0.56	<0.001	1.13	1.08 - 1.17	0.50	<0.001	1.16	1.10 - 1.21
	Male							
	Capital				Non capital			
	R ²	p	B	CI (95%)	R ²	p	B	CI (95%)
Brazil	0.63	<0.001	1.09	1.07 - 1.11	0.63	<0.001	1.12	1.10 - 1.14
Northern	0.64	<0.001	1.10	1.07 - 1.13	0.67	<0.001	1.13	1.09 - 1.16
Northeastern	0.66	<0.001	1.07	1.05 - 1.09	0.64	<0.001	1.12	1.09 - 1.14
Southeastern	0.61	<0.001	1.08	1.04 - 1.12	0.60	<0.001	1.11	1.06 - 1.15
Southern	0.67	<0.001	1.10	1.06 - 1.14	0.68	<0.001	1.15	1.11 - 1.19
Mid-western	0.63	<0.001	1.12	1.09 - 1.16	0.64	<0.001	1.15	1.11 - 1.18

Note: R² = determination coefficient; B = estimator B; 95% CI = confidence interval

Table 4 presents the contribution of “active commuting” to “total physical activity” in adolescents. For female adolescents living in capitals,

the largest contribution of “active commuting” to “total physical activity” was found in the Northern region, with 42% ($R^2 = 0.42$), followed by the Northeast region, with 41% ($R^2 = 0.41$). However, regarding those who did not live in capitals, this contribution was higher in the Northeastern region, with 49% ($R^2 = 0.49$), followed by the Mid-western region, with 48% ($R^2 = 0.48$).

Considering male adolescents living in capitals, the contribution of “active commuting” to “total physical activity” was higher in the Southeast region, with 34% ($R^2 = 0.34$); however, for those who did not live in capitals, the largest contribution was in the Southern region, with 35% ($R^2 = 0.35$).

Table 4. Contribution of “active commuting” to “total physical activity” in Brazilian adolescents, 2015.

	Female							
	Capital				Non capital			
	R ²	p	B	CI (95%)	R ²	p	B	CI (95%)
Brazil	0.37	<0.001	0.96	0.93 - 0.99	0.42	<0.001	1.03	1.01 - 1.05
Northern	0.42	<0.001	1.00	0.95 - 1.05	0.46	<0.001	1.09	1.04 - 1.15
Northeastern	0.41	<0.001	0.96	0.92 - 0.99	0.49	<0.001	1.04	1.01 - 1.06
Southeastern	0.34	<0.001	0.94	0.89 - 1.00	0.38	<0.001	0.99	0.95 - 1.03
Southern	0.33	<0.001	0.96	0.86 - 1.06	0.35	<0.001	1.08	1.01 - 1.15
Mid-western	0.36	<0.001	1.04	0.97 - 1.11	0.48	<0.001	1.10	1.04 - 1.16
	Male							
	Capital				Non capital			
	R ²	p	B	CI (95%)	R ²	p	B	CI (95%)
Brazil	0.31	<0.001	1.08	1.04 - 1.11	0.33	<0.001	1.13	1.08 - 1.17
Northern	0.31	<0.001	1.06	1.00 - 1.12	0.30	<0.001	1.16	1.09 - 1.23
Northeastern	0.26	<0.001	1.01	0.96 - 1.07	0.33	<0.001	1.14	1.09 - 1.19
Southeastern	0.34	<0.001	1.10	1.04 - 1.17	0.32	<0.001	1.09	1.00 - 1.17
Southern	0.30	<0.001	1.07	0.99 - 1.15	0.35	<0.001	1.20	1.12 - 1.28
Mid-western	0.31	<0.001	1.10	1.03 - 1.17	0.34	<0.001	1.13	1.05 - 1.21

Note: R² = determination coefficient; B = estimator B; 95% CI = confidence interval

Table 5 presents the contribution of “Physical Education classes” to “total physical activity” in adolescents. It was found that for female adolescents, regardless of type of municipality, the largest contribution of “Physical Education classes” to “total physical activity” occurred in the Southern region, with 23% ($R^2 = 0.23$) and 24% ($R^2 = 0.24$) for “capital” and “non-capital”, respectively. Considering males living in capitals, the region in which “Physical Education classes” best explained “total physical activity” was the Mid-western region, with 25% ($R^2 = 0.25$); however, for those who do not live in capitals, this domain presented greater explanation in the Southeast region, with 26% ($R^2 = 0.26$).

DISCUSSION

As the main result, it was found that the degree of contribution of physical

Table 5. Contribution of “Physical Education classes” to “total physical activity” in Brazilian adolescents, 2015.

	Female							
	Capital				Non capital			
	R ²	p	B	CI (95%)	R ²	p	B	CI (95%)
Brazil	0.17	<0.001	1.43	1.36 - 1.51	0.19	<0.001	1.58	1.51 - 1.65
Northern	0.16	<0.001	1.53	1.38 - 1.69	0.18	<0.001	1.72	1.53 - 1.91
Northeastern	0.13	<0.001	1.35	1.25 - 1.45	0.15	<0.001	1.57	1.46 - 1.68
Southeastern	0.18	<0.001	1.43	1.30 - 1.57	0.19	<0.001	1.53	1.40 - 1.67
Southern	0.23	<0.001	1.64	1.40 - 1.88	0.24	<0.001	1.65	1.49 - 1.80
Mid-western	0.23	<0.001	1.59	1.45 - 1.74	0.23	<0.001	1.86	1.67 - 2.05
	Male							
	Capital				Non capital			
	R ²	p	B	CI (95%)	R ²	p	B	CI (95%)
Brazil	0.19	<0.001	1.55	1.46 - 1.63	0.23	<0.001	1.69	1.60 - 1.78
Northern	0.17	<0.001	1.57	1.45 - 1.69	0.23	<0.001	1.69	1.57 - 1.80
Northeastern	0.18	<0.001	1.52	1.43 - 1.62	0.19	<0.001	1.53	1.43 - 1.63
Southeastern	0.18	<0.001	1.51	1.34 - 1.69	0.26	<0.001	1.74	1.55 - 1.92
Southern	0.15	<0.001	1.49	1.31 - 1.68	0.20	<0.001	1.75	1.56 - 1.94
Mid-western	0.25	<0.001	1.72	1.59 - 1.86	0.24	<0.001	1.80	1.62 - 1.97

Note: R² = determination coefficient; B = estimator B; 95% CI = confidence interval

activity domains to “total physical activity”, regardless of gender, type of municipality and region, were, respectively, “extra-school physical activity”, “active commuting” and “Physical Education classes”.

There is agreement between results of the present study and data obtained from PeNSE 2012, in which “extra-school physical activity” made the largest contribution to “total physical activity”, followed by “active commuting” and “Physical Education classes”¹⁰.

Regarding “extra-school physical activity”, it was found that for female adolescents living in capitals, this domain had the greatest contribution to “total physical activity” in the Midwestern region, however, for those who did not live in capitals, the greatest contribution occurred in the Southern region. For males, regardless of type of municipality, “extra-school physical activity” made the largest contribution to “total physical activity” in the Southern region.

One possible explanation for the greater engagement in “extra-school physical activity” in adolescents is their autonomy in choosing the activity to engage in¹³ and the social support offered, especially by friends, for involvement in extra-school physical activities¹⁴.

The result of the present study corroborates with previous study¹⁵ in which there was greater contribution of extra-school sports practice to “total physical activity”. Similarly, study⁹ found that during weekdays, adolescents had higher energy expenditure in sports practiced in the extra-school period. Study¹⁶ found that the practice of “extra-school physical activity” may be a strong predictor of subsequent practice over the years.

For female and male participants living in capitals, “active commuting” made the largest contribution to “total physical activity”, respectively, in

the Northern and Southeastern regions. However, when considering those who do not live in capitals, this domain made the largest contribution to “total physical activity” in the Northeastern and Southern regions for females and males, respectively. These findings are compatible with previous study⁸, who identified the mode of “active commuting” to school as a correlate of levels of physical activity for both sexes. In contrast, Smith, Aggio, Hamer¹⁷ did not identify association between type of commuting and levels of physical activity.

One aspect that should be considered is that, depending on the region of the country, “active commuting” is a compulsory activity, in which sociodemographic and environmental factors can be considered determinant for its practice^{8,18}.

Regarding “Physical Education classes” domain, it was found that adolescents of both sexes and living in capitals presented higher values in the Mid-western region compared to the other regions, indicating greater contribution of this domain to the “total physical activity” accumulation. However, for those who do not live in capitals, the “Physical Education classes” domain made the largest contribution to “total physical activity” for females in the Mid-western region and for males in the Southeastern region. These findings can be explained by the variation in the number of Physical Education classes offered in the different regions, considering that regions with the highest economic development have the highest number of Physical Education classes and greater involvement in physical activity during this period¹⁹.

In this sense, study²⁰ observed that the greater the offer of Physical Education classes, the greater the involvement of students in moderate to vigorous physical activities throughout the day. Similarly, previous studies have found that, on the days when Physical Education classes are offered, increase in levels of physical activities is observed, and the largest increase in these levels occurred mainly in inactive students^{19,21}.

The limitation presented by this study is that the amount of practice in each physical activity domain was self-reported, thus, values may be overestimated or underestimated and may not express the real values of their practice. However, studies have been conducted using subjective methods and the methodological rigor adopted increased the reliability of information collected. As strength, the study has representative sample size and information obtained can be extrapolated, ensuring its internal and external validity.

CONCLUSION

It could be concluded that “extra-school physical activity” make the greatest contribution to “total physical activity”, followed by “active commuting” and “Physical Education classes”. In addition, variation was observed in the contribution of domains by gender, type of municipality and region.

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COMPLIANCE WITH ETHICAL STANDARDS

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Ethical approval

Ethical approval was obtained from the local Human Research Ethics Committee – Conep and the protocol (no. 1.006.467) was written in accordance with the standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the study: JOC, RHOA, RJSS. Performed the experiments: JOC, RHOA, RJSS. Analyzed the data: JOC, RHOA, RJSS. Contributed reagents/materials/analysis tools: JOC, RHOA, ECMS, NMMS, AES, RJSS. Wrote the paper: JOC, RHOA, ECMS, NMMS, AES, RJSS.

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