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Team sports, running, walking: activity-specific associations with perceived environmental factors in adolescents

Esportes coletivos, corrida, caminhada: associações específicas de atividades com fatores ambientais percebidos em adolescentes

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Abstract *This study aimed to analyze the association between the practice of different types of physical activity (PA) with perceived environmental factors in boys and girls adolescents. Were evaluated 1,130 adolescents from Porto Alegre, Brazil. To evaluate different PA, students answered whether or not they practiced walking, running, team sports, and others general PA. Perceived environmental factors were assessed through Neighborhood Environment Walkability Scale for Youth (NEWS-Y). Analyses were performed using logistic regression. Adolescents who reported perceiving a distance up to 20 minutes to walking/running track, had their chances of practicing all types of PA increased in the total sample and for girls. For walking, it was also found an association with access in adolescents. For girls, it was found an association between shortest distance to indoor recreation or exercise facility and other playing fields/court with running and team sports. Aesthetics and road safety were associated with team sports in adolescents. Other general PA were associated with park, bike/hiking/walking trails in the total sample and for girls. Therefore, for each type of PA, specific associations of perceived environmental factors were found.*

Key words *Active transport, Built environment, Public health, Physical activity, Youth*

Resumo *Este estudo teve como objetivo analisar a associação entre a prática de diferentes tipos de atividade física (AF) com fatores ambientais percebidos em meninos e meninas adolescentes. Foram avaliados 1.130 adolescentes de Porto Alegre, Brasil. Para avaliar diferentes AF, os alunos responderam se praticavam ou não caminhada, corrida, esportes coletivos e outras AF em geral. Fatores ambientais percebidos foram avaliados pelo Neighborhood Environment Walkability Scale for Youth. As análises foram realizadas por meio de regressão logística. Adolescentes que relataram perceber uma distância de até 20 minutos para pista de caminhada/corrida tiveram suas chances de praticar todos os tipos de AF aumentadas na amostra total e para as meninas. Para caminhada, também foi encontrada associação com o acesso em adolescentes. Para as meninas, foi encontrada uma associação entre a menor distância para instalações de exercícios e outros campos de jogos/quadra com corrida e esportes coletivos. A estética e a segurança de ruas foram associadas com esportes coletivos em adolescentes. Outras AF gerais foram associadas com parque e trilhas de bicicleta/caminhada na amostra total e para meninas. Portanto, para cada tipo de AF, foram encontradas associações específicas de fatores ambientais percebidos.*

Palavras-chave *Transporte ativo, Ambiente construído, Saúde pública, Atividade física, Juventude*

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Introduction

Despite attempts by several international organizations to change the current scenario[1-3], physical inactivity is an increasingly recurring behavior in different populations[4]. The literature shows that four-fifths of adolescents worldwide do not meet the recommendations for physical activity for health[5]. Brazilian data follow this trend indicating that 78% of boys, and 89.4% of adolescent girls are inactive[6].

It is well known that changing this behavior depends on several aspects. Following the perspective of multiple level of influences, Sallis *et al.*[7] presents an ecological approach to the development of active communities that consider intrapersonal factors, the interaction between the person with the environment, and with the domains of active life, as well as places that allow the physical activity practice and public policies. The current evidence on the relationship between environment and physical activity has indicated that some features of the built environment (e.g., availability of recreation facilities and residential density), as well social supports and perceived pedestrian safety promote physical activity among adolescents[8,9].

Among these aspects, the individual's perception of the built environment has been importantly related with physical activity[10,11]. Studies have shown positive associations between the perceived environment and active commuting[9,12], leisure-time physical activity[13], and physical activity levels[14,15]. Concerning commuting, aspects related to seeing pedestrians and cyclists from inside their homes, safety when crossing the neighborhood streets, and perception of crime were considered relevant for commuting to school at different socioeconomic levels by adolescents and their parents from a Southern city in Brazil[9]. In addition, a study developed with Portuguese adolescents indicated that issues, such as accessibility to facilities, aesthetics, and social environment were associated with the participation of girls in non-guided physical activities by a trainer or other sports authority during leisure-time[16]. Similarly, to the Brazilian data, a meta-analysis that considered studies from different countries indicated a small, but significant association between perceived security of crime, and physical activity levels[11].

Our study looks for advances in the perspective that the current literature presents relationships between physical activity levels, commuting, and leisure-time, with the perceived environment, but not necessarily consider the potential specificity of the effect of different characteristics of the perceived environment on different modalities of physical activity according to sex. This approach was performed previously by Mendonça *et al.*[17] in Northeastern Brazil, a very different region in terms of socioeconomic and cultural characteristics. Therefore, the aim of the present study was to analyze the association between the practices of different types of physical activity with perceived environmental factors in adolescent boys and girls.

Methods

The quantitative cross-sectional approach was used. This study was developed in the city of Porto Alegre, capital of the state of Rio Grande do Sul, southern Brazil. The city has a territorial area of 496,681 km², a demographic density of 2,837.53 inhabitants/km², and approximately 1.4 million inhabitants in the year 2010[18]. Also, according to data from the Planning Environment Department, this city has about 630 public squares, eight public parks, and three conservation units, being considered one of the most forested capitals of the country[19], in which 82.7% of urban households are located on public roads with afforestation[18].

The population of the present study was composed according to the regions, being 15,897 from the Center, 8,057 from the North, 6,423 from the South, and 4,268 from the East. Thus, the study population corresponds to approximately 34,645 high school students enrolled in 71 public schools[20].

The sample selection was realized by multiple phases' procedure[21]. Initially, the schools were selected, accordingly to each region, and then, in the schools, the high school classes were randomly selected. A number was assigned for each school and all numbers were placed in a box, mixed and randomly reelected one by one. Then, data were collected in one class belonging to the first, second, and third year from high school. All students from each class selected were invited to participate in the research. Inclusion criteria were students should sign the assent document manifesting will to participate, as well as handing in the consent document signed by a parent or guardian, and belonging to the first, second, or the third year of high school.

In order to calculate the sample size, the following criteria were considered: a) estimated

population of 34,645 students (N); b) proportion of subjects in the target population 50% (p); c) complementary percentage of 100 minus p value (q); d) degree of confidence of 2 standard deviations (S); and e) acceptable sampling error of 3% (e). After the adoption of these criteria and accordingly to the formula presented below, it was estimated that 1,077 students should be evaluated. However, to avoid probable difficulties with the sample loss, an increase of 5% was assumed, totaling 1,130 youth. This formula was used to have a sample that represents the study population. This calculation was performed using the formula to have a representative sample of the population:

$n= S^2 . p . q . N / e^2 (N - 1) + (S^2 . p . q)$

The software G*power version 3.1 (Heinrich-Heine-Universität - Düsseldorf, Germany) was used to estimate the sample size needed for association analysis. Logistic regression (z-test) were used with normal distribution, test power (1-β=0.85, significance level of β=0.05, odds ratio 1.3, and R^2 0.4. Thus, the minimum sample size was established as 1098 for statistical analysis. Therefore, first, we found the appropriate sample size to estimate a proportion, and then, through G*Power we indicate that this number is adequate to run the regression analysis.

Sample selection considered the proportion of high school students enrolled in the schools by region. Thus, the sample was composed by 518 adolescents from seven schools in the central region (45.88%), 263 adolescents from four schools in the North region (23.26%), 209 adolescents from three schools in the South region (18.54%), and 140 adolescents from two schools in the East region (12.32%).

Regarding data collection, it was carried out in 2017 in approximately eight months, this period corresponds to three different seasons (winter, fall, and spring), however, we verified that there was no significant difference between walking, running, team sports and other general physical activities with the seasons. First, the researcher went to the selected schools, explained the aims of the study, and if the principals agreed to participate, they were asked to sign an acceptance term. Likewise, as mentioned in the inclusion criteria, the adolescents signed the assent form and parents the consent form. Then, data collection was scheduled and questionnaires were filled out during a regular class, corresponding to approximately 45 minutes. Data confidentiality was kept and the research was approved, under number 1,338.597, by the Ethics Committee of Research with Human Beings of the Federal University of Rio Grande do Sul. Another important aspect of the study is that we use the term adolescents even for students over 18 years old, according to Sawyer *et al.*[22] a definition of 10-24 years corresponds more closely to adolescent growth, and popular understandings of this life phase.

The types of physical activities were evaluated using an adaptation of the Self-Administered Physical Activity Checklist, validity and reproducibility values were tested and considered adequate in the Brazilian context[23,24]. Thus, the students answered whether or not they practiced different kinds of physical activity in the last week. The following list of activities was proposed: walking, running, team sports, stretching, martial arts/capoeira/fights, cycling/rpm/spinning, dances (ballroom/ballet), gymnastics (solo/located) and yoga/pilates. For each activity, the answers options were yes or no. Then, the variables walking, running and team sports were used individually, while for the other general physical activities, the other activities on the list were considered.

To measure perceived environmental factors, the version of the Neighborhood Environment Walkability Scale for Youth (NEWS-Y)[25], validated for the Brazilian context was used[26]. This questionnaire evaluates perceived environmental factors that may influence youth physical activity[25]. The questions used were the perceived distance from the student house, walking to a variety of places for physical activity practice, such as 1) Indoor recreation or exercise facility (public or private); 2) Bike/hiking/walking trails, paths; 3) Other playing fields/courts (like soccer, football, tennis, etc); 4) Walking/running track; 5) Small public park (public square); and 6) Large public park (park). The answers options were: "1-5 min", "6-10 min", "11-20 min", "21-30 min", "more than 30 min" and "don't know/there isn't". The option "don't know" was coded as "more than 30 min" because if it is not known whether the facility is within walking distance, the actual walk is likely more than 31 minutes[27]. Also, the NEWS-Y guidelines indicate a scoring to tally the number of stores or facilities within a 5, 10, or 20-minute walk, which was considered near home[27]. Thus, we classify each variable in less than 20 minutes and more than 20 minutes.

Four questions were selected from NEWS-Y, related to the perception of access (There are many places to go (alone or with someone) within easy walking distance of my home), aesthetics (There are many interesting things to look at

while walking in my neighborhood), road safety (Do you feel safe crossing the streets in your neighborhood?), and crime safety (There is a high crime rate in my neighborhood). All the questions had the following answers options: strongly disagree, partially disagree, partially agree, and strongly agree. These answers were dichotomized into agree and disagree.

Socioeconomic status (SES) was assessed through a questionnaire that includes the number of owned items at the adolescents' residences (such as washing machine, bathroom, among others) and the level of schooling of the parent or guardian. By means of the criteria established by the Brazilian Market Research Association, which is a company in the market research area[28]. For each answer, a score was constructed and the sum of the points was done to identify each student's economic class[28]. Then, adolescents were classified into the following economic groups: A1, A2, B1, B2, C1, C2, D, E. For the analyses, the groups were categorized as: high (A1+A2), middle (B1+B2) and low (C1+C2+D+E). Sex, age, and class were assessed in the same questionnaire.

Descriptive data were calculated as absolute and relative values for the total sample and split by sex, considering all variables of the present study. Then, the chi-square test was performed to verify the difference between boys and girls (variables with more than two categories were transformed into dummy variables). Logistic regression for complex sampling procedure were used to test the association between the perceived environmental factors with different types of physical activity (walking, running, team sports and other general physical activities), considering the conglomerates of region and class. The analyzes were split into three models: crude model, adjusted models for age and SES for the total sample and split by sex.

As supplementary material, it was presented the association, carried out through generalized linear regression analyzes, for each category of response from the perception of distance from the house to the facilities with each type of physical activity evaluated in the present study. All analyses were carried out using the IBM SPSS 22 (SPSS, Inc., Chicago, Illinois, USA), confidence intervals (95%) were presented, and a significance level (alpha) of 0.05 was adopted.

Results

A total of 1,130 adolescents (52.7% girls) participated in the study. The most recurrent types of physical activity were walking (48.9%); team sports (44.6%); and running (17.3%). In addition, we grouped as other general physical activities including stretching, fighting styles, dancing, among others, performed by 49.7% of the participants. The most-reported facilities near home by adolescents were public square (74.2%), indoor recreation or exercise facility (45.3%), and other playing fields/courts (44.2%). Also, students reported perceiving good access in the neighborhood (72.5%), interesting things in the neighborhood (36.7%), road safety (64.9%), and a high crime rate (71.0%). Differences were observed between boys and girls in all types of physical activity with the exception of walking, in addition to all variables related to the perception of less distance, aesthetics and road safety. Some variables presented a different sample number (Table 1) because the adolescents did not answered some questions properly.

Table 2 presents the crude and adjusted models for the total sample and split by sex of the association between walking with perceived environmental factors. Regarding perception variables, it was found an association between walking with the shortest distance for walking/running track in all models. Thus, perceiving a distance up to 20 minutes to walking/running track increases the chance of walking, compared to those students who perceive these facilities at a distance greater than 20 minutes from their homes. Access was associated with walking in the crude and adjusted model for the total sample.

In addition, we included as a complementary material the analysis of all responses from the distance to the facilities with different types of physical activity considered in the study. It is possible to observe that the variables other playing fields/courts and walking/running track, were those that showed a closer relationship between the shortest distance and the outcomes (Table 3).

Crude and adjusted associations between running with perceived environmental factors are presented in Table 4. It was found an association of the shortest distance (indoor recreation or exercise facility, walking/running track, and other playing fields/courts) with running only for girls. For example, girls who perceived a distance from their home up to 20 minutes to walking/running track had 2.08 more chances of practice running compared to their peers. In

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addition, the variable walking/running track was associated with running for the crude and adjusted model of the total sample.

Table 5 shows the association between team sports with perceived environmental factors for the total sample and split by sex. The results indicated that team sports were associated with the shortest distance to indoor recreation or exercise facility, other playing fields/courts, and walking/running track for the total sample. In addition, these variables were also associated for girls, along with the shortest distance to park. Con-

Table 1. Descriptive characteristics of participants. Porto Alegre, Brazil, 2017 (n=1,130).

Sociodemographic variables	Total sample n (%)	Girls n (%)	Boys n (%)
Age group (years)			
14-15	208 (18.4)	115 (19.4)	93 (17.5)
16-17	753 (66.6)	408 (68.4)	354 (64.5)
18-19-20	169 (14.9)	73 (12.2)	96 (18.0)*
Socioeconomic status (n=1,113)			
High	202 (18.1)	98 (16.7)	104 (19.8)
Middle	625 (56.2)	317 (54.0)	308 (58.6)
Low	286 (25.7)	172 (29.3)	114 (21.7)*
Class			
First year	569 (50.4)	287 (48.2)	282 (52.8)
Second year	213 (18.8)	121 (20.3)	92 (17.2)
Third year	348 (30.8)	188 (31.5)	160 (30.0)
Region			
Center	518 (45.8)	295 (49.5)	223 (41.8)*
North	255 (22.6)	133 (22.3)	122 (22.8)
South	217 (19.2)	101 (16.9)	116 (21.7)*
East	140 (12.4)	67 (11.2)	73 (13.7)
Types of physical activity (proportion: yes) (n=1,128)			
Walking	552 (48.9)	287 (48.2)	265 (49.7)
Running	195 (17.3)	63 (10.6)	132 (24.8)**
Team sports	503 (44.6)	185 (31.1)	318 (59.7)**
Other general physical activities	561 (49.7)	262 (44.0)	299 (56.1)**
Adolescents' perception of environmental factors			
Distances (proportion: near from home) (n=1,129)			
Indoor recreation or exercise facility (public or private)	512 (45.3)	237 (39.8)	275 (51.5)**
Bike/hiking/walking trails, paths	336 (29.7)	162 (27.2)	174 (32.6)*
Other playing fields/courts (like soccer, football, tennis, etc)	499 (44.2)	225 (37.8)	274 (51.3)**
Walking/running track	367 (32.5)	172 (28.9)	195 (36.5)*
Small public park (public square)	838 (74.2)	424 (71.1)	414 (77.5)*
Large public park (park)	407 (36.0)	190 (31.9)	217 (40.6)*
Access (proportion: agree) (n=1,130)			
There are many places to go within easy walking distance of my home	819 (72.5)	418 (70.1)	401 (75.1)
Aesthetics (proportion: agree) (n=1,130)			
There are many interesting things to look at while walking in my neighborhood	415 (36.7)	192 (32.2)	223 (41.8)**
Road safety (proportion: agree) (n=1,129)			
Do you feel safe crossing the streets in your neighborhood?	733 (64.9)	353 (59.2)	380 (71.2)**
Crime safety (proportion: agree) (n=1,129)			
There is a high crime rate in my neighborhood	802 (71.0)	436 (73.2)	366 (68.5)

Note: *≤0.05; **≤0.001.

Source: Authors.

cerning aesthetics and road safety an association was found only with the total sample.

The associations between other general physical activities with perceived environmental

Table 2. Crude and adjusted association between walking with perceived environmental factors in girls and boys adolescents.

Adolescents' perception of environmental factors	Walking							
	Crude		Total sample*		Girls*		Boys*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Distance								
Indoor recreation or exercise facility (public or private)								
Less than 20 min	1.20	0.63-2.30	1.18	0.66-2.12	1.51	0.46-4.92	0.93	0.88-1.02
More than 20 min	1		1		1		1	
Bike/hiking/walking trails, paths								
Less than 20 min	1.69	0.79-3.61	1.71	0.81-3.59	1.81	0.82-3.96	1.60	0.79-3.24
More than 20 min	1		1		1		1	
Other playing fields/courts (like soccer, football, tennis, etc)								
Less than 20 min	1.43	0.92-2.22	1.38	0.76-2.49	1.84	0.90-3.78	1.03	0.47-2.25
More than 20 min	1		1		1		1	
Walking/running track								
Less than 20 min	1.98	1.56-2.50	1,90	1.61-2.26	2.45	1.63-3.69	1.55	1.06-2.25
More than 20 min	1		1		1		1	
Small public park (public square)								
Less than 20 min	1.47	0.51-4.27	1.40	0.50-3.94	2.03	0.73-5.63	0.89	0.29-2.76
More than 20 min	1		1		1		1	
Large public park (park)								
Less than 20 min	1.50	0.59-3.77	1.48	0.60-3.62	1.92	0.69-5.31	1.16	0.60-2.21
More than 20 min	1		1		1		1	
Access								
There are many places to go within easy walking distance of my home								
Agree	1.39	1.02-1.89	1.40	1.02-1.92	0.58	0.29-1.15	0.89	0.63-1.25
Disagree	1		1		1		1	
Aesthetics								
There are many interesting things to look at while walking in my neighborhood								
Agree	1.18	0.65-2.13	1.18	0.68-2.04	0.64	0.36-1.16	1.06	0.52-2.13
Disagree	1		1		1		1	
Road safety								
Do you feel safe crossing the streets in your neighborhood?								
Agree	0.86	0.48-1.53	0.85	0.47-1.55	1.12	0.61-2.03	1.19	0.38-3.70
Disagree	1		1		1		1	
Crime safety								
There is a high crime rate in my neighborhood								
Agree	1		1		1		1	
Disagree	1.02	0.65-1.60	1.01	0.66-1.55	1.05	0.49-2.23	0.97	0.38-2.47

OR=odds ratio; *Adjusted for age, and socioeconomic status.

Source: Authors.

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factors for the total sample and split by sex are presented in Table 6. Bike/hiking/walking trails, paths, park and walking/running track were associated with other general physical activities, in the total sample and for girls. Thus, living in places where a shorter distance perceived (up to 20 minutes) to all these facilities increases the chances of students to perform other general physical activities.

In an attempt to summarize the results of the present study and make it easy to understand, we added a diagram that presents the main findings (Figure 1).

Table 3. Association between types of physical activity with perceived factors of distance in adolescents.

Adolescents' perception of environmental factors	Walking		Running		Team sports		General PA	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Distances								
Indoor recreation or exercise facility (public or private)								
1-5 min	1.44	1.03-2.00	1.81	1.17-2.79	1.51	1.08-2.10	1.92	1.37-2.68
6-10 min	1.17	0.82-1.67	2.27	1.46-3.53	1.39	0.97-1.98	1.62	1.14-2.32
11-20 min	1.25	0.87-1.79	1.70	1.06-2.72	1.37	0.95-1.95	1.28	0.90-1.83
21-30 min	1.46	0.92-2.32	1.76	0.97-3.17	1.36	0.85-2.16	1.65	1.04-2.63
More than 31 min	1		1		1		1	
Bike/hiking/walking trails, paths								
1-5 min	1.58	1.06-2.36	1.41	0.83-2.37	1.39	0.93-2.07	1.77	1.18-2.64
6-10 min	1.86	1.24-2.78	2.51	1.59-3.97	1.47	0.98-2.18	2.24	1.48-3.39
11-20 min	1.43	0.95-2.14	1.93	1.18-3.15	1.03	0.69-1.56	1.38	0.92-2.07
21-30 min	1.12	0.71-1.78	1.52	0.84-2.73	1.33	0.84-2.11	1.24	0.78-1.97
More than 31 min	1		1		1		1	
Other playing fields/courts (like soccer, football, tennis, etc)								
1-5 min	1.79	1.26-2.54	1.92	1.24-2.97	2.07	1.46-2.94	2.55	1.78-3.64
6-10 min	1.18	0.82-1.68	1.76	1.11-2.77	1.82	1.28-2.61	1.40	1.01-2.09
11-20 min	1.71	1.20-2.42	1.73	1.11-2.71	1.80	1.27-2.54	1.60	1.13-2.26
21-30 min	1.28	0.82-2.01	1.19	0.64-2.22	1.57	1.03-2.46	2.18	1.48-3.45
More than 31 min	1		1		1		1	
Walking/running track								
1-5 min	1.88	1.24-2.84	1.99	1.20-3.30	1.65	1.10-2.49	1.88	1.24-2.85
6-10 min	2.16	1.44-3.25	2.68	1.68-4.28	1.50	1.01-2.23	1.51	1.01-2.25
11-20 min	1.59	1.11-2.27	2.09	1.34-3.25	1.45	1.01-2.07	2.03	1.41-2.93
21-30 min	1.72	1.03-2.85	2.34	1.29-4.24	1.32	0.80-2.19	1.76	1.06-2.93
More than 31 min	1		1		1		1	
Small public park (public square)								
1-5 min	1.45	1.03-2.04	1.83	1.13-2.96	1.28	0.91-1.80	1.81	1.29-2.55
6-10 min	1.76	1.21-2.56	1.48	0.87-2.53	1.43	0.98-2.08	1.52	1.04-2.21
11-20 min	1.88	1.25-2.84	1.39	0.78-2.50	1.18	0.78-1.78	1.60	1.06-2.41
21-30 min	1.14	0.68-1.90	1.65	0.83-3.28	1.28	0.77-2.12	1.25	0.75-2.08
More than 31 min	1		1		1		1	
Large public park (park)								
1-5 min	1.33	0.90-1.96	1.29	0.77-2.15	1.21	0.82-2.01	1.71	1.15-2.54
6-10 min	1.72	1.15-2.57	2.02	1.26-3.24	1.40	0.94-2.09	1.54	1.03-2.29
11-20 min	1.97	1.39-2.79	1.61	1.04-2.48	1.52	1.07-2.14	1.79	1.26-2.53
21-30 min	1.31	0.85-2.02	1.15	0.64-2.07	1.29	0.84-1.98	1.11	0.72-1.70
More than 31 min	1		1		1		1	

OR=odds ratio; PA=physical activity.

Source: Authors.

Table 4. Crude and adjusted association between running with perceived environmental factors in girls and boys adolescents.

Adolescents' perception of environmental factors	Running							
	Crude		Total sample*		Girls*		Boys*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Distance								
Indoor recreation or exercise facility (public or private)								
Less than 20 min	1.54	0.76-3.13	1.42	0.74-2.74	2.68	1.40-5.14	0.88	0.32-2.43
More than 20 min	1		1		1		1	
Bike/hiking/walking trails, paths								
Less than 20 min	1.76	0.55-5.65	1.68	0.47-5.97	3.03	0.80-11.40	1.13	0.37-3.45
More than 20 min	1		1		1		1	
Other playing fields/courts (like soccer, football, tennis, etc)								
Less than 20 min	1.67	0.82-3.39	1.56	0.65-3.70	1.98	1.15-3.40	1.11	0.27-4.48
More than 20 min	1		1		1		1	
Walking/running track								
Less than 20 min	1.98	1.29-3.04	1.81	1.16-2.82	2.08	1.14-3.78	1.68	0.79-3.58
More than 20 min	1		1		1		1	
Small public park (public square)								
Less than 20 min	1.29	0.53-3.12	1.16	0.45-3.00	1.38	0.41-4.60	0.87	0.32-2.41
More than 20 min	1		1		1		1	
Large public park (park)								
Less than 20 min	1.47	0.98-2.22	1.37	0.92-2.05	2.14	0.87-5.25	0.95	0.82-1.10
More than 20 min	1		1		1		1	
Access								
There are many places to go within easy walking distance of my home								
Agree	1.33	0.89-2.01	1.28	0.74-2.21	0.87	0.30-2.49	0.76	0.24-2.43
Disagree	1		1		1		1	
Aesthetics								
There are many interesting things to look at while walking in my neighborhood								
Agree	1.22	0.96-1.55	1.13	0.73-1.75	1.07	0.20-5.57	0.92	0.26-3.28
Disagree	1		1		1		1	
Road safety								
Do you feel safe crossing the streets in your neighborhood?								
Agree	1.10	0.91-1.34	1.07	0.91-1.25	0.69	0.41-1.16	1.28	0.97-1.63
Disagree	1		1		1		1	
Crime safety								
There is a high crime rate in my neighborhood								
Agree	1		1		1		1	
Disagree	1.68	0.69-4.09	1.66	0.66-4.14	1.93	0.23-15.76	1.45	0.87-2.40

OR=odds ratio; * adjusted for age, and socioeconomic status.

Source: Authors.

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Table 5. Crude and adjusted association between team sports with perceived environmental factors in girls and boys adolescents.

Adolescents' perception of environmental factors	Team sports							
	Crude		Total sample*		Girls*		Boys*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Distance								
Indoor recreation or exercise facility (public or private)								
Less than 20 min	1.21	0.91-1.59	1.18	1.01-1.38	1.72	1.54-1.92	0.94	0.65-1.38
More than 20 min	1		1		1		1	
Bike/hiking/walking trails, paths								
Less than 20 min	1.33	0.60-2.94	1.29	0.61-2.74	1.68	0.95-2.96	0.92	0.43-1.96
More than 20 min	1		1		1		1	
Other playing fields/courts (like soccer, football, tennis, etc)								
Less than 20 min	1.84	1.24-2.73	1.84	1.44-2.36	2.03	1.56-2.65	1.32	0.59-2.95
More than 20 min	1		1		1		1	
Walking/running track								
Less than 20 min	1.74	1.48-2.05	1,72	1.56-1.89	2.48	1.31-4.66	1.29	0.84-1.98
More than 20 min	1		1		1		1	
Small public park (public square)								
Less than 20 min	1.37	0.69-2.72	1.35	0.83-2.21	1.17	0.64-2.12	1.22	0.58-2.57
More than 20 min	1		1		1		1	
Large public park (park)								
Less than 20 min	1.32	0.95-1.82	1.28	0.83-1.98	1.82	1.33-2.47	0.80	0.28-2.25
More than 20 min	1		1		1		1	
Access								
There are many places to go within easy walking distance of my home								
Agree	1.48	0.64-3.40	1.45	0.65-3.23	0.61	0.19-1.96	0.79	0.34-1.85
Disagree	1		1		1		1	
Aesthetics								
There are many interesting things to look at while walking in my neighborhood								
Agree	1.43	1.16-1.77	1.45	1.04-2.05	0.79	0.58-1.08	0.90	0.46-1.78
Disagree	1		1		1		1	
Road safety								
Do you feel safe crossing the streets in your neighborhood?								
Agree	1.19	1.09-1.29	1.19	1.08-1.32	0.93	0.79-1.10	0.91	0.65-1.28
Disagree	1		1		1		1	
Crime safety								
There is a high crime rate in my neighborhood								
Agree	1		1		1		1	
Disagree	1.27	0.91-1.77	1.24	0.88-1.75	1.04	0.65-1.67	1.32	0.89-1.96

OR=odds ratio; *Adjusted for age, and socioeconomic status.

Source: Authors.

Table 6. Crude and adjusted association between other general physical activities with perceived environmental factors in girls and boys adolescents.

Adolescents' perception of environmental factors	Other general physical activities							
	Crude		Total sample*		Girls*		Boys*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Distance								
Indoor recreation or exercise facility (public or private)								
Less than 20 min	1.58	0.81-3.06	1.57	0.99-2.50	1.58	0.78-3.17	1.45	0.63-3.35
More than 20 min	1		1		1		1	
Bike/hiking/walking trails, paths								
Less than 20 min	1.92	1.16-3.17	1.87	1.36-2.58	2.14	1.21-3.78	1.61	0.56-4.59
More than 20 min	1		1		1		1	
Other playing fields/courts (like soccer, football, tennis, etc)								
Less than 20 min	1.65	1.01-2.72	1.54	0.92-2.59	1.48	0.96-2.29	1.48	0.53-4.14
More than 20 min	1		1		1		1	
Walking/running track								
Less than 20 min	1.81	1.23-2.67	1.74	1.18-2.57	1.86	1.18-2.91	1.62	0.57-4.60
More than 20 min	1		1		1		1	
Small public park (public square)								
Less than 20 min	1.73	0.61-4.84	1.58	0.67-3.73	1.50	0.50-4.48	1.61	0.85-3.03
More than 20 min	1		1		1		1	
Large public park (park)								
Less than 20 min	1.66	0.84-3.28	1.63	1.01-2.62	1.76	1.07-2.91	1.41	0.59-3.37
More than 20 min	1		1		1		1	
Access								
There are many places to go within easy walking distance of my home								
Agree	1.39	0.75-2.56	0.74	0.40-1.37	0.94	0.53-1.65	0.56	0.12-2.62
Disagree	1		1		1		1	
Aesthetics								
There are many interesting things to look at while walking in my neighborhood								
Agree	1.21	0.74-1.98	0.82	0.54-1.25	0.86	0.57-1.30	0.84	0.39-1.83
Disagree	1		1		1		1	
Road safety								
Do you feel safe crossing the streets in your neighborhood?								
Agree	1.01	0.76-1.35	0.97	0.69-1.38	1.08	0.65-1.79	0.98	0.59-1.60
Disagree	1		1		1		1	
Crime safety								
There is a high crime rate in my neighborhood								
Agree	1		1		1		1	
Disagree	1.14	0.62-2.10	1.14	0.60-2.14	1.00	0.41-2.40	1.24	0.50-3.06

OR=odds ratio; *Adjusted for age, and socioeconomic status.

Source: Authors.

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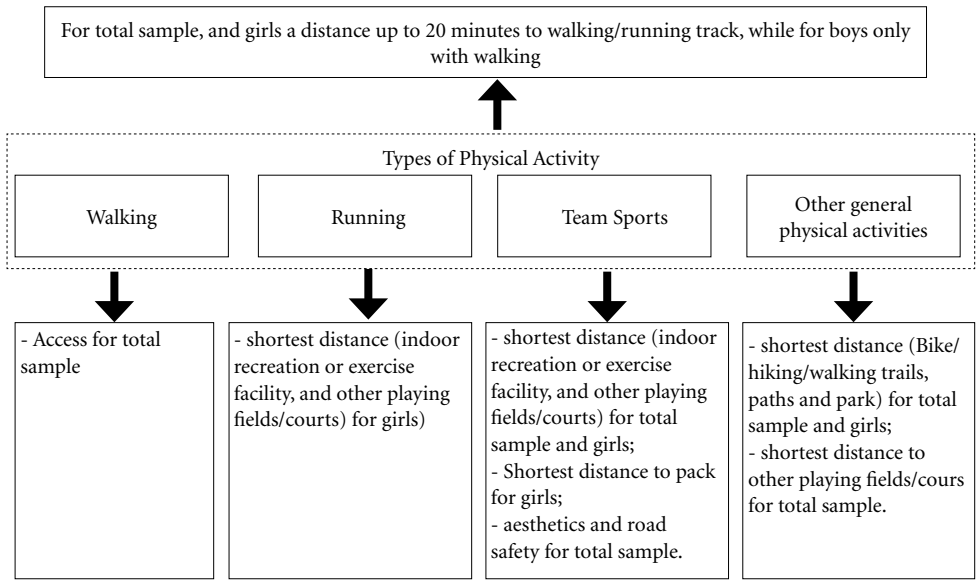

Figure 1. Summary of the main results of the present study.

Source: Authors.

Discussion

Results of the present study indicated that perception variables from the shortest distance to different facilities, access, aesthetics, and road safety were specifically associated with walking, running, team sports, and other general physical activities in adolescents. Thus, perceiving a distance up to 20 minutes to walking/running track, increases the chance of all types of physical activity, compared to those students who perceive these facilities at a distance greater than 20 minutes from their homes. Considering the role of sex, these associations were observed only for girls. Additionally, walking was associated with access in the total sample. Running was associated with indoor recreation or exercise facility (public or private) and other playing fields/courts only for girls, while team sports showed the same associations for the total sample and for girls. The shortest distance to park was associated with team sports, and also aesthetics and road safety. Regarding other general physical activities, the results showed an association with bike/hiking/walking trails and park in the total sample and for girls.

The perception of the shortest distance (up to 20 minutes) from neighborhood recreation facilities was associated with all types of physical activity evaluated in the present study. Similarly, the distance from open spaces was associated with leisure physical activity of girls in Argentine[29]. In Brazil, specifically in the southern region, the shortest distance to public squares/parks, beaches, and leisure facilities was positively associated with general physical activities practice, as well as moderate and vigorous physical activity during leisure[30-32]. We emphasize the relevance of our findings since walking/running track was related to walking, running, team sports, and other general physical activities. Indeed, the perception of the shortest distance to different spaces intended for physical activity is essential for adolescents to be more active and play sports.

In agreement with our results, a systematic review indicated that difficult access to public facilities was associated with physical inactivity in East Asian adolescents[33]. Furthermore, access to the destination was positively associated with active transportation to school for Nigerian adolescents[34]. Duncan *et al.*[35] found that accessibility to facilities was related to moderate and vigorous physical activity in American girls. Regarding the perception of aesthetics, our data showed an association with the other general physical activities of adolescents, which is in accordance to the literature[17,36]. Indeed, the relationships between the perception of access and aesthetics with different types of physical activity were observed in adolescents.

Likewise, the perception of safety was associated with team sports only for adolescents. A meta-analysis showed that participants who feel safe from crime have 27% more likely to engage in physical activity[11]. Also, adolescents from Poland and Czech Republic who perceived the neighborhood's environment as safer were more likely to meet the recommendations for leisure-time walking[37]. Esteban-Cornejo *et al.*[38] found that parent-perceived crime safety was positively associated with active transport and physical activity in the parks in American adolescents. A study carried out in Brazil showed that the perception "the neighborhood is not violent" was associated with the active commuting of adolescents[17]. Therefore, a safe environment can encourage students to be more active, and to practice different sports.

Considering the influence of sex, the perception of the shortest distance to different facilities (<20 minutes) was associated with types of physical activity for girls, while for boys the only variable associated was walking/running track. Indeed, Pereira *et al.*[14] found an association between shorter distance to local facilities with physical activity practice in Portuguese boys and girls. In addition, Lima *et al.*[30] reinforce these differences between sex, showing that the distance, and the number of leisure facilities in the neighborhood influence the pattern of physical activity among adolescents. This study showed that the number of facilities near home was positively associated with physical activity in boys, while distance (>31 minutes) to sports courts was inversely associated with strength training in girls. When considering this sex inequality, it is relevant to emphasize the importance of developing strategies aimed at promoting physical activity practice during leisure, in this case especially for adolescents, which may imply an increase in physical activity levels and improvements in health parameters.

Therefore, the findings of the present study reinforce the relevance of the perception of an environment with favorable characteristics for the practice of physical activity and sports, which can contribute to increasing physical activity levels of adolescents. In this sense, our study adds to the current literature showing that the perceived environmental aspects are differently related with each type of physical activity in adolescents, being one of the first studies to approach different modalities of physical activity in Brazilian adolescents. However, some limitations must be considered, such as the cross-sectional study that does not allow the cause and effect relationship. Also, the use of few items that do not consider the quality of the environment characteristics could affect in the present results. Physical activity was assessed subjectively, then we recognize the recall bias, although, the period that adolescents should remember was not a long retroactive time (only seven days). Finally, for assess on domains and types of physical activity, the instrument used is considered adequate.

The main findings of the present study (summarized in Figure 1) present the importance of observing and evaluating different physical activity practices associated with environmental factors, since for each type of activity the associations were specific, except for shortest distance to walking/running track that were associated with all types of physical activity assessed in the total sample and for girls. Another relevant issue is the encouragement of these sports practices and physical exercises for the young population, which can be performed not only in schools but also in leisure time, in active commuting, in environments outside of school, such as parks, public squares, bike paths, among others. In addition, these data can serve as a support for making political decisions and defining public strategies to make the city more active, covering the entire population. From these data, future studies should try to seek causal inferences and take into account the following aspects: environmental factors adding objective measures of the environment, impact of improvements in the infrastructure of the built environment, social and individual factors, as well as the influence of each type of specific physical activity, mainly in the young population.

In conclusion, the shortest distance to neighborhood recreation facilities, access, aesthetics, and road safety was associated with different types of physical activity in adolescents. Also, specific associations were observed according to sex. Taking these aspects into considerations, the public policy strategies must consider specific environmental aspects of the neighborhood in order to promote various types of physical activity and sport. Thus, an important factor to be considered in the development of intervention aimed to increase physical activity levels is the perception of the neighborhood's environmental characteristics.

Collaborations

AF Dias participated in the creation of the project, data collection, data analysis, interpretation of results and writing of the article. CF Fochesatto and C Brand participated in the analysis of the data, interpretation of the results and writing of the article. I Crochemore-Silva, J Mota, AR Gaya participated in the interpretation of the results, writing of the article and revision of the final version. ACA Gaya participated in the creation of the project, interpretation of the results, methodological analysis of the article and revision of the final version.

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