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Perceived barriers to leisure-time physical activity and associated factors in adolescents

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Abstract *The objective of this study was to identify the prevalence of perceived barriers to leisure-time physical activity in teenagers and to examine the possible association of these barriers with leisure-time physical inactivity. This cross-sectional study was conducted in 2011 and a representative sample of 1,409 high school students from public schools in the city of Londrina/Paraná was selected through multistage sampling. For data collection, the adolescents completed a questionnaire. The relationship between leisure-time physical inactivity (<300 minutes/week) and perceived barriers was analyzed by calculating the prevalence ratio (PR) in Poisson regression models. "Lack of friends company" was the most prevalent barrier for both girls (75.8%) and boys (58.7%). "Feel lazy" for girls (PR: 1.21; CI 95%: 1.08 to 1.36) and "prefer to do other things" for the boys (PR: 1.48; CI 95%: 1.01 to 2.15) were the barriers most strongly associated with leisure-time physical inactivity. For both genders, a strong dose-response relationship was observed between the number of perceived barriers and leisure-time physical inactivity. The perception of barriers was associated with a higher prevalence of leisure-time physical inactivity in adolescents and should therefore be considered in actions for promoting physical activity in this population.*

Key words *Motor activity, Adolescent health, Risk factors*

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Introduction

Chronic noncommunicable diseases are the leading cause of morbidity and mortality in Brazil and tend to negatively affect the quality of life of the population[1]. With the aim of tackling this situation, the Ministry of Health has implemented some policies, such as the Strategic Action Plan for the Combat of Chronic Noncommunicable Diseases in Brazil 2011-2022, including the prevention and reduction of physical inactivity as one its objectives, which is considered a modifiable risk factor for four of the major disease groups (circulatory, cancer, chronic respiratory and diabetes)[2]. This attention on physical activity by the Ministry of Health is justifiable when you consider that more than half the population over 14 years of age do not practice physical activity[3] which, in addition to being associated with health benefits[2], is recognized as a fundamental right of all[4], due to its potential to influence important values for life in society.

Despite the fact that chronic noncommunicable diseases associated with physical inactivity generally manifest themselves during adult life, their development appears to begin during childhood and adolescence[5]. Thus, it is recommended that children and adolescents accumulate at least 60 minutes of physical activity daily, predominantly aerobic and of moderate to vigorous intensity[6]. However, the National Study of School Health (PeNSE) pointed out that more than 50% of Brazilian adolescents do not meet the minimum recommended amount of physical activity[7].

Faced with the high number of young people in Brazil who do not meet the recommendations, identifying factors associated with physical activity could contribute to the development of actions that aim to change this situation[8]. Among the various factors that could lead to a greater understanding of this situation is increased knowledge of the perceived barriers to physical activity. This topic has been gaining attention in investigations in the context of studies on determining factors related to this behavior. A barrier is a construct derived from the Health Belief Model and can be understood as aspects deterring or preventing the realization of a behavior that has a relationship with health, especially if it exceeds the perceived benefits[9,10].

Research has pointed out that the perceived barriers have an inverse association with leisure-time physical activity in adolescents[11-13], therefore the greater the number of barriers perceived by young people, the less likely they are to engage in adequate levels of physical activity. However, it is important to consider that the majority of studies have been conducted in developed countries, which may not be generalizable in the Brazilian context, due to the socio-cultural differences, the physical environment and public policies, among others. In Brazil six cross-sectional observational studies were found on perceived barriers to physical activity in adolescents[14-19]. Regarding the results, the prevalence varied widely among these investigations, making it difficult to attempt to provide a summary of the most prevalent barriers. For example, lack of company was reported by 9.4% and 48.7% of girls from Sao Paulo/SP[14] and Curitiba/PR[16], respectively. Of these six studies, one investigated the association of perceived barriers to total physical inactivity[16], and another with leisure-time[17]. In both studies, the presence of the barriers feel lazy, lack of time and weather were associated with a higher prevalence of the analyzed outcomes. Although these findings may contribute to the development of actions to promote physical activity, some considerations must be taken into account: a) the evidence derived from such studies may be considered incipient in terms of the enormous cultural, social and environmental diversity of Brazil; b) some studies used instruments that have not been validated for adolescents[17-19], adapted from questionnaires developed for adults[17,19] and/or with little representation from the general population of adolescents[14,15,18].

Considering the aforementioned, identifying the magnitude with which certain perceived barriers are associated with leisure-time physical inactivity among adolescents will contribute to an increase in the knowledge on this issue as well as on more specific actions which should be devised, seeking to remove or reduce identified barriers and therefore increase the effectiveness of interventions and public policies to promote leisure-time physical activity involving young people. Thus, this study had two objectives: a) to identify the most prevalent perceived barriers to leisure-time physical activity among girls and boys in Londrina, Paraná; b) to investigate the possible association between such perceived barriers and leisure-time physical inactivity in the same population.

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Methods

Sample

This cross-sectional study was conducted in the first half of 2011, with a representative sample of the population of 14,258 adolescents enrolled in secondary education in public schools located in the urban area of Londrina, Paraná.

To calculate the sample size a population size of 14,258 students was used, with an estimated prevalence of physical inactivity of 50% and a tolerable sampling error of five percentage points. To calculate the sample size for association studies, a ratio of eight to one was used between subjects unexposed and exposed to the barriers, the expected percentage of leisure-time physical inactivity among unexposed subjects was 85%, while among exposed subjects this value was 95%. Both for prevalence and association, a confidence level of 95%, 80% power and design effect of 1.5 were adopted. The parameters used for the calculation were based on results of previous studies on barriers to physical activity among Brazilian adolescents[14,16].

To estimate the prevalence of barriers to physical activity 561 subjects were necessary. However, to examine the association between barriers and leisure-time physical inactivity 1,323 individuals were required (this value was adopted as a reference).

To obtain the sample, cluster sampling was carried out in multiple stages. In the first stage, the sample unit adopted was the school; among the 42 in the city, two were randomly selected from each of the five geographical regions (Central, East, North, West and South), totaling 10 schools. Next, from the 99 high school classes in the 10 schools, 60 were selected, respecting the proportions of students per time of day in school (morning or night) and geographical region of the city. Finally, all students aged from 14 to 19 years in the 60 randomly selected classes were invited to participate. All information used in the sampling process was provided by the Regional Center of Education in Londrina.

Instrument

Evaluation of the perceived barriers to leisure-time physical activity was performed using an instrument developed and validated by Santos et al.[20], with adolescents in the city of Curitiba, Paraná. The instrument evaluates 12 barriers, namely "lack of facilities nearby ", " not knowing locations", "friends living far away", "there is nobody to take", "weather", "prefer to do other things", "feel lazy", "lack of motivation", "so much homework", "lack of time", "lack of friends company" and "at home nobody does". Each item of the instrument has four answer choices: Strongly Disagree, Disagree, Agree and Strongly Agree. The adolescents were classified according to the absence (Disagree or Strongly Disagree) or presence (Agree or Strongly Agree) of each barrier.

Leisure-time physical activity was evaluated using section four of the International Questionnaire of Physical Activity, long version[21]. This section contains six questions that cover the number of days and daily time spent on recreational, sport, exercise and leisure physical activities, performed in the seven days immediately prior to the administration of the questionnaire. The physical activities during Physical Education classes were disregarded. The score for leisure-time physical activity was established based on the time spent on walking and moderate activities. In addition, the time spent on vigorous activities was multiplied by two. For the purposes of analysis, individuals with a score <300 minutes of physical activity per week were considered inactive in leisure.

In addition to the above described perceptual and behavioral variables, the following factors were also collected: a) gender (female, male); b) age in years, which was subsequently used to create the variable age group (14-15 years, 16-17 years, 18-19 years); c) time of day in school (morning, evening); d) education of the individual responsible for the teenager which was used to create the parents' education (secondary school or less, high school, graduate); e) skin color (yellow, white, brown, black, indigenous); f) self-reported height and body weight, which were used to calculate the body mass index in kg/m^2 according to the critical reference values specific to age and sex proposed by Cole et al.[22] (eutrophic, overweight/obesity). In all analyzes, the variables and their respective categories were treated exactly as presented in this paragraph.

In order to test the reproducibility of the instrument questions a pilot study was conducted. Fifty-seven adolescents participated, one group from the morning period and the other from the night period, both composed of students from the first year of high school in public schools in Londrina, Paraná. The application and reapplication of the test occurred at an interval of five days. The results of the reproducibility related to the categorical variables presented agreement

ranging from moderate to perfect, according to the Kappa index: lack of facilities nearby (0.94), friends living far away (0.90), at home nobody does (0.88), prefer to do other things (0.81), so much homework (0.81), not knowing locations (0.78), feel lazy (0.77), lack of friends company (0.75), lack of time (0.69), weather (0.67), lack of motivation (0.64), there is no body to take (0.56), leisure-time physical inactivity (0.75), skin color (1.0) and parents' education (1.0). With regard to the numerical variables, the intraclass correlation coefficient demonstrated adequate correlations: height (0.97) and weight (0.99).

Data collection and ethical issues

A physical education professional with experience in data collection applied the questionnaire directly in the classrooms. The application of the instrument took 20-25 minutes of class time. To reduce missing data (e.g., blank responses or questions with two marked responses), after the completion of the application the interviewer remained in the classroom for the remainder of the class verifying the responses, so that students who did not answer some questions or had answered any questions mistakenly could be requested to make the correction.

All subjects presented a free and informed consent form signed by their parents or by the student themselves if they were 18 years of age or over. This study forms part of a larger project that was approved by the Ethics Committee in Research involving human beings of the State University of Londrina (No. 238/2010).

Tabulation and analysis of the data

The data were entered using Epi-Info. For the descriptive analysis the distribution of absolute and relative frequencies was used, while for the bivariate analysis the chi-square test was used for heterogeneity or linear trend. Crude and multivariable prevalence ratios were calculated through Poisson regression with robust variance. As suggested by the literature[23], the multivariable analysis was based on a previously developed conceptual model; one being built for boys and one for girls. The first level of influence included parents' education, age and skin color; the second level included body mass index and time of day in school; all perceived barriers were encompassed in the third level. The variables were only entered into the next level when $p \leq 0.10$ and furthermore, having met this statistical criterion, the variable was maintained until the final model. Thus, the final model for the boys included parents' education and, as barriers: lack of facilities nearby, weather, prefer to do other things, feel lazy, lack of motivation and lack of friends company. The girls' model included parents' education and time of day in school, and for the barriers: not knowing locations, friends living far away, prefer to do other things, feel lazy, lack of motivation and so much homework. A 5% level of significance was adopted to test the association between physical inactivity and perceived barriers. Due to the complex sample design, the survey (svy) commands from Stata 9.0 software were used.

Results

Among the 60 high school classes visited in the public schools, 1,476 students were invited to take part in the study. Sixty-seven students refused to participate and/or did not present the signed consent form. Thus, the final sample consisted of 1,409 subjects (loss rate = 4.5%).

Of the 1,409 respondents, the majority were female (54.9%), the average age was 16.1 ± 0.5 years for boys and 15.9 ± 0.4 years for girls; 63.4% of boys and 68.9% of girls studied in the morning period, the majority were classified as eutrophic (boys: 74.7%, girls: 86.2%); and 79.0% of boys and 80.3% of girls reported that the parents had an education level below college degree. With respect to leisure-time physical inactivity, the proportion of girls who practiced less than 300 minutes per week was higher than that of boys (80.8% vs. 48.9%; $p < 0.001$).

Table 1 presents the prevalence of all perceived barriers to the practice of physical activity during leisure time according to gender. Except for "not knowing locations" and "lack of time" there were statistically significant differences between girls and boys in the proportion of all perceived barriers, with the prevalence being higher in females in all comparisons. Among the boys, only one of the 12 investigated barriers presented a prevalence greater than 50%, while among the girls, five barriers were higher than this value. The three most prevalent barriers among the males were: lack of friends company (58.7%), lack of time (43.7%) and so much homework (39.8%). Among the girls, lack of friends company (75.8%) was also the most prevalent; however the second and third most reported barriers were: prefer to do other things (64.1%) and weather (54.9%), respectively.

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Table 2 presents the prevalence of perceived barriers to leisure-time physical activity, stratified by age group, nutritional status and parents' education. The twelve barriers investigated, six (prefer to do other things, feel lazy, lack of motivation, weather, there is nobody to take and lack of friends company) were excluded solely on Table 2 because they do not have statistically significant association with any of the three independent variables investigated in this table (age group, nutritional status and parents' education). In the girls, it was observed that age group was associated with the following barriers: "not knowing locations", "friends living far away" and "lack of time". In all cases, the most prevalent of these barriers was observed in the oldest age group (18-19 years). In the boys, only the barriers "friends living far away" and "lack of time"

Table 1. Prevalence of perceived barriers to leisure-time physical activity in accordance with gender. Londrina, Paraná, Brazil, 2011.

Barrier	% total	% boys	% girls	p
Psychological, cognitive and emotional				
Prefer to do other things	51.3	35.8	64.1	< 0.001
Feel lazy	40.9	25.8	53.2	< 0.001
Lack of motivation	33.5	25.1	40.5	0.002
Personal organization				
Lack of time	46.5	43.7	48.8	0.10
So much homework	46.0	39.8	51.2	< 0.001
Cultural and social				
Lack of friends company	68.1	58.7	75.8	< 0.001
At home nobody does	34.3	28.8	38.8	0.003
Friends living far away	29.3	24.3	33.3	0.003
There is nobody to take	20.2	15.9	23.6	0.01
Physical environment				
Weather	45.1	33.2	54.9	< 0.001
Lack of facilities nearby	39.8	33.5	45.0	0.01
Not knowing locations	26.3	24.0	28.2	0.11

Table 2. Prevalence of perceived barriers to leisure-time physical activity, by age group, nutritional status and parents' education. All analyzes were stratified by gender. Londrina, Paraná, Brazil, 2011.

	Physical environment				Cultural and social				Personal organization			
	Lack of facilities nearby (%)		Not knowing locations (%)		Friends living far away (%)		At home nobody does (%)		Lack of time (%)		So much homework (%)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Age group (years)	*0.55*	*0.09*	*0.30*	*0.004*	*0.04*	*0.01*	*0.43*	*0.09*	*0.02*	*0.003*	*0.21*	*0.30*
14-15	35.3	40.3	25.4	21.7	21.8	35.3	25.4	38.9	32.5	38.3	34.5	46.5
16-17	33.7	46.7	24.6	31.4	27.2	30.1	30.1	36.4	46.7	53.3	40.3	54.0
18-19	28.3	54.6	17.6	35.4	17.8	45.0	31.3	53.4	57.0	65.5	50.3	53.4
Nutritional status	*0.70*	*0.84*	*0.65*	*0.09*	*0.80*	*0.77*	*0.95*	*0.90*	*0.68*	*0.21*	*0.33*	*0.02*
Overweight/obesity	31.5	44.4	21.8	24.5	25.5	31.8	29.0	38.5	42.6	56.8	37.9	64.3
Eutrophic	34.2	45.1	24.7	28.8	24.0	33.5	28.8	38.8	44.0	47.5	40.4	49.1
Parents' education	*0.04*	*0.04*	*0.06*	*0.23*	*0.15*	*0.45*	*0.01*	*0.01*	*0.47*	*0.38*	*0.31*	*0.40*
Secondary school or less	36.0	50.6	26.1	31.7	20.7	34.6	37.6	47.0	46.2	51.7	36.7	54.6
High school	34.3	43.4	25.8	26.4	26.6	30.8	27.8	36.1	*41.5*	45.1	41.8	48.3
Graduate	27.3	37.2	16.5	27.8	26.7	36.0	*14.5*	28.3	*43.1*	50.7	41.7	50.4

Note: Italics value indicates p-values.

were associated with age group. In the case of "friends living far away," the intermediate age group (16-17 years) was the most prevalent for this barrier. The barrier "lack of time" was more prevalent among the older age group (18-19 years). Regarding nutritional status, no association with the barriers was found among the boys. Among the girls, the barrier "so much homework " was associated, and its occurrence was higher in students with excess weight. With respect to the parents' education, there was an association in both genders for the variables "lack of facilities nearby " and "at home nobody does". In these cases, the adolescents whose parents had a lower level of education reported higher prevalence of these barriers.

Tables 3 and 4 present the prevalence ratios, crude and adjusted, of leisure-time physical inactivity according to the perceived barriers, for boys and girls respectively. Considering the boys, in the crude analysis, an association was observed with all 12 barriers to leisure-time physical inactivity. After the adjustment, seven barriers remained associated: prefer to do other things (PR = 1.48), feel lazy (PR = 1.42), lack of facilities nearby (PR = 1.34), lack of motivation (PR = 1.32), so much homework (PR = 1.31), weather (PR = 1.31) and lack of time (PR = 1.26). With regard to the girls, eight barriers presented association in the crude analysis. After the adjustment, six remained associated with the studied outcome: feel lazy (PR = 1.21), prefer to do other things (PR = 1.16), not knowing locations (PR = 1.14), so much homework (PR = 1.12), lack of motivation (PR = 1.09) and friends living far away (PR = 1.07). In Figure 1 it can be seen that the prevalence of leisure-time physical inactivity in both genders presented a positive relationship with the number of perceived barriers. The prevalence of leisure-time physical inactivity among those who perceived six or more barriers was 7.83 and 6.53 times higher for boys and girls, respectively, when compared to their peers who reported no barriers.

Discussion

This study identified a high prevalence of barriers to leisure-time physical activity in a representative sample of high school public school students, with "lack of friends company" and "there is nobody to take" being the barriers with the highest and lowest prevalence, respectively for both genders. In addition, the failure to perform 300 min/week of leisure-time physical activity was associated with perceived barriers in the four studied domains, in that "prefer to do other things" and "feel lazy" were the two barriers most strongly associated with the investigated outcome, in girls and boys.

In the comparison between genders, the results of this study are in accordance with the literature[16,19], by pointing out that, in general, perceived barriers to leisure-time physical activity are more prevalent among girls. This difference in the perception of barriers between genders has practical relevance as it indicates that actions to

Table 3. Prevalence ratios (crude and adjusted) for leisure-time physical inactivity according to perceived barriers in boys (n = 624). Londrina, Paraná, Brazil, 2011.

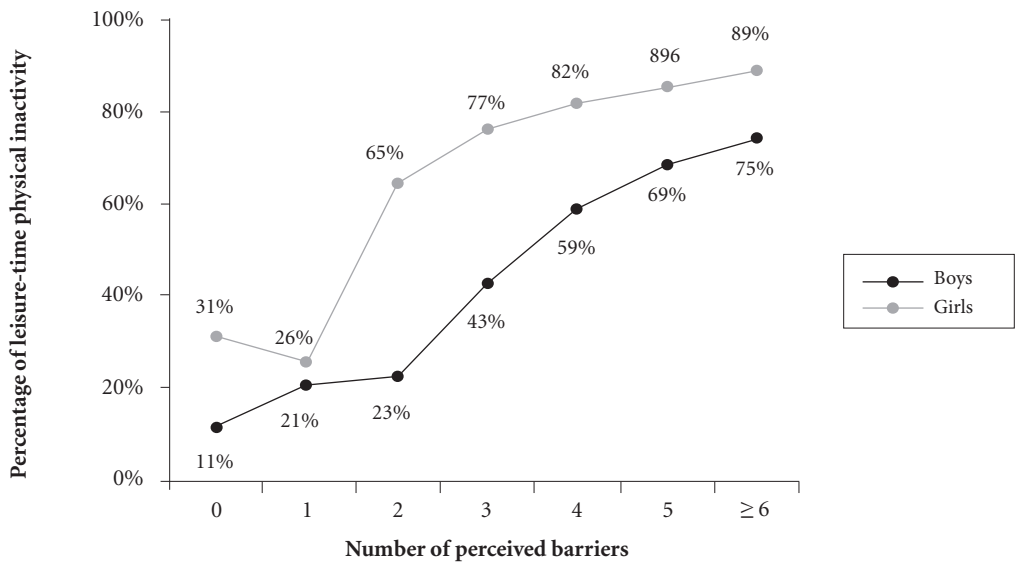
Barrier	Crude			Adjusted[a]		
	PR[b]	(95% CI)[c]	p	PR	(95% CI)	p
Prefer to do other things	2.06	(1.48-2.88)	0.003	1.48	(1.01-2.15)	0.05
Feel lazy	2.11	(1.91-2.34)	< 0.001	1.42	(1.01-1.98)	0.05
Lack of facilities nearby	1.63	(1.24-2.14)	0.01	1.34	(1.06-1.69)	0.02
Lack of motivation	1.93	(1.57-2.38)	< 0.001	1.32	(1.02-1.72)	0.04
So much homework	1.55	(1.18-2.04)	0.01	1.31	(1.01-1.70)	0.05
Weather	1.54	(1.23-1.93)	0.004	1.31	(1.09-1.57)	0.01
Lack of time	1.43	(1.18-1.73)	0.01	1.26	(1.04-1.52)	0.03
There is nobody to take	1.48	(1.08-2.01)	0.02	1.22	(0.94-1.58)	0.11
Friends living far away	1.46	(1.14-1.88)	0.01	1.14	(0.93-1.40)	0.15
Lack of friends company	1.39	(1.12-1.72)	0.01	1.11	(0.97-1.26)	0.09
Not knowing locations	1.53	(1.17-2.01)	0.01	1.09	(0.89-1.35)	0.32
At home nobody does	1.53	(1.24-1.89)	0.003	0.99	(0.83-1.20)	0.95

[a] Adjusted for parents' education and barriers. [b] PR = Prevalence ratios. [c] 95% IC = Confidence interval 95%.

Table 4. Prevalence ratios (crude and adjusted) for leisure-time physical inactivity according to perceived barriers in girls (n = 785). Londrina, Paraná, Brazil, 2011.

Barrier	Crude			Adjusted[a]		
	PR[b]	(95% CI)[c]	p	PR	(95% CI)	p
Feel lazy	1.30	(1.14-1.47)	0.003	1.21	(1.08-1.36)	0.01
Prefer to do other things	1.32	(1.19-1.46)	0.001	1.16	(1.06-1.27)	0.01
Not knowing locations	1.13	(1.03-1.25)	0.02	1.14	(1.03-1.26)	0.02
So much homework	1.18	(1.05-1.32)	0.02	1.12	(1.02-1.24)	0.03
Lack of motivation	1.22	(1.12-1.33)	0.002	1.09	(1.00-1.19)	0.05
Friends living far away	1.10	(1.03-1.16)	0.01	1.07	(1.03-1.11)	0.01
At home nobody does	1.15	(1.09-1.22)	0.001	1.06	(0.99-1.13)	0.06
Lack of friends company	1.14	(1.02-1.28)	0.03	1.04	(0.94-1.15)	0.33
Lack of facilities nearby	1.07	(0.94-1.22)	0.22	1.03	(0.94-1.11)	0.48
Weather	1.07	(0.96-1.20)	0.17	1.00	(0.91-1.10)	0.95
There is nobody to take	1.03	(0.90-1.19)	0.57	0.99	(0.84-1.16)	0.82
Lack of time	1.08	(0.96-1.22)	0.16	0.97	(0.89-1.06)	0.45

[a] Adjusted for parents' education, time of day in school and barriers. [b] PR = Prevalence ratios. [c] 95% IC = Confidence interval 95%.



Graphic 1. Prevalence of leisure-time physical inactivity according to the number of perceived barriers (n = 1.409). Londrina, Paraná, Brazil, 2011.

promote physical activity during leisure time for this population should take into consideration that girls perceive more obstacles (barriers). Thus, the development of different strategies between genders seems to be necessary to ensure that greater numbers of adolescents, especially females, start physical activity practice in this domain. This difference in perception of barriers between boys and girls may also be related to symbolic systems that naturalize housework and delicate temperament as being of women, while men are assigned the role of family provider and

aggressive personality[24]. Therefore, gender equality policies are important.

For both genders the most reported barrier was "lack of friends company", a result consistent with the literature. An investigation conducted with adolescents in Curitiba, Paraná, pointed out the same barrier as the most prevalent for both girls and boys[16]. Moreover, this finding is also consistent with qualitative research conducted with American teenagers, in which the young people reported that the opinion of friends can influence the decision to perform physical activity[25,26]. Two aspects are worth mentioning regarding this result: the first draws attention to the importance of social support from friends in the practice of leisure-time physical activity in this age group. This aspect seems to be justified when considering that adolescence is a phase during which young people begin to display some independence from the family and begin to strengthen group ties with friends, so that the opinion of the members of this new group becomes relevant in decision-making related to health behaviors[27]. The second important aspect of this result is that it indicates that, during adolescence, actions to promote physical activity could be more effective if they address both the subject and the related social network.

"Lack of time" was a barrier reported by almost half the respondents of both genders. Its high perception among adolescents is in agreement with the results of quantitative[12,16] and qualitative[25,26] research, in which lack of time was cited as a major obstacle to the practice of leisure-time physical activity among adolescents. Considering this barrier presented a positive association with age group, it is plausible to assume that it relates to responsibilities outside school hours, such as: work, time spent on household activities, preparation for entry into university and entry into the labor market, among others.

"Lack of facilities nearby" was inversely associated with the parents' education, indicating that adolescents with low socioeconomic status may have more difficulty to practice leisure-time physical activity, due to the lack of public physical activity facilities. One possible explanation for this finding is that young people with higher socioeconomic level, when faced with a lack of public facilities for physical activity, can opt for private spaces, while those with lower socioeconomic status have difficulty to access private facilities for physical activity. Moreover, the facilities for physical activity tend to be located in higher socioeconomic status regions, which could even indicate inequality[28,29]. In other words, public policy, rather than focusing on the principle of equity and favoring people who need it the most, ends up favoring people who theoretically need these actions less.

This is a finding that deserves attention, considering that the lack of safe and good quality public facilities for physical activity, may be contributing to the increase in health inequities in the study population, by hindering the practice of leisure-time physical activity among young people of lower socioeconomic status. In addition, it is important to note that build environment is recognized by the literature as an important facilitator of this physical activity[29]. Thus, providing a favorable physical environment for physical activity should be considered in order that actions to address chronic noncommunicable diseases are more effective.

Independent of gender and even after the adjusted analysis, the two barriers most strongly associated with non-participation of at least 300 min/week of leisure-time physical activity were "prefer to do other things" and "feel lazy". With respect to the first barrier, it is possible that the association can best be explained by the results of qualitative research, to which the respondents reported that the willingness to practice physical activity during leisure time is overcome by preference for technological activities such as watching television, playing with electronic games on the computer/game console, surfing the internet and talking on the phone[25,26]. With regard to "feel lazy", it is believed that, to some extent, this may reflect a low level of motivation for leisure-time physical activity. Thus, the strong association found between this barrier and the outcome investigated is not surprising, since the theoretical model proposed by Iso-Ahola and St. Clair[30] assumes that motivation is the principle and most immediate determinant of human behavior, such as physical exercise. From a practical point of view, motivation appears to be related to pleasure, therefore, various measures can be taken to encourage adolescents to experience this sensation, for example, offering a wide range of activity options, and those that have cultural meaning, so that the young person can choose an activity with which they have greater affinity and/or is more closely related to their culture. It is important to be cautious when considering these results regarding the barriers "feel lazy" and "prefer to do other things" principally not to blame the individual and ignore the fact that the practice of leisure-time physical activity depends on many

factors, which go beyond the will and preferences of the subjects individually.

Despite presenting high prevalence, some barriers were not associated with the failure to practice 300min/week of leisure-time physical activity. This lack of association may be partly explained by the difficulty in detecting the magnitude with which two factors are associated, when the independent variable has a high prevalence, as was the case, for example, for the barrier "lack of friends company" , which presented an overall prevalence of 68.1% in this investigation. In any case, it is important to consider both the prevalence of each barrier as well as the magnitude of its association with physical activity.

One problem with studies on barriers to physical activity in adolescents is that it is common to evaluate them by means of instruments adapted from the adult population. It is believed that studies which use this type of selection run the risk of evaluating barriers that are not relevant for the population studied. Therefore, one positive point of the present study is the instrument used to assess perceived barriers, as it was validated and developed through focus groups conducted with Brazilian adolescents of the same State in which the study was conducted[20]. Another positive point to highlight of this study is the low sample loss as well as the representativeness and sufficient size of the sample, which allow for greater confidence in extrapolating the results to the population investigated.

Despite the above positive points, some methodological considerations should be taken into account. First, the cross-sectional design does not allow establishment of a causal relationship between barriers and leisure-time physical inactivity. Second, all measures of the study were obtained through a questionnaire, which could present response bias. However, the pilot study, conducted in order to test the reproducibility of all items of the instrument, presented results with adequate values for all variables. Finally, this study did not evaluate young people who are outside the formal education system or students from private schools, who may present different characteristics in relation to public education. In any case, one should consider that the majority of the Brazilian adolescent population attends school and this proportion has increased in recent years[31]. Moreover, the number of Brazilian adolescents enrolled in the private school system is well below that of the public system[31].

In the present study, a strong and positive dose-response relationship was observed between the number of perceived barriers and leisure-time physical inactivity. In the adjusted analysis it was found that, among girls barriers in the four dimensions studied were identified as factors associated with leisure-time physical inactivity (psychological, cognitive and emotional; cultural and social; physical environment; and personal organization), while among boys, barriers in the first three dimensions were identified as factors associated with the same health condition. From this perspective, helping to overcome the barriers could be an important strategy for confronting leisure-time physical inactivity in adolescents as well as the public health problem. In addition, by identifying barriers in different domains, this study reinforces the models/theories[32] departing from the premise that actions to promote physical activity are most effective when they enable alterations in factors from different domains, such as: intrapersonal, social, physical environment and public policies. Interventions in factors with multiple dimensions are highly complex and require multisectoral coordination[33]. Therefore, it is believed that dialogue is required between sectors such as health and education, among others, strengthening and enhancing existing initiatives and creating new strategies in order to promote physical activity among adolescents. Specifically with respect to the health sector, this can play an important role, especially as it already has some initiatives such as the School Health Program, one of the goals of which is coordination between schools and the primary health care network.

Contributors

DF Dias worked on every stage of the research and manuscript; MR Loch and ERV Ronque worked on the revision of the manuscript.

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