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Intensity and duration of physical efforts in Physical Education classes

ABSTRACT

OBJECTIVE: To evaluate the intensity and duration of physical efforts in Physical Education classes in primary and secondary school.

METHODS: School-based cross-sectional study carried out by means of the observation of 218 Physical Education classes, including a total of 272 students (each one of the students was evaluated three times). The study was carried out in the city of Pelotas (Southern Brazil), between August and December 2009. In order to evaluate the intensity of the efforts, accelerometers were used and the following cut-off points were adopted (in counts per minute): sedentary activities (0-100), light activities (101-2,000), moderate (2,001-4,999), vigorous (5,000-7,999), and very vigorous activities (>8000).

RESULTS: The mean duration of the classes was 35.6 minutes (SD 6.0). The mean proportion of time spent in moderate to vigorous physical activity was 32.7% (SD 25.2). Boys (44.1%) were involved significantly more in moderate to vigorous physical activity as compared to girls (21.0%; $p<0.01$). Students who practice physical activities outside the classes participated more in moderate to vigorous physical activity in the Physical Education classes.

CONCLUSIONS: Besides the fact that Physical Education classes have a short duration, students practice moderate to vigorous physical activity during one third of the class, with a poor significant contribution to students' level of physical activity.

DESCRIPTORS: Students. Physical Education and Training. Motor Activity. Physical Exertion. Cross-Sectional Studies.

INTRODUCTION

The world scenario regarding the main causes of morbidity and mortality has been changing for some decades. Infectious diseases have been progressively replaced by non-communicable diseases and injuries (NCDI).[16] Public health studies have been increasingly aiming to answer questions that identify and characterize the reasons for such changes and to evaluate forms of mitigating their consequences.

According to the World Health Organization (WHO),[a] 4.9 million people die every year as a result of tobacco consumption, 2.6 million because they are overweight or obese, 4.4 million due to high total cholesterol levels and 7.1 million due to high blood pressure. Physical activity is related to at least three of these factors: overweight and obesity, high total cholesterol levels and blood pressure.

[a] Organização Pan-Americana da Saúde. Prevenção de doenças crônicas um investimento vital. Brasília (DF); 2005.

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Health-related behaviors, such as the practice of physical activity, are largely incorporated in childhood and adolescence and tend to be maintained in adulthood,[1,15] which indicates that special attention should be given to this portion of the population in NCDI prevention. A recent study showed high prevalence of physical inactivity, inadequate food habits and alcoholism in Brazilian adolescents.[7]

The school configures an opportunity to approach children and adolescents in order to foster knowledge and habits that promote an active lifestyle, especially by means of the curricular Physical Education classes. To a significant portion of youths, the school activities are the only opportunities to develop significant physical activities, and schools have shown good results in interventions targeted at their promotion.[8,b] In a systematic review study in Latin America, the group of Physical Education classes was the only one that presented conclusive evidences of effectiveness among the studied interventions for the promotion of physical activity.[13]

The practice of physical education may be linked to diverse objectives, which vary among individuals. However, as a health modulation instrument, this practice causes physiological adaptations in the search for balance in the organism's functions and should be committed to intensity, duration and frequency.[19] The recommendation is at least 60 minutes per day of moderate to vigorous activities in the majority of the weekdays for children and adolescents.[3] Vigorous intensity can promote additional benefits compared to moderate intensity,[20] but the benefits of the latter are also recognized. Although with methodological differences, studies have shown high prevalence of physical inactivity in this population.[11,18,23] Even with extensive literature presenting the benefits of physical activity for children's and adolescents' health,[10,24] the levels of fitness and physical activity seem to decline in this stage.[14,25]

The approach to school programs regarding physical activity and its relation to health, how these programs are organized or whether these themes are tackled are little known in Brazil. Not much is known about whether Physical Education promotes activities with enough intensity, duration and frequency so as to bring benefits to students' health. The few studies that have been found indicate that Physical Education classes present short periods in which the intensity is sufficient to cause physiological adaptations in students.[8,12]

The aim of this study was to analyze the intensity and duration of physical efforts and associated factors in Physical Education classes in primary and secondaryschool.

METHODS

School-based, cross-sectional study carried out in the city of Pelotas, Southern Brazil, from August to December 2009. The city is located in the south of the State of Rio Grande do Sul and has a population of approximately 320,000 inhabitants. The study was developed by means of observations of Physical Education classes, with evaluation of physical activity through accelerometry and interviews with students.

The largest sample size that was necessary was calculated based on an estimate of the time of the classes that was spent in vigorous physical efforts. The sample size was 777 observations (not individuals) through accelerometry, considering a margin of error of two percentage points, a level of confidence of 95% and a 10% addition for possible losses and refusals.

The lists with all the city's schools were obtained for sampling. The urban schools with complete primary education and the secondary schools remained for the draw (n = 110). Eleven primary schools and eight secondary schools were drawn, stratified by teaching network (municipal, state-run, federal and private). Three schools drawn for the secondary level coincided with schools drawn for the primary level, totaling 16. One class was drawn to each year of primary school (from the fifth year onwards) and of secondary school.

Four students from each classroom were randomly drawn, two boys and two girls, and were observed during three classes. The evaluation of 68 classrooms, 272 students, 246 classes (classrooms separated according to gender) and 816 observations through accelerometry (39 more than what was necessary) was estimated.

There were 21.3% of losses of observations through accelerometry due to the student's absence in the Physical Education class and to the accelerometer's failure during data collection.

A questionnaire was developed for this study and contained sociodemographic questions; teaching level, network and year; whether the student liked to participate in Physical Education classes, whether he/she participated in guided physical activities outside the class period and, in case he/she did, how many times per week. The students' weight was measured through a digital scale (students without their shoes and wearing minimum clothing). Their height was measured by means of a metric tape fixed on the wall one meter from the floor (students without their shoes and with their backs to the wall).

[b] World Health Organization. Promoting physical activity in schools: an important element of a health-promoting school. Geneva; 2007. (WHO Information Series on School Health, 12).

The classification of students' body mass index (BMI) was performed according to the proposal by Cole et al,[5] considering the children's and adolescents' age and sex in order to determine overweight and obesity.

Physical activity was evaluated by means of Actigraph accelerometers, model GT1M, with five-second epoch programming. The accelerometer was fixed on the students' waist from the beginning to the end of the Physical Education class. In order to categorize the physical activity levels, the following cut-off points were adopted (in counts per minute): sedentary activities (0-100), light activities (101-2,000), moderate (2,001-4,999), vigorous (5,000-7,999), and very vigorous activities (≥ 8000). The categories moderate, vigorous and very vigorous were grouped to compose the outcome "moderate to vigorous physical activities (MVPA)".[21] The total time spent in MVPA was recorded for each class.

The initial time of each class was written down when at least 51% of the students were present and the final time, when at least 51% had left the space. This record was used to calculate the duration of each class. The measure of the outcome (mean proportion of class time spent in MVPA) was obtained by dividing the mean class time spent in MVPA by the mean total duration of the classes.

The instruments were administered by trained Physical Education students. The questionnaires were checked and doubly keyboarded in the program EpiInfo 6.0. After checking the keyboarded questionnaires, the data were transferred to the program STATA 10.0 for analysis. Descriptive analysis (absolute and percentage number for categorical variables, and mean with standard-deviation (SD) for numerical variables) was carried out. The mean proportion differences were evaluated with Student's t-test (variables with two categories) and one-way analysis of variance (variables with three or more categories). The level of significance was 5%.

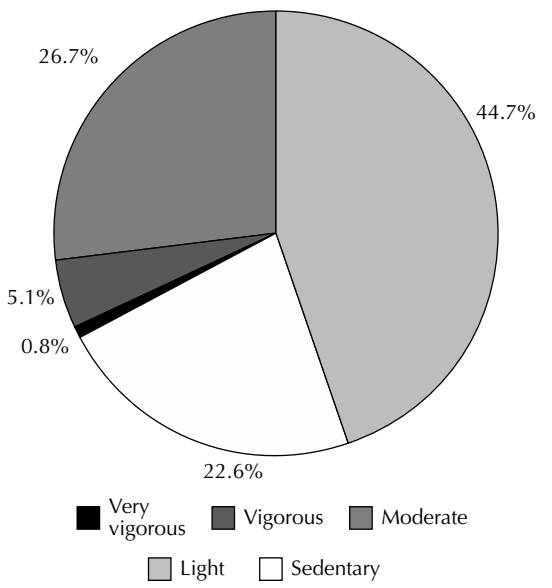

Figure 1. Proportion of class time spent in different intensities of physical activity. Pelotas, Southern Brazil, 2009.

Table 1. Students according to school variables. Pelotas, Southern Brazil, 2009.

Variable	N	%
Teaching network		
Municipal	86	33.7
State-run	74	29.0
Federal	12	4.7
Private	83	32.6
Teaching level		
Primary education	171	67.1
Secondary education	84	32.9
Year		
5th primary school	43	16.9
6th primary school	46	18.0
7th primary school	39	15.3
8th primary school	43	16.9
1st secondary school	31	12.2
2nd secondary school	28	11.0
3rd secondary school	25	9.9

The study was conducted with the consent of the Municipal Education Department and Regional Education Coordination of each school, of the teachers and of the students' guardians. The study was approved (opinion no. 040/2009) by the Research Ethics Committee of Escola Superior de Educação Física of Universidade Federal de Pelotas.

RESULTS

Of the 272 students, 6.2% did not obtain any valid accelerometry datum and were excluded of the other analyses. The sample contained 50.2% of female students, with mean age of 14.3 years (SD 2.8), predominantly with white skin color (72.6%). The majority of students studied at public schools (67.4%) and were enrolled in primary school (67.1%) (Table 1).

The mean proportion of students' participation in MVPA in the classes was 32.7% (SD 25.2). The mean duration was 35.6 minutes (SD 6.0) and the mean time spent in MVPA was 12.3 minutes (SD 9.7) (Figure 1).

Male students (44.1%) presented a mean proportion of class time in MVPA that was significantly higher than that of female students (21.0%; $p < 0.01$). There was no statistically significant difference between public and private schools, but the mean proportion of MVPA in the federal network was significantly higher (49.3%; SD 27.6; $p < 0.01$) than that of the municipal (33.9%; SD

Table 2. Mean proportion of class time spent in moderate to vigorous physical activities according to independent variables. Pelotas, Southern Brazil, 2009.

Variables	Mean proportion (%)	Standard deviation (%)	p
Sex			
Male	44.1	26.4	<0.001*
Female	21.0	17.6	
Age (years)			
10 to 12	33.7	23.5	0.40**
13 to 15	34.1	25.1	
16 or more	29.2	26.7	
Skin Color			
White	31.7	24.6	0.49*
Non-white	34.2	26.6	
Body Mass Index			
Normal	32.1	25.2	0.78*
Overweight/Obesity	34.2	25.4	
Teaching network			
Public	31.5	27.0	0.26*
Private	35.2	21.0	
Year			
5th primary school	33.1	20.1	0.69**
6th primary school	36.6	28.4	
7th primary school	35.2	24.4	
8th primary school	33.2	28.0	
1st secondary school	29.4	24.0	
2nd secondary school	28.4	25.3	
3rd secondary school	27.3	26.2	
Likes to have Physical Education classes			
No	22.0	23.1	0.07*
Yes	33.3	25.2	
Practice of guided physical activity outside the classes			
No	28.7	23.3	<0.01[a]
Yes	37.8	26.8	

* T-test
** One-way analysis of variance
[a] Cut-off points suggested by Cole et-al.[5]

28.6), state-run (24.8%; SD 22.4) and private (35.3%; SD 21.0) networks. Practice of guided physical activities outside the Physical Education classes was reported by 50.7% of the boys and 31.1% of the girls, and was positively associated with the proportion of time spent in MVPA (Table 2).

The variable "likes to have Physical Education classes" was not associated with higher proportions of MVPA, neither in the general sample nor in the sex-stratified analysis. In this study, 3.7% of the boys and 11.8% of the girls reported that they did not enjoy having Physical Education classes. The other variables did not present association with the proportion of time spent in MVPA in the classes.

The theoretical period of the Physical Education classes varied from 35 to 50 minutes, with the majority of the classes (81.7%) presenting theoretical periods that lasted 45 minutes or more. However, the real mean duration was 35 minutes. The private network presented a higher mean duration (38. 7 minutes) compared to the other networks and the municipal network presented the lowest mean (33.3 minutes). Figure 2 represents the mean time of the classes during which the students remained in MVPA.

DISCUSSION

The low mean proportion of class time in MVPA (32.7%) in the present study was coherent with what was observed in other studies.[9,12] Even with different methods of physical activity calculation, Hino et al[12] showed proportions of 26.3% for moderate activities and 8.7% for vigorous activities, totaling 35% of MVPA. In another study, the proportion of moderate activities was 16% and, despite the higher proportion of vigorous activities in relation to the other studies (15%), the total proportion in MVPA was similar.[9]

The mean duration of the Physical Education classes (35 minutes) indicates that some of the classes do not have their duration fully used. Similar mean times for classes' duration were found by other researchers in Brazil[9] and in the USA.[17] Changing uniforms and moving from the classroom to the space where the classes take place may explain the difference between available time and the real time of development of the classes.

The low mean time effectively spent in MVPA occurs due to classes with short total duration and low proportions of MVPA. Two other studies[9,17] have shown similar results, with mean times of 17 minutes and 12 minutes for MVPA. So that health-related benefits occur as a result of the practice of physical activity, individuals must be submitted to moderate and/or intense efforts occurring during a determinate period.[19,22]

Physical Education classes have suffered a reduction in the USA, mainly in the more advanced years, in favor of disciplines that are present in academic knowledge evaluations and tests that are similar to *vestibulares* (university entrance tests).[26] In Brazil, there is no scientific evidence of the reasons for the reduction in classes duration and frequency, although they are probably the same.

[c] Trost SG. Active education: physical education, physical activity and academic performance. San Diego (CA): Robert Wood Johnson Foundation; 2009.

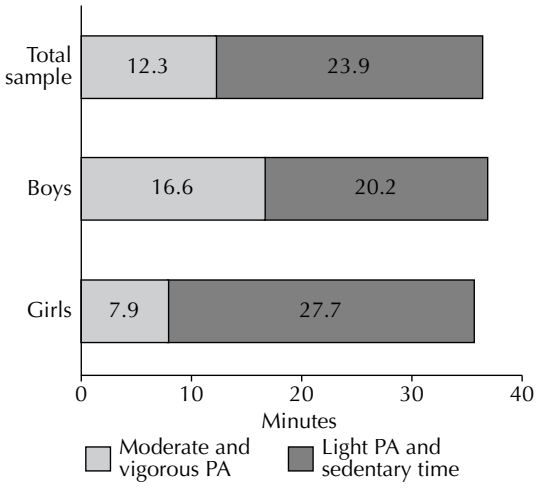

Figure 2. Mean of class minutes spent in different intensities of physical activity. Pelotas, Southern Brazil, 2009.

A review has shown that, even with time reduction, the performance of physical activities acts positively over academic performance[c] by means of diverse mechanisms. Better academic performances are associated with higher intensities of physical activity.[4] Higher levels of physical fitness are related to better academic performance, suggesting that physically active children and adolescents are likely to achieve better results.[26]

Boys presented a significantly greater engagement in MVPA than girls, in agreement with other studies.[6,12] The difference in physical activity practice between females and males can be explained by social and/or cultural differences.[27] Nevertheless, in the school environment, it is expected that the offer of time, space and possibilities of engaging physical activities are the same to all individuals. This difference can be explained by students' motivation to attend the classes.

Enjoying the classes or not did not present significance in relation to the outcome. However, the number of children who reported not to enjoy the Physical Education classes may have been underestimated. Even though this variable was collected without the presence of the teacher, the students may have been afraid of answering this question because they were inside the school, because they did not know the interviewer or because they believed that the information might be given to the teacher, and this may have influenced the result. Even with this limitation, the differences between sexes can be explained by the taste for the Physical Education classes: girls reported that they did not enjoy participating in the classes more than boys.

The level of physical activity decreases with the increase in age in adolescence,[2,18] although the physical efforts undertaken in the Physical Education classes did not differ according to age groups, which suggests that the reduction in the other studies is explained by a decrease in physical activity outside the school. This result may be explained by the obligatoriness of practice in the Physical Education classes, which leads to minimum participation in the developed activities.

The MVPA proportion was not different between the public and private networks. However, after the stratification of the public network, the federal network presented a positive association with MVPA proportion. We have not found studies that evaluated the intensity of the Physical Education classes in different teaching networks, which prevented comparisons. No explicit relationship was found to explain such association, as the determinants of students' engagement and the development of Physical Education classes are little studied. In addition, there are two federal schools in the city, and one of them was part of the sample. Thus, specific characteristics of the federal school may have influenced the results, perhaps more than the teaching network.

Students who practice guided physical activities outside the school period presented a higher proportion of MVPA during classes. This may be explained by the taste for the classes, higher among those who practice physical activity outside the school.

Students and teachers knew when data were being collected due to the observer's presence and the utilization of the accelerometer. Thus, the teacher might alter the classes' routine, and the students might present a different behavior because they were using the accelerometer. However, this behavior alteration, if it existed, may have occurred in the increase in the physical activities' duration and intensity, which makes the results be even more worrisome.

The low proportion of time spent in the classes in physical efforts whose intensity is enough to produce physiological adaptations, as well as the short duration of these stimuli are important, but not sufficient, findings. Knowledge about Physical Education classes and teaching programs is still limited. New studies that aim to identify the factors that influence the development of the classes, as well as the determinants of students' practice of physical activities in Physical Education classes should be conducted.

Students spend little time in physical activities in the school and the short periods occur with intensity that is at least moderate, but both should be higher. Although one of the responsibilities of Physical Education classes is the autonomy for the practice of physical activities, they could have a more significant contribution to the students' level of physical activity.

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