Patterns of Moderate to Vigorous Physical Activities and daily Compliance with Guidelines for Youth

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Abstract: Physical inactivity is a well-documented risk factor for coronary heart disease and it is associated with increased risk for several chronic diseases. Current health-related physical activity recommendations for youth call for at least 60 min·d-1 of moderate-to-vigorous physical activities (MVPA) daily as part of their lifestyle. The aim of this study was to compare the compliance among boys and girls with 60 minutes of Moderate to Vigorous Physical Activities (60MVPA) daily. A random sample of 210 (12-18 years) boys and girls was evaluated from Porto region. The following measurements were carried out: weight, height, Body Mass Index (BMI), and PA levels (accelerometers). The study was conducted during 7 consecutive days. Our results showed that there was a difference in the compliance of 60MVPA between boys and girls, in both weekdays and weekend days (p<0.05). The compliance with PA guidelines for girls ranged between 19.4% (Saturday) and 70.6% (Friday) while in boys the data ranged between 47.7% (Sunday) and 84.6% (Friday). However, only 15% of boys and 7% of girls accomplished the 60MVPA criteria everyday.

Key Words: Physical activity, children, guidelines.

INTRODUCTION

Childhood obesity is linked to several risk factors associated with chronic diseases [1-3] that might be tracking into adulthood [4, 5]. Thus, prevention of overweight and obesity in children seems to be the best way of preventing these adult diseases [6]. The preventive measures should be focus on those who are not yet overweight especially in the inactive children.

Moreover, despite evidence on the social, health, and personal benefits of physical activity, many people still choose not to exercise. The value of physical activity to normal growth and development, including the health and well being of children and adolescents is well established [7-9]. The health benefits of regular physical activity for children and adolescents include building and maintaining healthy bones, controlling weight, decreasing body fat, increasing muscle mass, decreasing blood pressure, and reducing anxiety and depression [9].

Accordingly, promoting physical activity and healthy lifestyles has become a public health priority worldwide. Furthermore, exercise or increasing physical activity is one of the cornerstones of pediatric obesity treatment, along with dietary and behavior change [10], and it is essential for children's current and future health [11].

Because of the growing awareness of the health benefits of regular physical activity, public health guidelines for physical activity have been established. Several of these guidelines focus on youth [8, 12, 13], and current

recommendations call for at least 60 min·d-1 of moderate-to-vigorous physical activities, daily as part of their lifestyle.

Although different studies have addressed the question of the 60 MVPA accomplishments with regard different accelerometer cut-points [14, 15] epoch length [15, 16] and gender [17, 18], they mostly showed the percentage or prevalence of those whom accomplished that guideline. Despite that very little attention has been paid with regard the percentage of youth whom accomplished this guideline daily. As a matter fact most of the studies analyzed the total amount of weekly MPVA divided by the number of days monitored and assumed the accomplishment of weekly MVPA. However, PA showed a large variation across day [17, 19, 20] and, therefore, differences in the compliance of guidelines accomplishment might be seen.

Thus, the aim of this study was to compare the compliance among boys and girls with the daily MVPA recommendations for youth.

METHODS

The sample was recruited from 3 different schools in Porto district, and consisted of 210 (12-18 years) boys (n, 80; age, 15.1 ± 1.6; weight, 62.4 ± 14.3; height, 168.6 ±11.1; BMI, 21.7 ± 3.6) and girls (n, 130; age, 14.8 ± 1.8; weight, 53.7 ± 9.5; height, 159.1 ±6.6; BMI, 21.2 ± 3.3), that were evaluated in schools premises, in classrooms and gym . Weight, percentage of fat mass (Tanita Inner Scan, model BC 532), waist circumference (WaistC), Heigth (Holtain Stadiometer) and PA levels (GT1M, ActiGraph, LLC), were evaluated in accordance with standard procedures. The activity monitor (GT1M) was used as instrument to objectively measure daily PA. Body Mass Index (BMI) was calculated from the children's height and weight [weight (Kg)/height^2 (m)]. Children and adolescents were classified in categories

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of BMI, as normal, overweight and obese, in accordance with internationally agreed procedures [21].

Objective and Outcome Measures

Physical activity was objectively measured for seven consecutive days using the GT1M accelerometer (ActiGraph, LLC, Pensacola, FL, USA). The students went trough the anthropometric evaluations, and in the same day was explained to children and adolescents how to use the accelerometer, and they were allowed to ask questions about all the procedures. The GT1M was initialized to start collecting data in the next day at 6.00AM, and researchers went back to school to collect them after 8 days, in order to assure the complete 7 days of evaluation. The use of this monitor to measure physical activity in children has been described previously [22-24]. Before each test period and for every child, the activity monitors were tested for updated firmware and battery life, during initialization of units. For the present study, the epoch duration or sampling period was set at 1 min. and the output was expressed as counts per minute (counts.min^{-1}). The accelerometer was placed in a small nylon pouch and firmly adjusted at the child's waist by an elastic belt over the non-preferred hip. A log was given to children's and their parents, and they were instructed to record the time when the monitor was attached in the morning and detached in the evening. They were also instructed to note every time the child performed any restricted activities like showering and swimming.

For the purposes of this study, only the total counts provided by the accelerometer were used in the analyses. Counts from the accelerometer were averaged to determine the mean count per minute for the intensity of each physical activity. Therefore, the physical activity variables were expressed in counts per minute (activity counts divided by minutes of monitored activity). The daily time spent in MVPA (>3 MET) was calculated by summing the minutes of moderate, vigorous and very vigorous physical activities for each day. The age-specific count ranges corresponding to the intensity levels developed by Freedson *et al.* [25]

were adopted. The gender and age-specific count ranges corresponding to the intensity levels were derived from the energy expenditure prediction equation (r = 0.94; standard error of the estimate = 1.19) developed by Freedson *et al.* [26], for a pediatric population. This equation accounted for 90% of the variance in observed MET levels and predicted energy expenditure during treadmill running and walking within +1.1 METs. This procedure has previously been used in other populations [27] and similar cultural context [28].

Statistical Procedures

Means and standard deviations of the main variables, and the total time spent in MVPA were calculated For this analysis, we only considered MVPA because youth health-related PA guidelines stress health-related participation in MVPA. Differences in MVPA, daily and weekly, between genders were obtained with independent samples t-test. The chi-square test (χ^2) was used to determine the differences in the prevalence's in different days, and the amount of days with adherence to the guidelines. The level of significance was set at an alpha level of p<0.05. Statistical analysis was performed using SPSS (*Statistical Package for the Social Sciences*) 15.0 for Windows (SPSS Inc, Chicago, IL).

RESULTS

The participants' characteristics are shown in Table **1**. Regardless the time period considered (daily or weekly) boys were significantly (p<0.05) more physically active than girls. Additionally our data also showed that on average children were quite active.

Our results (Fig. **1**) show that there's a difference in the adherence to 60MVPA between boys and girls, during nearly all the days of the week and weekend (p<0.05).

When comparing results in the different days of the week, we can observe that in girls the percentage, meeting the guidelines for a day, fluctuate between 19.4% (Saturday) and 70.6% (Friday). When comparing boys we can look at values between 47,7% (Sunday) and 84.6% (Friday).

Table 1. Mean ($\overline{X}$) and Standard Deviation (SD) of Age, Weight, Height, Waist Circumference (WaistC), Body Mass Index (BMI), Moderate to Vigorous Physical Activities (MVPA; Weekly and Daily); Percentage of Normal Weight, Overweight and Obese Children, and Statistical Differences Between Genders (p value; [*] Independent Samples t-test; [#] Chi-square test)

Variables	Boys		Girls		p
	$\overline{X}$	SD	$\overline{X}$	SD	
Age (years)	15.1	1.6	14.8	1,8	0,241[*]
Weight (Kg)	62.4	14.3	53.7	9,5	0,000[*]
Height (cm)	168.6	11.1	159.1	6,6	0,000[*]
WaistC (cm)	78.6	9.8	73.8	8,3	0,001[*]
BMI (Kg/m^2)	21.7	3.6	21.2	3,33	0,249[*]
MVPA (min.week^{-1})	624.7	243.3	428.4	403,5	0,000[*]
MVPA (min.day^{-1})	89.2	34.8	61.2	27,7	0,000[*]
Normal-overweight-obese (%)	72.5-17.5-10		83.8-12.3-3.8		0.000-0.000[#]

Actually, when we analyze all children that accomplish the recommendations of 60MVPA during all days of the week (7 days) only 15% of boys and 7% of girls meet the criteria (Fig. **2**). Interesting to note that if we only consider the adherence to the recommendations in 5 or more days during a week, boys would accomplish with 53.7% of the recommended guidelines, whilst girls achieve 24.6%. On the other end if we consider those that didn't accomplish the

guidelines in 3 or less days/week, 29.3% of boys and 60% of girls would be considered as inactive.

DISCUSSION

The main finding of this study was the estimates of the prevalence of compliance to activity guidelines ranged from 7,7%-15% (7 day; for girls and boys) to 24,6% (girls)-53,7% (boys) for at least 5 days a week in MVPA, depending how
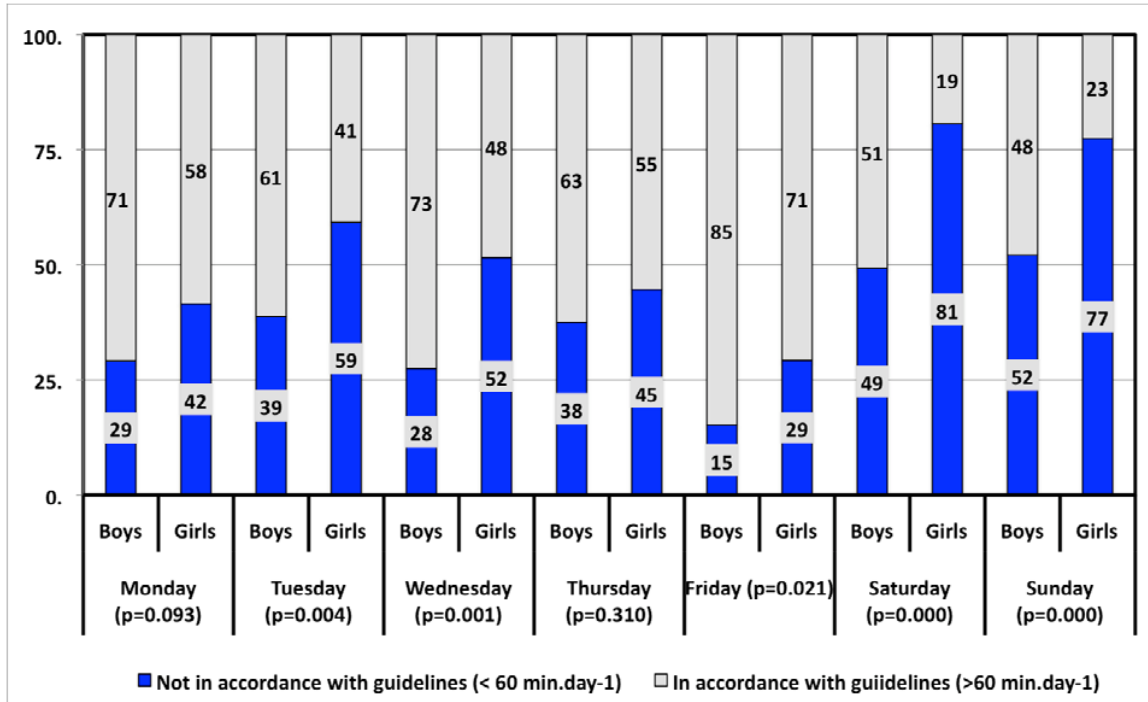

Fig. (1). Percentage of children compliant and not compliant with PA guidelines (60MVPA), by gender and days of the week. Differences between genders in each day of the week [chi-square test (χ^2)].
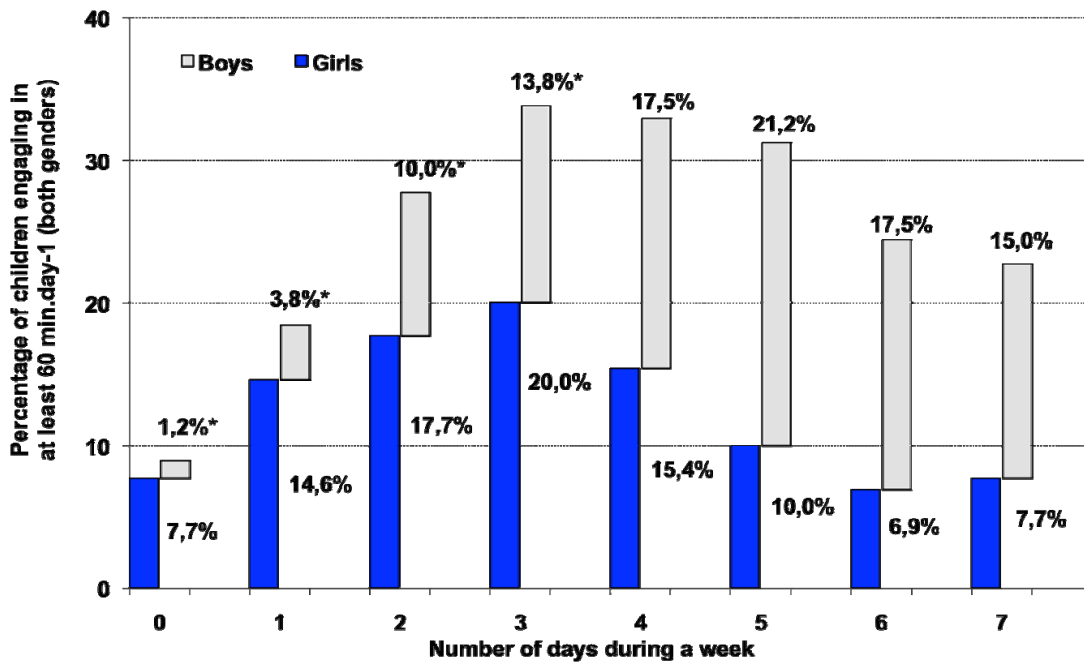

Fig. (2). Percentage of children that meet up with the PA guidelines (60MVPA) in different number of days by gender. *Significant differences between genders [$p<0.05$; chi-square test (χ2)].

the guidelines were interpreted. Similar results were observed by Olds *et al.* [29] in a sample of Australian children, where they found prevalence's of 20% in four complete days, but ranging from 20%-68%, given that children were classified with significantly different compliance's by the different methods. In particular, only a very small proportion of children were compliant using the "All Days" method. The results from studies using different methods would therefore not be comparable, and predictors and correlates of compliance calculated using one method may no longer be significant when compliance is calculated by another method [29].

The decline in physical activity levels of young children seems to be combined with a high prevalence of obesity and overweight and a reduction in the participation in organized sport [30-32]. With the ever-increasing interest in exploring the relationship between physical activity and obesity amongst children, it is important to provide a more precise estimate of both physical activity and the compliance with PA guidelines.

Although several recommendations have been made recently aiming at increasing the levels of PA and the compliance with 60 or more minutes of MVPA [33], data from the 2005 Youth Risk Behavior Surveillance System demonstrated that only 35.8% of high school students met those current physical activity recommendations of 60 minutes of MVPA on 5 or more days per week [34].

In much the same way as internationally-agreed BMI cut-points represented a major advance without which secular trend and cross-country comparisons were impossible, some papers highlight how important consistency is when putting to practice physical activity guidelines for youth [35, 36].

The choice of method will certainly be flawed, but should nonetheless be agreed for these purposes. Future research must address the physical activity and inactivity criteria most closely associated with health and illness [29].

A recent review contributed considerably to the understanding of the effects of regular physical activity on children's health [37], however the evidence-based knowledge to formulate physical activity recommendations and guidelines for children is still controversial [38, 39]. Making recommendations, even without consensus, is relatively easy; achieving the recommendations is the most challenging task.

Although the small sample size, and the limitations of the use of accelerometers to evaluate specific aspects of PA patterns in this study, like cycling or muscular resistance training, it should be highlighted that to our knowledge there isn't much published results in children and adolescents in Portugal using accelerometers.

CONCLUSIONS

The prevalence of children and youth meeting the guidelines of 60MVPA for every days of a week is very small, although when comparing individually the days of the week we can find percentages between 19.4% (girls) and 84,6% (boys) in specific days of the week. There is uncertainty concerning the true prevalence of adherence to the recommendations with physical activity guidelines in Portuguese children and youth, a national representative sample is needed in order to establish several public health strategies aiming at increasing the compliance with physical activities guidelines.

Standard methodological procedures (measurement instruments) and protocols concerning the number of days needed for adherence to the recommended guidelines, all days of a week (7 days a week), or partially (most of the days of a week), is needed in order to assemble internationally observance of the suggested guidelines of MVPA.

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