

THE EFFECT OF DAILY PHYSICAL EDUCATION LESSONS ON HUNGARIAN STUDENT'S PHYSICAL ACTIVITY LEVELS AND BODY COMPOSITION

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Abstract

Lifestyle, physical activity level and nutritional habits as well as environmental factors are having a greater and greater detrimental effect on the health of various populations. In the present study we systematically researched the physical status of schoolchildren.

It is well known that as children grow up, the amount of spontaneous physical activity they perform decreases as they have more mental tasks to do these negative factors can be offset with daily physical education.

We measured children participating in physical education on a daily basis, consisting of 5th (10-11 years old) and 9th (14-15 years old) grade students and control groups of 4th (9-10 years old) and 8th (13-14 years old) grade students, respectively, for a total of 196 persons (94 girls and 102 boys). Habitual physical activity was obtained with Actigraph, (GT1M/GT3X) and body fat percentage was calculated from anthropometrical measurements.

As expected, we were able to observe a linear correlation between the physical activity levels and the body composition of the participants. The more time the subjects spent performing MVPA (Moderate and Vigorous Physical Activity), the less body fat they had. The recommended MVPA is a minimum of one hour per day, but these Hungarian children had two hours of MPVA per day. Our results lead us to conclude that ninety minutes of additional physical education per week for 7-8 months cannot be considered

sufficient for a full impact analysis nor for schoolchildren's physical activity needs or body composition, though an increase in the amount of time spent in physical education classes shows beneficial effects for these children.

Keywords: Daily physical education (PE), physical activity, Actigraph GT1M/GT3X, body fat

Introduction

According to a study which compares 850 Journal articles, schoolchildren should do sixty minutes per day of intensive, varied and generative physical activity (Strong et al., 2005).

Physical activity is not only necessary for good mental and physical health, but aids in helping people avoid obesity. It was difficult to objectively determine the amount of time subjects spent in sedentary and vigorous states. Activity was measured with subjective methods where the reliability and replicability are questionable. Ten to twelve (10-12) year-old children's physical activity levels were measured in five European countries. The objective in this international research was to compare the different countries and genders. The ages of ten to twelve seemed to be the most dangerous ages where children start spending a lot of time in inactive state and less time in active state. Actigraph was the most reliable, replicable and feasible method to measure physical activity, but the only negative factor regarding its use is that its sensors don't measure arm movements, during swimming activities and they can not differentiate between sitting, lying, and still standing. On the other hand, they underrate the intensity of cycling and other sports. In several cases the measurements were not valid, which led to a marked decrease in the number of the subjects (Verloigne et al., 2012).

Nowadays childhood obesity is becoming more and more frequent, and its correlation with physical activity has not been compared enough in the literature. A study in San Diego researching 900 eleven to fifteen year-old children highlights this insufficiency. According to this American study, being overweight correlates negatively with the a lack of MVPA (Moderate and Vigorous Physical Activity) (Patrick et al., 2005).

A study in Philadelphia measuring inner-city school children compares gender, ethnicities and weight differences to physical activity levels, in addition to school grades. 470 children living in the center of Philadelphia took part in the study. They spent 48 minutes in MVPA on average, which was 6% of the whole wear time of the actigraph. 60% of the time was spent in the sedentary zone and 31% with light physical activity. Boys spent significantly more time in the intensive activity zone than girls. Fifth grade students spent significantly more time in the intensive zone than fourth and sixth grade males. Sixth grade girls spent less time in MVPA than

fifth and fourth grade females. Overweight children spent more time in the inactive zone than children of normal weight. 24.3% of the whole sample performed the recommended activity amount of the Philadelphia's public health policy. These conclusions highlight the fact that physical activity requires effective dissemination among inner-city children. More secure playgrounds next to schools and churches could raise the physical activity level of the children. Another method could include adjusting the quality and quantity correction of PE lessons (Troost et al., 2012).

Subjects

196 subjects, including 94 girls (N_G) and 102 boys (N_B), took part in this study in which their physical activity levels were monitored with accelerometer in the spring of 2013. The effect of everyday physical education on physical activity and childhood obesity was the main objective of the research. Fifth and ninth grade school children (participating in daily PE lessons) were compared with fourth and eighth grade (not participating in daily PE lessons) children. There were 85 fourth and fifth grade students with an average age of 11.24 ± 0.62 years. In this cluster, the daily activity of 34 girls and 51 boys was monitored. There were 34 fourth grade students and 51 fifth grade students. There were 111 eighth and ninth grade students with an average age of 15.2 ± 0.72 . In this age cluster we analyzed 60 girls and 51 boys, of which 51 were from the eighth grade and 60 were from the ninth grade. More than the half of the students were taking part in sport activities outside school.

The research was anonymous and conducted with volunteers who got written permission to participate in the study, in accordance with the Helsinki declaration. The children were from the schools of the Capital, cities, small towns and villages.

Anthropometrical analysis

Anthropometrical measurements were taken in line with the recommendations of International Biological Program (Weiner and Lourie, 1963). The present study followed the Pařízkova model (Fat%) (Pařízková, 1963) for evaluating body composition. For this measurement, we needed the body mass and the five skinfolds (biceps, triceps, subscapula, suprailiac and medial calf) with ISAK methodology.

Actigraph

Habitual physical activity was measured with triaxial accelerometer (ActiGraph wGT3X). The sensor is 3.8 cm by 3.7 cm by 1.8 cm in dimension. It can save 16 MB data, which is 40 days of activity, stepcounts, MET and activity zone measures. Actigraph GT3X+ measures the

movements and their amplitude of three space dimensions. For the analysis of daily activity and its clustering, the sensor measured counts. One count is a sign which is strong enough to be digitalized from the actigraph. The subjects wore the sensors for five days for 24 hours. One of the five days was always a weekend day. The children wore the sensor on the right side of their hips and avoided wearing it in water. To analyze our data, we measured daily activity from 6am to 8pm in five epoch intervals. Activity levels could be divided into five groups (Freedson et al., 2005): Sedentary, greater than 149 counts/minutes; light activity, 150-499 counts/minutes; moderate, 500-3999 counts/minute; vigorous, 4000-7599 counts/minute; and very vigorous activity, greater than 7600 counts/minute. Time spent in activity zones are given in minutes. MVPA means moderate to vigorous physical activity; from the five days of data we can evaluate one-day averages which can be compared with the International Recommendations.

Statistics

To compare the genders we used a two sampled t-test for independent samples. For a comparison of the subgroups when F test was significant we used Tukey post hoc analyses. For correspondence analysis we used correlation analysis. Level of significance was $p < 0.05$.

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We could observe significantly higher MVPA values with the boys than with the girls (647.55 ± 220.05 vs. 575.16 ± 197.35 minutes; $p = 0.016$) in the whole sample ($N_B = 102$ vs. $N_G = 94$). The girls' sedentary behavior wasn't significantly higher than the boys (3210.6 ± 382.73 vs. 3235.47 ± 448.88 minutes). For the different age groups we could observe a significantly higher sedentary behavior level in the case of the older children ($p = 0.000$) (Figure 1).

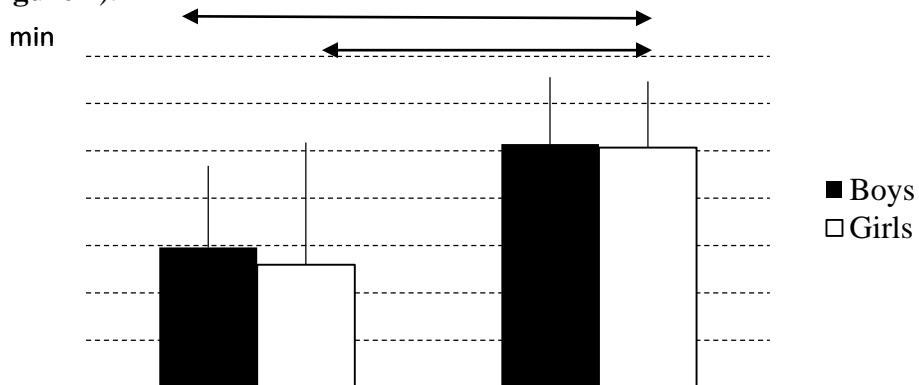


Figure 1. Comparison of the sedentary behavior of 10 to 12 year-old and 13 to 15 year-old students (\leftrightarrow significant differences between the age groups)

The boys in the younger grades spent significantly more time in MVPA than the girls of the same age ($B_{4-5} 750.48 \pm 193.28$ vs. $G_{4-5} 644.65 \pm 203.42$; $p=0.000$). In the older grades there were no significant differences between the boys and girls ($B_{8-9} 544.63 \pm 197.08$ vs. $G_{8-9} 535.78 \pm 184.09$). Younger boys and girls spent significantly more time in MVPA than older children (boys: $p=0.000$; girls: $p=0.043$) (**Figure 2**).

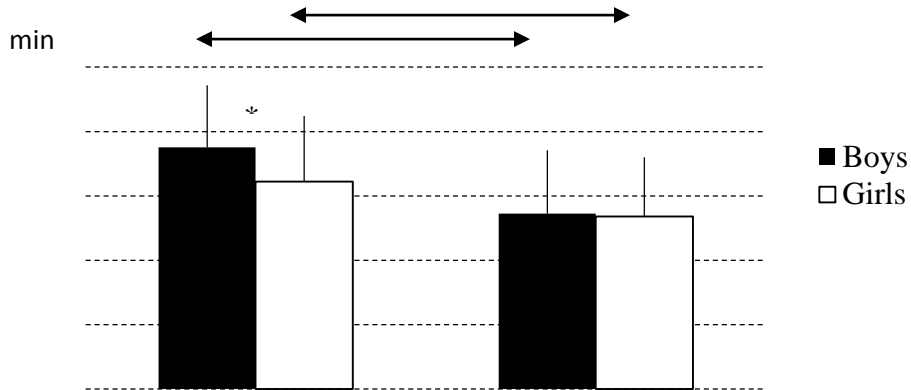


Figure 2 Comparison of the younger (10 to 12 years old) and older students' (13 to 15 years old) MVPA (*significant differences in gender; ↔ significant differences between the age groups)

We performed more analyses to see the effect of daily physical education training on children. In regards to the whole sample, boys spent less time on average at a sedentary level than girls, except for ninth graders. In comparing the times spent in MVPA, we could observe that boys spent more time at this level, with the exception of the 9th grade students (**Figure 3**).

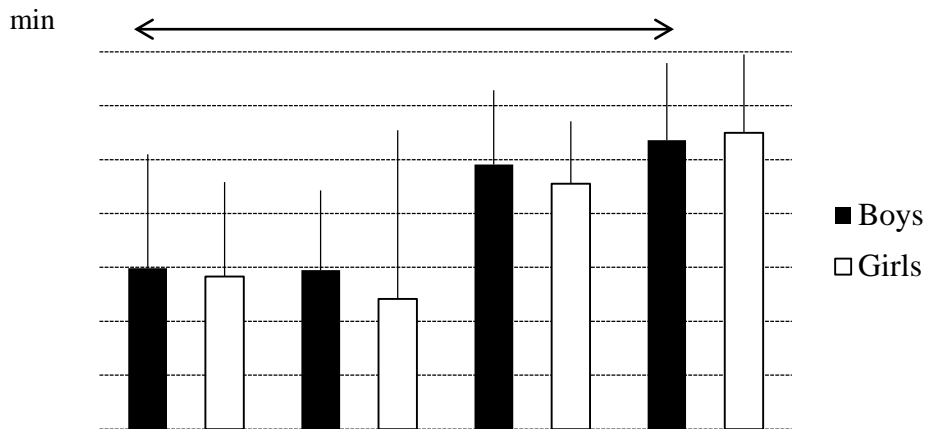


Figure 3. Sedentary behavior of the classes and genders

The body fat percentage of the boys was significantly lower in the whole sample ($FAT\%_B=19.32\pm5.85$ vs. $FAT\%_G=23.25\pm5.13$). We could observe a significantly lower fat percentage when comparing 9th grade boys and girls (Grades 4-5: $FAT\%_B=19.43\pm5.90$ vs. $FAT\%_G=20.93\pm5.36$ and grades 8-9: $FAT\%_B=19.20\pm5.84$ vs. $FAT\%_G=24.56\pm4.54$; $p=0.009$). The 9th grade girls had an even significantly higher fat percentage than the younger females (**Figure 4**).

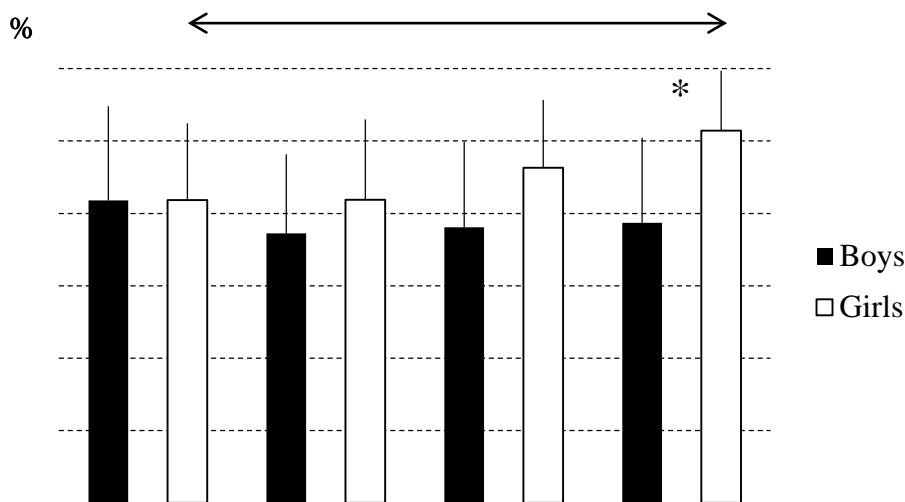


Figure 4 Body fat percentages of the genders and classes (*significant differences in gender; ↔ significant differences between the age groups)

For the different levels of habitual activity compared with relative fat mass we were able to observe a negative correlation between them in the whole sample, and in girls it was especially significant. In the older children this correlation was not significant (**Table 1**). Sedentary behavior and body fat percentage showed a positive moderate correlation in the case of girls and no correlation was found in boys.

Table 1 The correlation between fat percentage and time spent at various activity levels (significant correlations in italics)

	Fat% (whole sample)	Fat% (10-12 years)	Fat% (13-15 years)	Fat% (boys)	Fat% (girls)
Sedentary	<i>0.16</i>	0.05	0.12	0.04	<i>0.3</i>
Light Intensity	-0.23	-0.16	-0.12	-0.06	<i>-0.31</i>
Moderate Intensity	-0.24	-0.20	-0.07	-0.06	<i>-0.27</i>
Vigorous Intensity	-0.26	<i>-0.41</i>	-0.13	<i>-0.24</i>	<i>-0.21</i>
Very Vigorous Intensity	-0.19	-0.19	-0.23	<i>-0.25</i>	<i>-0.28</i>
MVPA	-0.2	-0.27	-0.1	-0.11	<i>-0.29</i>

The different amounts of physical education activity didn't show any significant differences in the compared groups (for fourth, fifth, eighth, and ninth grade students) with regards to habitual activity and relative fat percentage.

Conclusion

Activity levels and body composition showed the following correlation: the more time the subjects spent in MVPA, the less relative fat percentage they had.

In the study where European children were measured very few subjects reached the daily 60 minutes in MVPA and they spent daily 8 hours in inactive zone on average. Boys did a few more physical activity and they could observe differences among the countries (Verloigne et al., 2012).

Another European research obtains that 15 years old adolescents spend 58 in MVPA zone daily (girls spend 50 and boys 66 minutes). Those children who don't reach the daily 10 minutes in MVPA have more chance to be obese. According to the study daily 90 minutes of MVPA is recommended in Canada, which is also necessary to the European children (Martinez-Gomez et al, 2010).

According to a former Hungarian study, 96% of girls and 92% of boys spent the recommended sixty minutes or more in MVPA. These 11 year-old children from the capital city of Hungary (n=53) spent 68 minutes per day on average in MVPA over the course of the study. There were no significant differences between the activity of the boys and the girls (Uvacsek et al, 2011). In our study the children spent 118,18 minutes in MVPA on average. From our research we were able to conclude that from the beginning of primary school to the beginning of high school, boys spend more time in MVPA than girls, and we could observe less time being spent at a sedentary level in the case of the boys. Physical activity is getting less by growing up, but without daily physical education this decrease will be more drastical.

Based on age and gender differences, we could see a relationship between less activity and more body fat, especially in girls. Based on these findings, we recommend a gender- and age-differentiated physical education lesson, which takes into account the individual. This new PE lesson should change as the children are getting older. The study has also been designed with a longer follow-up period.

Our results shows that the first seven to eight months of daily physical education, which means 90 minutes more physical activity per week is not enough to show the positive effects on habitual physical activity and obesity, but we can obtain positive changes with regards to activity levels and body composition.

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