



## Step count for 7<sup>th</sup> and 8<sup>th</sup> grade students in structured and unstructured physical education classes

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### Abstract

The aim of the study was to analyze step counts of middle school students in structured and unstructured physical education classes (PE) according to age, gender, and school type. Data were collected on a sample of 74 students, 40 7<sup>th</sup> and 34 8<sup>th</sup> grade students recruited from private and public middle schools. Omron HJ-112 pedometers were used in this study to obtain step counts. There were statistically significant differences between boys and girls in the step counts in both structured and unstructured PE. A significant difference was observed between school types in step counts during structured PE in both genders, while no significant difference was found for unstructured PE. Significant difference was found between step counts of only boys of different grades in unstructured PE. Boys made more steps than girls both in structured and unstructured PE. In structured PE, 7<sup>th</sup> grade boys reached a higher number of steps than 8<sup>th</sup> grade boys.

**Keywords:** students, step counts, structured physical education, unstructured physical education

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## INTRODUCTION

Regular physical activity (PA) reduces the risk of some chronic diseases such as cardiovascular disorders, cancer, obesity, and diabetes [1,2]. People who exercise regularly have an important advantage in the prevention of disease because they can balance the ratio of energy intake and outflow [3]. Although the health benefits associated with moderate-to-vigorous PA (MVPA) are well-known, worldwide participation in MVPA is still lower than recommended levels. Especially children in developed countries tend to adopt a sedentary lifestyle at early ages, which is highly worrying regarding sustainable health development [1]. Lower participation in recreational activities and longer periods spent at screens can lead to a decrease in children's PA levels [4]. World Health Organization (WHO) recommend that 5-17-year old children accumulate an average of 60 minutes of MVPA each day [5]. However, it is known that more than 80% of 11-17-year old children worldwide are not as active as they are recommended to be [5]. Several studies on this issue have revealed that school setting and especially physical education (PE) classes [4] play a significant role in increasing PA levels [6].

The United Kingdom Associations for Physical Education (AfPE) recommended that children be actively moving for 50-80% of learning time to increase the level of PA in PE [7,8]. However, previous report showed that MVPA duration of children during PE was 40% [9] and that, on the whole, PE intensity levels were less strenuous than walking activity [7,10]. Hollis et al. [6] found that middle school students spent 27-47% of PE time at MVPA levels.

Children and adolescents spend an average of 6-7 hours at school each day, a major portion of their day time. Thus, studies on the topic are highly important in helping children and adolescents acquire the recommended daily PA levels during their school time [11]. In their study, Tudor-Locke et al. [12] described 3300-3500 steps per 30 min as MVPA for 11-15-year old children. Therefore, PE is a very important opportunity for MVPA to be covered in school setting within the recommended time and intensity [4]. It was also reported that without school-based PA, such as PE, PA out of school could not alone meet the daily recommended PA levels [13]. 17-18% of the recommended daily step count for middle school students (12,000 steps/day) was found in other studies to be covered during PE [14].

PA levels during PE could vary both between individuals within the same class and between different classes due to variations in pedagogy, age, gender, activity type, and other individual and environmental factors [13] such as PE equipment and facilities [15]. The majority of private schools may have important advantages in terms of educational opportunities and the learning environment [16]. For example, private schools may have more qualitative equipment and especially for increasing physical activity. It may be a reason for changing the physical activity of students in PE lessons [17]. Therefore, the advantages of private schools may affect students' physical activity levels even if the PE lessons syllabus of private and public schools is the same in Turkey. Some studies which analyzed mean step counts during PE according to gender revealed that there were no significant differences between mean steps made by boys and girls [14,18,19]. MVPA levels were also considered to vary, possibly according to PE type (structured or unstructured PE) and the topic of the class [2,7]. For instance, Fairclough and Stratton [20] reported that most of the 11-14-year old adolescents who played team sports and did individual activity during PE reached the recommended MVPA levels. Therefore, the type, volume, and intensity of the class activity could affect the PA level. In this respect, it is likely that the PA level in structured and unstructured PE could vary according to gender and age. At the same time, different class content may result in differences in activity type and PA level. As a result, an analysis of the step counts of students in structured and unstructured PE content according to age and gender variables constituted the main topic of this study.

In conclusion, the aim of the study was to analyze step counts of 7<sup>th</sup> and 8<sup>th</sup> grade students in structured and unstructured physical education classes according to age, gender, and school type (private or public school).

## METHODS

### *Participants*

A total of 74 students (n=40 7<sup>th</sup> grade; n=34 8<sup>th</sup> grade), 46 boys (height = 159.91±6.23; weight= 50.73±9.29) and 28 girls (height = 160.25 ±4.42; weight = 51.42 ±7.31) from both private and public middle schools voluntarily participated in this study in Ankara province. Forty students attended private schools and the other 34 were from public schools. All participants were recruited from a convenience sample method. The study's a representative sample consist of the step counts of middle schools in Ankara province. The appropriate sample size of the study was obtained from G-Power (Effect size d = 0.22; power = 0.80) analysis. Written permission was obtained for the research from the Provincial Directorate of National Education of Ankara Governorship (Ref: 14588481/605.99/3302971).

### *Procedures*

A 10-question Personal Information Form prepared by researchers and Omron HJ-112 pedometers were used in the study. Students were instructed to wear the pedometers vertically at waist level on their trousers' belts. Students' step length was measured before adjusting the pedometers. To determine step length, students walked 10 steps, and the distance covered from the starting point to the end of the 10<sup>th</sup> step was calculated in inches, which was then divided by 10 (the number of steps made) to determine the average step length for each participant. Written consent was obtained from parents and students prior to data collection. Participation was entirely based on voluntariness.

Step counts were recorded for 30 min during PE as described in the study by Tudor-Locke et al. [12], in which it was suggested that a minimum of 3300 steps in 30 min were required to reach the recommended exercise intensity. Prior to the lesson, the researchers explained to the students how to wear and where on their body to place the pedometers.

Two 40-min PE lessons, 80 min in total, were included in the study. The first 40 min PE lesson was structured according to the syllabus designed by the Ministry of Education. The steps made by the students were recorded during the first 30 min. The second 40 min PE lesson was unstructured. Students were allowed to choose any sport to do without teacher interference, and step counts were recorded during the first 30 min of the lesson. Data were collected only one time both structured and unstructured PE lessons. Step counts of the students were recorded using the Omron HJ 112 model pedometer. No researchers were present in the class setting during the 80 min to avoid any influence on the students, teachers or the course of the lesson.

Two criteria had to be met for any data to be counted in this study: (1) Before each PE lesson, pedometers were checked by the researchers to ensure a reading of zero, and (2) the students did not make any steps after the end of each lesson until the researchers themselves collected the pedometers. Step counts on the pedometers were then read and recorded by the researchers after they were taken off.

### *Statistical Analysis*

Step counts obtained from structured and unstructured PE were evaluated according to gender and grade using the Mann-Whitney U test, and t-test was used to analyze the differences according to school type in independent groups. Paired Sample t-test was used to compare step counts during both structured and unstructured PE in boys and girls. The significance level was set at  $p < 0.05$ .

## RESULTS

The steps taken in structured and unstructured PE lessons were compared according to gender, grades, school type. Moreover, structured and unstructured PE lessons were compared for both girls and boys. It was found that boys made significantly more steps than girls in structured and unstructured PE ( $p < 0.05$ ) (Table 1).

While no statistically significant difference was observed in step counts during PE between 7<sup>th</sup> and 8<sup>th</sup> grade girl students ( $p>0.05$ ), step counts of 7<sup>th</sup> grade boys were statistically significantly greater than those of 8<sup>th</sup> grades ( $p=0.05$ ) (Table 2). In addition, with regard to step counts of boys and girls in structured and unstructured PE, it was found that there was no statistically difference between grade levels (grade 7 and 8) ( $p>0.05$ ) (Table 2). On the other hand, 7<sup>th</sup> grade boys succeeded in making the 3300 steps in 30 min in structured PE as suggested by Locke et. al. [12] (Table 2).

It was observed that, in structured PE, the number of steps made by both genders of private school students was bigger than that of public school students ( $p<0.05$ ) (Table 3). As far as unstructured PE is concerned, on the other hand, there were no statistically significant differences in the step counts of either boys or girls between school types (public and private) ( $p>0.05$ ) (Table 3). It was also found that boys attending private schools succeeded in covering the 3300 steps in 30 min in structured PE, consistent with the recommended level by Tudor-Locke et al. [12] (Table 3).

The comparative results of step counts in structured and unstructured PE for boys and girls were presented in Table 5. No statistically significant difference was found between structured and unstructured PE either for girls or boys ( $p>0.05$ ) (Table 4).

Table 1. Comparison of step counts during structured and unstructured PE according to gender.

Type of lesson	Girls				Boys				Z Score	p
	n	Mean	SD	Mean Rank	n	Mean	SD	Mean Rank		
Structured PE	28	1832.28	652.24	24.04	46	2831.86	976.09	45.70	-4.2	0.001
Unstructured PE	28	1930.0	752.68	22.75	46	3026.36	844.36	46.48	-4.6	0.001

p - was obtained using Mann-Whitney U test

Table 2. Grade-based comparison of step counts for girls and boys during structured and unstructured PE.

Type of lesson	Gender	Grade 7			Grade 8			Z score	p
		n	Mean $\pm$ SS	Mean Rank	n	Mean $\pm$ SS	Mean Rank		
Structured PE	Girls	12	1896.33 $\pm$ 415.55	16.08	16	1784.25 $\pm$ 795.85	13.31	-0.882	0.397
	Boys	28	3348.25 $\pm$ 828.68	30.54	18	2028.61 $\pm$ 555.87	12.56	-4.434	0.01
Unstructured PE	Girls	12	1738.08 $\pm$ 728.94	12.67	16	2073.93 $\pm$ 760.61	15.88	-1.022	0.324
	Boys	28	3174.89 $\pm$ 941.33	26.25	18	2795.33 $\pm$ 622.12	19.22	-1.733	0.08

p - was obtained using Mann-Whitney U test

Table 3. Comparison of step counts of the students in structured and unstructured PE according to school type.

Type of lesson	Gender	Private School		Public School		t	p
		n	Mean $\pm$ SS	n	Mean $\pm$ SS		
Structured PE	Girls	11	2245.45 $\pm$ 685.01	17	1564.94 $\pm$ 480.96	3.095	0.005
	Boys	29	3352.68 $\pm$ 800.88	17	1943.41 $\pm$ 476.25	7.484	0.000
Unstructured PE	Girls	11	1888.81 $\pm$ 775.93	17	1956.64 $\pm$ 760.13	-0.229	0.821
	Boys	29	3172.27 $\pm$ 923.28	17	2777.47 $\pm$ 639.52	1.555	0.127

p - was obtained using unpaired t-test

Table 4. Comparison of the step counts of boys and girls in structured and unstructured PE.

Gender	Structured PE			Unstructured PE			t	p
	n	Mean	SD	n	Mean	SD		
Girls	28	1832.28	652.24	28	1930.0	752.68	-0.749	0.460
Boys	46	2831.86	976.09	46	3026.36	844.36	-1.865	0.069

p - was obtained using paired student t-test

## DISCUSSION

Step counts of 7th and 8th grade middle school students in structured and unstructured PE were evaluated according to age, gender, and school type in the light of the findings of this study. Steps made by girls and boys were also compared according to structured and unstructured PE. It was previously reported that gender based evaluations during PE did not show any significant differences in step counts between boys and girls [14, 19]. For instance, Tudor-Locke et al. [19] had found that although the 6<sup>th</sup> grade boys accumulated a higher number of steps than girls during breaks and lunchtime and out of school, the difference between boys and girls was not significant in step counts during PE. Another study showed similar results suggesting that there were no significant differences in count steps during PE between Mexican boy and girl students [18]. On the other hand, there are some other studies with findings suggesting gender based differences in PA level in PE [4, 21-24]. It was demonstrated in those studies that the PA level of boys during PE was greater than that of girls. As a result, the studies in the literature which focused on PA level in PE according to gender seemed to report contradictory results [24, 25]. In our study, it was concluded that step counts of boy students during both structured and unstructured PE was greater than that of girls ( $p < 0.05$ ) (Table 2).

There were some other studies which demonstrated that participation in PA could depend on the participant's behavioral attitudes. It was reported in those studies that boys generally tended to develop a more positive behavioral attitude towards challenging and risky PA than girls, who seemed to turn more to activities of aesthetical and elegant actions [26]. In other words, behavioral and attitudinal differences could be the decisive factor leading boys to performing more vigorous PA [26]. Besides, Couturier et al. [27] suggested that activities such as team sports included in the PE curriculum seemed to appeal more to boys compared to girls. Tanaka et al. [28] found that children active significantly less during gymnastics and track and field lessons when compared to ball game lessons. In addition to this, sedentary time during gymnastic lessons was significantly longer than other lesson contents. In this respect, the lesson content (team sports, etc.) can stimulate boys to be more active in PE.

It was revealed that lesson content in PE had an important effect on PA level [29]. For example, physical fitness practices were considered more vigorous than both basic skill and play activities [24]. For this reason, the comparison of step counts of the students in structured and unstructured PE in our study is important at least from this standpoint. It was reported in the literature that the number of steps adolescents made in structured PE was higher than that of unstructured PE [30]. However, inconsistently with the results of Lonsdale et al., there was no significant difference between step counts of either girls or boys made in structured and unstructured PE in the present study (Table 5). Factors such as the type, intensity, and content of the activity students themselves chose to do might have influenced the number of steps in unstructured PE, which might explain the reason why no significant difference was found between step count during the structured and unstructured PE in our study. However, allowing students to do the type of activity they chose themselves can enhance their motivation [30]. Furthermore, Hastie et al. [31] reported that students who performed to autonomy-supportive climates in PE improve in motor performance when compared to less supportive climates. The free choice atmosphere created in PE can also support the students' sense of independence and enable them to do the activity they feel more competent at [30], which ultimately meets their psychological need for a sense of autonomy and self-competence [32].

Brusseu et al. [25] found that boys made 1622 steps, and girls 1581 steps, during PE. In another study, it was reported that, in a PE during which 4<sup>th</sup> and 5<sup>th</sup> grade students performed such activities as throwing and athletics, girls reached 39 step/min, while boys made 36 step/min [33]. Tudor-Locke et al. [19] indicated that 6<sup>th</sup> grade boy students in the south-west region of the US made 48 steps/min in PE, and girls 47 steps/min. Generally, step count of different grades was found to be similar in PE. In our study, however, it was found that 7<sup>th</sup> and 8<sup>th</sup> grade girls made 46 steps/min in structured PE while step counts for boys was 70 steps/min. As for the unstructured PE, the ratio was approximately 76 steps/min for boys and 49 steps/min for girls. When mean step counts for boys and girls in structured and unstructured PE were compared according to grade, it was observed that only in boys in structured PE there was a significant difference between grades ( $p < 0.05$ ) (Table 3). The age difference between the groups compared in studies in literature analyzing PA according to age was

generally wide. In other words, those studies mostly compared students on criteria of highly different ages, such as pre-school children to adolescents. For example, it was reported that times spent in moderate physical activity (MPA), MVPA, and total PA of children (mean age  $8.1 \pm 1.5$  years) for physical education class were more than adolescents mean age  $14.0 \pm 1.6$  years) [34]. Thus, the relatively closer age groups of 7<sup>th</sup> and 8<sup>th</sup> grade students might account for the similarity found in our study between the step counts of different grades.

School type, daily routines, and in-class practices are among other factors affecting students' PA level during their school day [24]. Structural differences between public and private schools could affect PA level of students. In our study, step counts in structured and unstructured PE were also compared according to school type. It was found that step counts of private school students in structured PE were significantly greater than those of public school students ( $p < 0.05$ ) (Table 4). However, the analysis of step counts in unstructured PE revealed no significant difference between school types ( $p < 0.05$ ) (Table 4).

Studies that examine the number of steps taken in structured and unstructured PE lessons are limited considerably in the literature. In this regard, of the study may contribute to the literature to understand how the physical activity of students changes in terms of various PE lesson contents.

The limitation of the study is that all data were collected only one time both structured and unstructured PE lessons and that a relatively small sample of participants was recruited. Moreover, the pedometers used in the present study only measured step count, not the intensity of PA. The average number of steps in both structured and unstructured PE lessons may be examined simultaneously throughout a semester in future studies.

## CONCLUSION

The results of the present study showed that girls made fewer steps than boys both in structured and unstructured PE. It was observed that neither gender group reached 3300 steps in unstructured PE. However, in structured PE, step counts of 7<sup>th</sup> grade boy students were higher than those of 8<sup>th</sup> grade boys and surpassed the recommended 3300 steps per 30 min. Step counts of both girl and boy private school students were greater in structured PE compared to those of public school students. In conclusion, although the step counts of neither gender group were at recommended levels, the relatively smaller number of steps made by girls compared to boys suggested that girls should also be encouraged to adopt MVPA.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author

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