

Investigation of Physical Activity Levels and Body Compositions of Adolescent Boys and Girls

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KEYWORDS Physical Activity. Body Mass Index. Pedometer. Adolescent. Student

ABSTRACT The purpose of this study is to investigate the physical activity and body composition of boys and girls between 14 and 18 years of age studying in high school. The research comprises 532 people without any health problems, including 279 girls and 253 boys, who participated voluntarily. An independent t-test, the Pearson Correlation test and Chi-square test were used. There was a significant difference ($p < 0.001$) between the pedometer values of boys (12377.59 ± 4245.16) and girls (9438.95 ± 2806.01). In the standard of Body Mass Index (BMI) values, girls were average and below by seventy-six percent, overweight by 17.2 percent, obese by 6.8 percent, while boys were average and below by 75.1 percent, overweight by 18.6 percent, and obese by 6.3 percent. A significant relationship was found at a level of $p < 0.05$ between the daily step counts and BMI variables of boys ($r = -.156$) and girls ($r = -.121$). Consequently, improving the physical activity level is thought to be a factor inhibiting obesity.

INTRODUCTION

Physical activity is the consumption of energy as a result of the movement of the body through skeletal muscles. All kinds of physical activity require energy consumption. According to the kind of the workouts in physical activity, it can be demonstrated in different ways such as aerobic, anaerobic, or static, dynamic (Zorba and Saygin 2013).

Physical activity is beneficial to the health at all ages. Regular physical activity can create significant differences in children's healthy growth and development, in getting rid of unwanted bad habits, in socializing, in the prevention of several chronic diseases of adults, or support of the treatment or in the treatment of these diseases, in providing the elderly with an active old age. In other words, it increases the quality of life throughout life (Tunay 2008) and physical activity in healthy population (Holmback et al. 2015). Belanger et al. (2015) suggest that the association between adolescent and adult physical activity is dependent, at least in part, on the type of physical activity engaged in during adolescence.

The living conditions of today's age make people lead less active lives. Most people work

sitting during the day, spend the majority of their time watching television or using the computer for hours, and having something to eat in the meanwhile. The energy intake, which is more than the consumed amount, leads to greater amount of body fat mass and obesity due to a sedentary lifestyle. Obesity has become a problem often encountered today (Ersoy et al. 2008).

Considering that the obesity and chronic diseases in adults originate from the first year of life, the physical activity, health and fitness status of kids and adolescents becomes more important (Leonard 2001). Obesity is a major public health problem, which is common in adults and children. Childhood obesity has an increasing prevalence all over the world, especially in developed countries. There are a number of studies indicating that the obesity beginning in childhood continues in adulthood. Obesity is a condition that should be prevented and treated due to the problems it causes both in childhood and adulthood, and the high morbidity and mortality rates in adulthood (Yumuk and Ercan 2011).

The purpose of this study is to investigate the effects of the physical activity levels of high school boys and girls on their body compositions.

METHODOLOGY

This research comprises 532 voluntary people, including 279 girls and 253 boys, who attended high school in the *Mugla* Central District. It was required for the adolescents included in the study that they should not be a li-

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censed athlete of any clubs and be convenient for physical education classes in term of health.

Necessary permissions were received from the Provincial Directorate of Education, the school principal and physical education teachers, and measurement of height, body weight, body composition and physical activity level were made.

Determination of Physical Activity Levels (PAL)

Pedometer was used to determine the physical activity level.

Pedometer: Measurements were taken using the Kenzi Lifecorder brand pedometers. It is usually worn around the waist and includes a lever arm attached to a horizontal spring that bounces with the vertical acceleration of hips during walking (up-down movement during walk). It is designed to detect vertical movements and to indicate the number of logical steps (Pitta et al. 2006).

Pedometer Assessment: To assess the number of steps per day, the standards were used (Tudor-Locke et al. 2009)

Body Composition Measurements

Height: The measurements were made with a digital height gauge tool with a sensitivity of 0.01cm.

Body Weight: With a sensitivity of 0.1 kg, the subjects were measured with shorts, t-shirts, socks, and without shoes (Tamer 2000).

Body Mass Index (BMI): It was obtained by the ratio of body weight to height squared in meters (w/h^2) (kg/m^2) (Zorba and Saygin 2013).

Body Mass Index Assessment: For the assessment of BMI, standards were applied (Cole et al. 2000).

Statistical Analysis

The data obtained from the measurements was assessed using SPSS for Windows 18 software package. The arithmetic mean and standard deviation of the obtained data were calculated. An independent t-test was used to find the differences between genders, the Pearson correlation test to examine the relationship between variables, and Chi-square test to find the differences in the assessment standards. The level of significance was taken as $p < 0.05$.

RESULTS

While there was a significant difference of $p < 0.001$ in height (pretest; 171.81 ± 6.97 , posttest; 161.00 ± 6.22) and body weight (pretest; 65.05 ± 11.90 , posttest; 58.08 ± 11.84) values in adolescents, no significant difference was detected in age and BMI values (Table 1).

There was a significant difference between the pedometer values of boys and girls ($p < 0.001$). It was found that boys were physically more active than girls (Table 2).

A significance difference of $p < 0.001$ was found between the pedometer assessment stan-

Table 1: Arithmetic Mean (X) $\pm$, Standard Deviation (SD) and “t” test results for the anthropometric characteristics of adolescent boys and girls

Anthropometric features	Boys		Girls		t	p
	X±SD		X±SD			
Age (years)	15.47±	1.39	15.63±	1.29	-1.341	.181
Height (cm)	171.81±	6.97	161.00±	6.22	18.880	.000***
Body Weight (kg)	65.05±	11.90	58.08±	11.84	6.763	.000***
Body Mass Index (BMI) (kg/m²)	22.00±	3.57	22.39±	4.31	-1.132	.258

*** $p < 0.001$

Table 2: Arithmetic Mean (X) $\pm$, Standard Deviation (SD) and “t” test results of the pedometer values of adolescent boys and girls

Physical Activity Levels (PAL)	Boys	Girls	t	p
	X±SD	X±SD		
Pedometer(number of steps)	12377.59±4245.16	9438.95± 2806.01	9.499	.000***

*** $p < 0.001$

dards (Tudor-Locke et al. 2009) of adolescent boys and girls (Table 3). In the pedometer evaluation standards, girls and boys adolescents were found to be sedentary by 84.9 percent, 52.6 percent, normal by nine percent, 30.4 percent and active by 6.1 percent, seventeen percent, respectively. According to pedometer assessment standards by Tudor-Locke et al. (2009), the physical activity levels of boys and girls were found to be normal and sedentary, respectively (Table 3).

There was no significant difference between the BMI assessment standards (Cole et al. 2000) of adolescent boys and girls ($p>0.05$). In the standard of BMI values, girls were average and below by seventy-six percent, overweight by 17.2 percent, obese by 6.8 percent, while boys were average and below by 75.1 percent, overweight by 18.6 percent, obese by 6.3 percent. In the pedometer evaluation standards, female and male adolescents were found to be sedentary by 84.9 percent, 52.6 percent, and normal by nine percent, 30.4 percent and active by 6.1 percent, seventeen percent, respectively (Table 4).

A significant relationship was found at a level of $p<0.05$ between the daily step counts and BMI variables of boys ($r= -.156$) and girls ($r=-.21$). The study showed that increased physical activity cause decreases in body mass index (Table 5).

Table 5: Physical activity levels and Body Mass Index (BMI) correlation values of adolescent boys and girls

Variable	Gender	Body Mass Index (BMI)	
		<i>r</i>	<i>p</i>
Pedometer (Number of Steps)	Boys	-.156	0.013*
	Girls	-.121	0.044*

* $p<0.05$

DISCUSSION

Physical activity can be defined as bodily movements produced by the contraction of skeletal muscle, and requiring energy consumption above basal levels (Ozer 2001). In other words, it

Table 3: Frequency (f), Percentage (%) and Chi-square (χ^2) results of pedometer assessment standards of adolescent boys and girls

	Assessment standards						
	Sedentary		Normal		Active		
Boys	Below 12000 steps		12001-16000 steps		16001 steps and above		
Girls	Below 12000 steps		12001-14000 steps		14001 steps and above		
(Tudor-Locke et al. 2009).							
	Measurement Results						
	<i>n</i>	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Boys	253	133	52.6	77	30.4	43	17.0
Girls	279	237	84.9	25	9.0	17	6.1

$\chi^2 = 65.896$, $p<0.001$

Table 4: Frequency (f), Percentage (%) and Chi-square (χ^2) results of Body Mass Index (BMI) assessment standards of adolescent boys and girls

	Assessments						
	Normal and below			Overweight		Obese	
Boys	22.5 and below			22.6-25.0		27.6 - 30.0	
Girls	23.2 and below			23.3-25.0		28.6 - 30.0	
(Cole et al. 2000).							
	Measurement Results						
	<i>n</i>	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Boys	253	190	75.1	47	18.6	16	6.3
Girls	279	212	76.0	48	17.2	19	6.8

$\chi^2 = .201$, $p>0.05$

is the consumption of energy as a result of movement of the body using skeletal muscles (Pate 1993). All kinds of physical activity require the expenditure of energy (Peker et al. 2000). Physical activity is one of the vital elements in improving public health (Salci and Kocak 2001). The increasing number of overweight children and adolescents show a prevalent increase that cannot be taken under control. Decrease in physical activity and sedentary lifestyles are proposed as the primary causes of obesity, and the negative relationship between physical activity and obesity in children is mentioned (Gutin et al. 2005).

In this paper, there was a significant difference between the pedometer values of boys and girls ($p < 0.001$). It was found that boys were physically more active than girls (Table 2). According to pedometer assessment standards by Tudor-Locke et al. (2009), physical activity levels of boys and girls were found to be normal and sedentary, respectively (Table 3). In their study conducted on the entire population, Le Masurier et al. (2003) determined that physical activity levels decreased continuously from childhood towards old age. In their study on adults, Tudor-Locke et al. (2008) defined 5000 steps and below as sedentary, 5000-7459 steps as low active group step, 7500-9999 steps as somewhat active, 10000-12499 steps as active, and 12500 steps and above as highly active. Barreira et al. (2015) showed that there were reductions in the number of steps between 3000 and 4500 steps/day from 6-7 to 18-19 years of age. For girls the reduction with increasing age grouping was more apparent with a more dramatic drop of approximately 2000 steps/day between 10 to 11-year-old girls and 12 to 13-year-old girls. Studies on the assessment criteria for the pedometer counts per day are available in the literature for children and adults. But there is no scoring scale to make accurate assessments for adolescents in the 12-19 years age range. According to the studies in the literature, 12000-16000 steps for boys and 12000-14000 steps for girls are the step values for normal healthy individuals (Tudor-Locke et al. 2009). Al-Sobayel et al. (2015) showed that female adolescents are much less active than males, especially during leisure time physical activities. Hopepa et al. (2008) concluded a study that the threshold values of 10000 steps can be used due to the following reasons. First, due to a remarkable decrease in the physical activity in

high school years, the threshold of 10000 steps per day, which means being active for adults, should be considered as an absolute level that young people should try to reach. Second, 12000-15000 steps per day, the threshold for children, and 7500-9999 steps per day, the threshold of being somewhat active for adults provide a middle ground between the two. Third, although these criteria do not represent the active percentages in determining the proportions of students, the benefits for health corresponds to a magic number for the group measured. Tudor-Locke et al. (2010), in their study on children and young people, stated that boys were at a level of 13000 steps per day and girls at a level of 12000 steps per day. Craig et al. (2010), in their study on children, stated that boys were at a level of 12259 steps per day and girls at a level of 10906 steps per day. Hands et al. (2004), in their study on children and adolescents in western Australia, found that boys reached the maximum steps per day at the age of 14.3 and girls at the age of 12.8. They concluded that the PAL of boys measured by pedometer (12377.59) was found to be significantly higher than that of girls (9438.95). It is stated that the time spent on popular activities such as watching television, playing video and computer games increases in the course of time, and therefore the physical activity level decreases, leading to a sedentary lifestyle. This is regarded as the main cause that increases the risk of obesity, reducing the power consumption (Romero et al. 2001). Van Mechelen et al. (2000) reported that the physical activity habits decreased after the age of 15 for both genders (especially for males between 13-27 years of age), that the time allocated to moderate intensity physical activities decreased more in males than females, and that organizing sports activities would contribute significantly to increase the physical activity habits in this period.

In this paper, there was no significant difference between the BMI assessment standards (Cole et al. 2000) of adolescent boys and girls ($p > 0.05$). According to BMI standards, body mass index of boys and girls was found to be normal and below (Table 4). Ceylan et al. (2014) found that there was no significant difference in body mass index values between boys and girls. Saygin (2014), who studied 2378 Turkish children, expressed that there was no significant difference found in BMI values according to

gender. Epstein et al. (2000) stressed the need to reduce sedentary behaviors in obesity therapy and observed that the body fat was significantly associated with the decrease in body weight percentage. In the study of Thaler et al. (2007) conducted on adolescents and young adults comprising 409 Swiss college students, following an obesity assessment made with BMI and BFP, it was reported that female students were overweight by 6.13 percent, weak 16.51 percent and body fat percentage of 16.98 percent was >30 percent, while the male students were overweight by 5.95 percent, weak by 9.52 percent and body fat percentage of 2.98 percent was >20 percent. Simsek et al (2005) in their study conducted on 1510 children between 6-17 years of age in Ankara, found the obesity rate to be 4.8 percent. They identified family history of obesity, malnutrition and low physical activity as risk factors. Oner et al. (2004) in their study conducted on 989 children between 12-17 years of age in Edirne, determined that incidence of being overweight was 10.6 percent for girls and 11.3 percent for boys, and the obesity rates were 2.1 percent and 1.6 percent, respectively. Simsek et al. (2008) in their study conducted on 6924 children between 6-17 years of age in Duzce, found the incidence of being overweight to be 10.3 percent, and obesity rate to be 6.1 percent, thus showing the incidence decreased in rural areas.

In this paper, a significant relationship was found between the daily step counts and BMI variables of boys and girls. The study showed that increased physical activity cause decreases in body mass index (Table 5). Looking at fifty studies, which evaluate the relationships between physical activity and body fat rate in children, negative relationships were observed in seventy eighty percent of the studies, and positive relationships were observed in four percent, while no significant relationships were found in eighteen percent of them (Rowland et al. 1999). Bayrakdar (2010) stated that there were inverse relationships between PAL and BMI in both girls ($r = -0.90$, $p < 0.001$) and boys ($r = -0.89$, $p < 0.001$). The study that was conducted on 1209 children by Saygin (2003) found negative relationships between moderate physical activity and body fat percentage in girls ($r = -.155$, $p < 0.05$) and boys ($r = -.155$, $p < 0.05$). Physical activity was negatively associated with measures of body composition (Joshi et al. 2015). Remmers et al. (2014) found an inverse relationship between

PAL and body composition. Kyle et al. (2001) expressed that physical activity is important in keeping BMI at the same level and preventing it from increasing, and that it exhibited a cyclical correlation with the prevention of fat mass in physically active individuals. They have reported that body fat and weight increase occurring in both genders due to age could be limited by physical activity, and that sedentary men and women having the same BMI values have < 0,7 kg more fat mass than physically active people.

CONCLUSION

Significant differences were found in PAL and BMI between boys and girls. The PAL (number of steps) of boys was found to be higher than girls. According to pedometer assessment standards, while physical activity level of boys was normal, the girls were sedentary. According to BMI standards, BMI of boys and girls was found to be normal and below. Physical activity affects BMI so improving the physical activity level is thought to be a factor inhibiting early obesity. Efforts to increase the physical activity level of adolescent boys and girls will be useful in terms of public health.

RECOMMENDATIONS

Parents should encourage their adolescent children to participate in physical activities. Promoting physical activity is a very important tool for improving life quality of adolescents. It can be suggested that it is important for public health to bring body compositions of boys and girls up to normal levels by increasing their physical activity level.

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