

Physical Activity Level and Obesity Prevalence of Primary and Secondary Students

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ABSTRACT This study aimed at examining physical activity level and obesity prevalence of Turkish students at age of 6-12 according to age and gender variables. The study covered 2378 children in total. Researchers used pedometers in order to determine physical activity level of children, and evaluated the pedometer score standards. Body compositions were determined as per Body Mass Index (BMI) and evaluated under BMI standards. Independent t test, one-way analysis of variance test, Tukey HSD test, and Chi-square test were used in this study. In the pedometer step counts, there were differences associated with gender in each age ($p < 0.001$). There was a significant difference in BMI values and the pedometer step counts of boys and girls according to their ages ($p < 0.001$). There was difference in both groups according to age ($p < 0.001$). There were gender-related differences in ages ($p < 0.05$, $p < 0.01$ and $p < 0.001$ respectively) in standard value of the pedometer step counts and the pedometer step counts. It is considered important for public health to bring body compositions of boys and girls up to normal levels by increasing their physical activity levels.

INTRODUCTION

The most important reasons that increase the prevalence of chronic diseases and conditions such as obesity, cardiovascular diseases, hypertension, diabetes and osteoporosis include low level of knowledge about importance of physical activity, lack of awareness about importance of physical activity for health and adoption of a more sedentary way of life (Baltaci 2008). Nevertheless, human body needs to move constantly by its innate nature. Yet, conditions today lead not only adults and elders but also children, even at very early ages, to a sedentary way of life, which puts human organism into a behavior that is not appropriate to its own nature. This type of behavior called as a “sedentary way of life”, results in organic depressions and prepares ground for children and youngsters to develop various diseases, which increases health problems (Zorba et al. 2013). Previous studies reported that the sedentary way of life played important role in development of obesity which is defined by World Health Organization (WHO) as abnormal and excessive accumulation of fat in the body to such an extent to distort health (Peker et al. 2000). Obesity causes many health problems due to its

adverse impact on body systems (endocrine system, cardiovascular system, respiratory system, gastrointestinal system, skin, genitourinary system and musculoskeletal system) and psychosocial situation (James et al. 2004). Body Mass Index (BMI) is often taken as basis to diagnose obesity. BMI is a value that is obtained by dividing body weight of an individual (kg) to square of body height (m) ($BMI = kg/m^2$) (WHO 2014). Obesity mostly starts in childhood. The risk of adulthood obesity in children with obesity in childhood is three times more than children with a normal BMI values. The more a child grows up with obesity problem, the more difficult it shall be for him/her to get rid of obesity in adulthood. Furthermore, children of obese adults will probably suffer from obesity, and will be parents of overweight children in the future as well (Ardle et al. 2000). Experts report that obesity has increased and keeps on increasing as an epidemic worldwide, and underline importance of the role played by physical activity and exercise on prevention of obesity and related health problems. Regular physical exercise has a critical role in reducing obesity-related health problems and mortality rate associated therewith (Mcinnis 2003), however physical activity improves body composition (Remmers et al. 2014). Physical activity protects muscle tissue and reduces fat tissue and abdominal fat in particular (Wareham 2007). This study was conducted in order to examine physical activity levels and obesity prevalence.

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lence of Turkish boys and girls at age of 6-12 according to age and gender variables.

METHODOLOGY

Subjects: This study covered 1162 girls and 1216 boys, 2378 children in total, attending in primary and secondary schools in *Mugla* Province in Turkey on voluntary basis.

Height (cm) and Weight (kg) Measurements: Height was measured to the nearest 0.1 cm by using a stadiometer. Weight was measured to the nearest 0.1 kg on an electronic scale (Seca Corp, Birmingham, United Kingdom).

Measurement of Physical Activity Level: Physical activity levels were measured on 2 week-days and 1 weekend day using Kenz Lifecorder pedometer. Pedometers were placed on the hip and they were checked against any problems by taking a few steps before the measurements (Saygin 2012). They were made to wear these pedometers after getting up and kept them until going to bed. Daily step standards graphics were developed for children by Tudor-Locke et al. (2008).

BMI (Body Mass Index): BMI was calculated as body mass in kilograms divided by height in meters squared (kg/m^2) (WHO 2014) Body Composition was evaluated by using Body Mass Index criteria which were designed by Cole et al. for 2-18 aged children (Cole et al. 2000).

Statistical Analyses: SPSS 16.0 Statistical package was used for analyzing the data. Height, weight, BMI, and pedometer step counts with regard to gender were analyzed by using independent t test, and with regard to age were ana-

lyzed by using One Way ANOVA test ($p < 0.05$) and Tukey HSD. BMI and step standards with regard to age were analyzed by using chi square test ($p < 0.05$) for both genders.

RESULTS

Findings of the study that was carried out to examine physical activity levels and obesity prevalence of Turkish boys and girls at age of 6-12 according to age and gender variables are given in tables as follows.

Height and weight values of boys and girls according to their ages were displayed. Height and weight values of seven ages (6, 7, 8, 9, 10, 11, 12) were examined (Table 1).

No significant difference was found in BMI values while significant difference was found between boys and girls in the pedometer step counts in terms of age ($p < 0.001$) (Table 2). Significant difference was found in BMI values and the pedometer step counts of girls in terms of age ($p < 0.001$) (Table 3).

There was significant difference found in BMI values and the pedometer step counts of boys in terms of age ($p < 0.001$) (Table 4). BMI values of boys and girls increases as age goes up. There are differences among all ages except ages of 11 and 12. There was a significant decrease in the pedometer step counts as the age goes down, except for the ages of 9 and 10. However, the pedometer step counts decreases in boys as age goes up and there is a significant difference among all ages (Table 5).

Table 1: Body height and weight values of boys and girls according to their ages

Variable/ Age	Gender	N	Height (cm)		Weight (kg)	
			X	SD	X	SD
6	F	121	122.04	3.21	21.02	5.21
	M	133	121.93	3.30	20.94	4.89
7	F	128	127.15	4.62	24.81	5.25
	M	141	128.06	4.41	24.59	6.01
8	F	178	130.51	4.01	27.43	6.31
	M	191	131.40	4.12	28.03	5.88
9	F	180	134.73	5.54	31.57	7.07
	M	176	135.82	5.32	31.23	7.23
10	F	204	140.34	6.63	35.73	8.87
	M	185	139.27	6.81	35.44	9.11
11	F	191	148.69	7.68	41.58	9.83
	M	212	146.55	7.55	40.81	10.13
12	F	160	154.84	7.83	46.71	8.92
	M	178	152.21	8.04	44.62	9.68

Table 2: t-test results of BMI and the Pedometer step counts of boys and girls according to ages

Variable/ Age	Gender	N	BMI (kg/height ²) X±SD	t	p	The Pedometer step counts X±SD	t	P
6	F	121	14.11±2.31	.159	N.S.	12014.21±1094.13	15.126	0.000***
	M	133	14.09±2.27			14727.33±1221.19		
7	F	128	15.35±2.78	.979	N.S.	11915.52±1104.75	14.973	0.000***
	M	141	14.99±2.61			14621.63±1347.83		
8	F	178	16.10±3.01	-.327	N.S.	11709.32±9485.12	17.578	0.000***
	M	191	16.23±3.32			14589.66±1134.68		
9	F	180	17.39±3.66	1.044	N.S.	11403.81±8447.29	18.808	0.000***
	M	176	16.93±3.81			14322.08±1209.57		
10	F	204	18.13±3.47	-.693	N.S.	11351.74±1413.71	14.129	0.000***
	M	185	18.27±3.80			14027.78±1242.53		
11	F	191	18.81±4.01	-.578	N.S.	11129.41±1629.47	15.805	0.000***
	M	212	19.00±3.87			13544.92±1554.53		
12	F	160	19.48±3.57	.461	N.S.	10871.84±1633.24	13.785	0.000***
	M	178	19.26±3.78			13125.14±1741.33		

N.S: Not Significant, *p<0.05, **p<0.01,***p<0.001.

Table 3: Results of One-Way Analysis of Variance (ANOVA) of BMI and the Pedometer step counts of girls according to age

VVariable/ Age	Gender	N	BMI X±SD	F	p	The Pedometer step counts X±SD	F	P
6	F	121	14.11±2.31	52.985	0.000***	12014.21±1094.13	130.279	0.000***
7	F	128	15.35±2.78			11915.52±1104.75		
8	F	178	16.10±3.01			11709.32±9485.12		
9	F	180	17.39±3.66			11403.81±8447.29		
10	F	204	18.13±3.47			11351.74±1413.71		
11	F	191	18.81±4.01			11129.41±1629.47		
12	F	160	19.48±3.57			10871.84±1633.24		

N.S: Not Significant, *p<0.05, **p<0.01,***p<0.001.

Table 4: Results of One-Way Analysis of Variance (ANOVA) of BMI values of boys according to age

Variable/ Age	Gender	N	BMI X±SD	F	p	The Pedometer step counts X±SD	F	P
6	M	133	14.09±2.27	47.855	0.000***	14727.33±1221.19	27.656	0.000***
7	M	141	14.99±2.61			14621.63±1347.83		
8	M	191	16.23±3.32			14589.66±1134.68		
9	M	176	16.93±3.81			14322.08±1209.57		
10	M	185	18.27±3.80			14027.78±1242.53		
11	M	212	19.00±3.87			13544.92±1554.53		
12	M	178	19.26±3.78			13125.14±1741.33		

N.S: Not Significant, *p<0.05, **p<0.01,***p<0.001.

No significant difference was found in BMI standards values in terms of gender whereas there was significant difference in BMI values of boys and girls in terms of age (p<0.001) (Table 6). No significant difference was found in the

pedometer step counts standards value of boys and girls at age of 6 and 7 while significant differences were found between boys and girls in other ages (p<0.05, p<0.01 and p<0.001 respectively). There were significant differences in the pe-

Table 5: Tukey HSD Results of BMI values and the Pedometer step counts of boys and girls

Age	Female		Male	
	BMI <i>p</i>	Pedometer step counts <i>p</i>	BMI <i>p</i>	Pedometer step counts <i>p</i>
6-7	0.000***	0.033*	0.000***	0.009**
6-8	0.000***	0.006**	0.000***	0.000***
6-9	0.000***	0.000***	0.000***	0.000***
6-10	0.000***	0.000***	0.000***	0.000***
6-11	0.000***	0.000***	0.000***	0.000***
6-12	0.000***	0.000***	0.000***	0.000***
7-8	0.000***	0.007**	0.000***	0.032*
7-9	0.000***	0.000***	0.000***	0.000***
7-10	0.000***	0.000***	0.000***	0.000***
7-11	0.000***	0.000***	0.000***	0.000***
7-12	0.000***	0.000***	0.000***	0.000***
8-9	0.000***	0.000***	0.040*	0.000***
8-10	0.000***	0.000***	0.000***	0.000***
8-11	0.000***	0.000***	0.000***	0.000***
8-12	0.000***	0.000***	0.000***	0.000***
9-10	0.000***	N.S.	0.000***	0.000***
9-11	0.000***	0.000***	0.000***	0.000***
9-12	0.000***	0.000***	0.000***	0.000***
10-11	0.003**	0.000***	0.005**	0.000***
10-12	0.000***	0.000***	0.000***	0.000***
11-12	N.S.	0.000***	N.S.	0.000***

N.S.: Not Significant, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6: Chi-square test scores of BMI standards of boys and girls

Variable / Gender Age	N	Normal and below		Overweight		Obese		χ^2	<i>P</i>
		<i>F</i>	%	<i>F</i>	%	<i>F</i>	%		
6	F	121	107	88.4	10	8.2	4	3.3	.455
	M	133	111	83.4	16	12.0	6	4.5	
7	F	128	104	81.2	17	13.2	7	5.4	.122
	M	141	117	82.9	16	11.3	8	5.6	
8	F	178	145	81.4	23	12.9	10	5.6	.081
	M	191	149	78.0	33	17.2	9	4.7	
9	F	180	145	80.5	27	15.0	8	4.4	.275
	M	176	146	82.9	20	11.3	10	5.6	
10	F	204	159	77.9	31	15.1	14	6.8	.438
	M	185	140	75.6	32	17.3	13	7.0	
11	F	191	147	76.9	32	16.7	12	6.2	.101
	M	212	156	73.5	43	20.2	13	6.1	
12	F	160	121	75.6	34	21.2	5	3.1	.354
	M	178	126	70.7	38	21.3	14	7.8	

+ girls according to ages: $\chi^2 = 48.757^{***}$, ++ boys according to ages: $\chi^2 = 55.253^{***}$, N.S.: Not Significant, * $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

dometer step counts of both boys and girls according to age ($p < 0.001$) (Table 7).

DISCUSSION

In the study, there were significant differences in the pedometer step counts of both boys and girls according to age (in Tables of 2, 3, 4 and 5). Significant differences were found be-

tween girls and boys in all ages, except for the ages of 6-7, in terms of pedometer step counts standard values (Table 7). Sedentary way of life has been increasing all around the world. Sedentary life results in many physical and psychological diseases. Physical activity has many preventive and curative impacts on many diseases (Saygin 2012). Decelis et al. (2014) stated that there were significant differences in total physi-

Table 7: Chi-square test scores of Pedometer step counts standards of boys and girls

Variable/ Age	Gender	N	Copper (Sedentary)		Bronze (Low Active)		Silver (Somewhat active)		Gold (Active)		Platinum (Highly active)		χ^2	P
			F	%	F	%	F	%	F	%	F	%		
6	F	121	0	0	7	5.7	61	50.4	52	42.9	1	1.2	6.345	N.S.
	M	133	1	0.7	10	7.5	70	52.6	52	39.0	1	0.7		
7	F	128	0	0	5	3.9	66	51.5	57	44.5	0	0	8.687	N.S.
	M	141	2	1.4	13	9.2	78	55.3	47	33.3	1	1.4		
8	F	178	0	0	9	5.0	80	44.9	88	49.4	1	1.7	10.224	0.041*
	M	191	3	1.5	19	9.9	84	43.9	82	42.9	3	1.5		
9	F	180	0	0	19	10.5	87	48.3	74	41.1	0	0	15.889	0.005**
	M	176	2	1.1	14	7.9	105	59.6	53	30.1	2	1.1		
10	F	204	1	0.4	21	10.2	83	39.3	99	48.5	0	0	21.457	0.000***
	M	185	2	1.0	31	16.7	123	66.4	28	15.1	1	0.5		
11	F	191	2	1.0	27	14.1	105	54.9	57	29.8	0	0	35.876	0.000***
	M	212	4	1.8	57	26.8	128	60.3	19	8.9	4	1.8		
12	F	160	1	0.6	26	16.2	99	61.8	34	21.2	0	0	41.254	0.000***
	M	178	7	3.9	51	28.6	107	60.1	9	5.0	4	2.2		

+ girls according to ages: $\chi^2 = 179.721^{***}$, ++ boys according to ages: $\chi^2 = 298.659^{***}$,
 NS: Not Significant, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

cal activity time between girls and boys aged 11-12 years. It was found that the values of total physical activity time of boys were better than girls. Telford et al. (2013) found out in their study in 2013 the daily pedometer step count for girls as 9762, 8523, 9078, 10002, 9008 for the ages of 8, 9, 10, 11 and 12, respectively. For boys, the daily pedometer step counts were 12014, 10552, 11206, 11459 and 10477 for the ages of 8, 9, 10, 11 and 12, respectively. A study reported the daily pedometer step count for girls as 14710 for the age group of 6-9, and for boys as 16821 at the same age group (Belton et al. 2010) whereas another study stated that the pedometer step count for boys at the age group of 8-11 was 12263 and 11748 for girls at the same age group (Duncan et al. 2007). A study conducted on children between 7-11 ages in 2009 suggested daily pedometer count as 9789 for boys and 9397 for girls (Gorely et al. 2009) while Raustorp et al. (2007) stated that daily pedometer count was between 13788 and 15141 for girls at the age group of 7-9 and between 15991 and 16273 for boys. Bayrakdar (2010) found significant inverse differences in daily pedometer counts in all age groups according to both gender (in favour of boys) and age. An analysis of pedometer count standards values shows that the values are 0.23% platinum, 17.26% gold, 48.92% silver, 31.89% bronze and 1.67% copper in girls whereas 0% platinum, 10.03% gold, 53.07% silver, 28.89% bronze and

7.99% in boys. Saygin (2003) conducted a study on 1209 Turkish children and found significant difference in physical activity level in favour of boys at age of 10-12. Physical activity level reduces as age goes up in both boys and girls. It was reported that physical activity was in silver level for all children. Tudor-Locke et al. (2004) reported that children at age of 6-12 making 12000-15000 steps daily were healthier and had a better BMI level.

In the study, no significant differences were found between genders in terms of BMI (Table 2) and BMI standards (Table 6). Significant differences were found between BMI values of girls and boys in terms of ages except for the ages of 11-12 (Table 5). Obesity is the most important global health problem of our era. Obesity is increasing day by day in both developed and developing (Molarius 1999). Obesity prevalence has been doubled in the world between the years of 1980 and 2008 (WHO 2011). Remmers et al. (2014) found negative relationship between moderate-vigorous physical activity and body composition. There is a difference of about 2 kg in favour of girls at age of 12-13 (Muratli et al. 2005). Gorely et al. reported in 2009 that BMI value of boys at age of 7-11 was 17.5 kg/m² while that of girls was 18.1 kg/m². Another study suggested BMI value of girls at age of 9-11 was 18.6 kg/m² while that of boys was 18.2 kg/m² (Dukanci 2008). Bayrakdar (2010) did not find out any difference

in BMI values of the age group of 7-11 whereas there were significant increases according to age. A study that was conducted on 1209 Turkish children suggested no significant difference in BMI values of children at ages of 10-12 according to gender whereas there are significant differences according to age variable. According to Lohman's body composition evaluation standards for children and youngsters, the value above the normal was found as 21.63% in boys and 18.6% in girls at age of 10; 22.8% in boys and 19.35% in girls at age of 11; and 19.12% in boys and 18.22% in girls at age of 12 (Saygin 2003). Zadeh et al. (2013) conducted a study on children at age of 12-14, and observed a significant inverse relationship between physical activity and BMI ($p < 0.05$). The level of physical activities was significantly different between overweighted and obese students and thinness and underweighted ones. Another study found that the body fat percentage affected physical activity level in girls (Beta=-.283) and in boys (Beta=-.311) inversely at the level of $p < 0.01$ (Saygin 2003). European Nutrition and Health Report (2009) states that overweight and obesity prevalence of children was rapidly increasing in Europe. 27% of girls from 4-6 to 9 years old and 24% of boys from 4-6 to 8 years old fall into this category. It is 36% in girls at age of 10-14 in Spain while it is 36% in boys at age of 7-9 in Italy, too (Elmadfa 2009). In recent years, obesity prevalence is increasing and physical activity level is decreasing both in Turkey and all around the world. According to Nutrition and Health Survey in Turkey (TBSA 2010), 8.2% of children in the age group of 6-18 (M:9.1%, F:7.3%) are obese, and 14.3% (M:14.2%, F:14.4%) were overweight. Obesity prevalence in boys is higher than that in girls at this age group. According to the same survey, 58.4% of children at the age group of 6-11 does not exercise regularly all around Turkey. 65.8% of children at the age group of 6-8 and 52.7% of children at the age group of 9-11 did not exercise at all. As age goes up in children and youngsters, physical activity level decreases and they spend more time by watching TV and playing computer games (Saygin 2012).

CONCLUSION

The reason of the Pedometer step counts of girls was lower than boys can be especially explained by socio-cultural factors. As age goes

up, the physical activity level decreases while BMI scores increase. It may depend on watching TV, playing computer games, eating junk food, Turkish educational systems. Individuals who are obese in their childhood and youth are more likely to be obese in their adulthood, as well. Therefore, it is critical for public health to make children gain physical activity habits at very early ages, as well as good behaviors, to prevent obesity as early as possible. It is considered important for public health to bring body compositions of boys and girls up to normal levels by increasing their physical activity levels.

RECOMMENDATIONS

Parents should encourage their children to participate in physical activities. Promoting physical activity is very important tool for improving life quality of children. Kids should watch less TV and play computer games and they should be avoided to consume junk food.

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