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Examination Of Physical Activity and Body Composition Levels of Adolescents

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Abstract

Purpose of the Study: The study aimed to examine adolescents' physical activity and body composition levels according to various variables. Materials and Methods: The participant group of this study consisted of a total of 1104 children (551 girls and 553 boys between the ages of 10-14, enrolled in primary schools in Ankara. In our study, physical activity questionnaire for children (PAQ-C) scale was used to determine the weight, height, BMI measurements, and physical activity level. Result: According to the findings, a significant difference was found in the physical activity levels of boys according to the types of transportation to school ($p<0.05$). When children's sleep duration is examined, boys' and girls' BMI and physical activity levels are similar ($p>0.05$). Significant differences were found in the BMI and physical activity levels of both boys and girls during the daily use of the technological device ($p<0.05$). A negative correlation ($p<0.05$) was found between the daily use of technological devices, sleep duration, and physical activity levels of boys and girls, and a positive correlation with BMI ($p<0.05$). Conclusions: Prolonged screen time is thought to affect body Composition and physical activity level negatively. It is thought that the sleeping time should be 8 hours and the screen time should be less in order for BMI and physical activity level to be at appropriate levels.

Keywords: Physical Activity; Body Composition; Sleep; Television; Smartphone

Ergenlerin Fiziksel Aktivite ve Vücut Kompozisyon Düzeylerinin İncelenmesi

Özet

Araştırmanın Amacı: Araştırmada adölesanların fiziksel aktivite düzeylerini çeşitli değişkenlere göre incelemek amaçlanmıştır. Materiyal ve Metod: Çalışmanın örneklemini Ankara ilindeki okullardan randomize yöntem ile seçilmiş 10-14 yaş arasındaki 551 kız ve 553 erkek olmak üzere toplam 1104 çocuk oluşturmuştur. Katılımcılara kişisel bilgi formu, Çocuklar için fiziksel aktivite (ÇFAA) ölçeği uygulanarak vücut ağırlığı, boy uzunluğu ve vücut kitle indeksi (VKİ) ölçümleri alınmıştır. Grupları karşılaştırmak için tek yönlü varyans analizi (ANOVA) kullanılmıştır. Bulgular: Elde edilen bulgulara göre erkek çocukların okula ulaşım türlerine göre fiziksel aktivite düzeylerinde anlamlı farklılık bulunmuştur ($p<0.05$). Çocukların uyku süreleri incelendiğinde erkek ve kız çocukların BKİ ile Fiziksel aktivite düzeyleri benzerlik göstermektedir ($p>0.05$). Teknolojik cihazı günlük kullanma süresinde ise hem erkek hem kız çocukların BKİ ve fiziksel aktivite düzeylerinde önemli farklılıklar tespit edilmiştir ($p<0.05$). Erkek ve kız çocukların teknolojik cihaz günlük kullanma süreleri ve uyku süreleri ile fiziksel aktivite düzeyleri arasında negatif yönde ($p<0.05$), BKI ile pozitif yönde ilişki bulunmuştur ($p<0.05$).
Sonuç: Sonuç olarak, teknolojik cihazların uzun süreli kullanımının beden kompozisyonunu ve fiziksel aktivite düzeyini olumsuz yönde etkilediği düşünülmektedir. BKİ ve fiziksel aktivite düzeyinin uygun seviyelerde olması için uyku saatinin 8 saat olması ve teknolojik cihazlara ayrılan sürenin daha az olması gerektiği düşünülmektedir.

Anahtar Kelimeler: Fiziksel aktivite, Vücut Kompozisyonu, Uyku, Televizyon, Akıllı telefon

INTRODUCTION

Adolescence is defined as the period between 10-19 by the World Health Organization (WHO). The amount of fat, hormones, and water in the body changes rapidly in adolescence when the fastest development is seen after infancy (19). These changes increase the need for nutrients and energy. Overeating and fast eating habits also occur during this period. While spending a long time in front of the computer and television, snacking is also common. These behaviors pave the way for a sedentary lifestyle and a tendency to gain weight during adolescence (32). Malnutrition and physical activity habits gained in adolescence can be permanent and affect the individual's health for life (23).

It is believed that the proliferation of screen time negatively impacts children, especially as they become an indispensable part of children's daily lives and gradually reduce outdoor playgrounds (35). Screen time has been associated with attention problems, aggressive behavior, physical inactivity, obesity, and sleep problems in preschool and school-age children. Excessive screen time causes the misuse of time that needs to be allocated for playing games, eating, and sleeping (5). The motor skills of children in developing age develop with a wide variety of activities, in this period, when technological devices are not used under suitable conditions, with appropriate software, and children's motor development is delayed for an appropriate period. Spending time with technological devices without movement for a long time negatively affects their gross and fine motor development, such as large and small muscle skills, hand and eye coordination (21).

There is growing research showing that the use of digital technology negatively affects sleep. It has been reported that sleep time decreases with the increased habit of having a television, computer, or mobile phone in the bedroom in early childhood (6, 8, 27, 22). Because poor or inadequate sleep habits negatively affect children's mental state, behavior, academic achievement, and growth and development rates, it is crucial to take care of sleep quality in children (28).

Worldwide, it is stated that 11% of children are obese, which is a significant health problem that continues to increase (15). Many clinical programs have been developed to combat this problem. Many focus on weight gain prevention rather than weight loss, allowing the child to become thinner over time as they grow in height (1). The child obesity rate has tripled in the last 20 years. To determine the most appropriate way of measuring adiposity changes, we need to know how BMI varies over time in normally growing children (10.). Nowadays, children travel by vehicle rather than walking and use elevators instead of stairs. With digital games, children's lives are becoming more automatic; as a result, children are less active in daily life. Children require 3-4 hours of physical activity and social interaction a day to develop healthily (20). It has been found that there is a low but significant relationship between excessive screen time in the preschool period and the increase in BMI, and it has been reported that it paves the way for more weight gain in the future (12). It has been suggested that the limit of screen time in preschool children is 2 hours, and every hour that this limit is exceeded is associated with an increase in BMI (44).

Regular physical activities and the body Composition of children are critical in being healthy individuals in their later years. Nowadays, children's most significant obstacles to becoming healthy individuals are the long periods of sleep, television, smartphone, and computer use, which drag children to a sedentary lifestyle and negatively affect their body Composition. Since no comprehensive study was conducted in this way before in the 10-14 age group in Turkey, the study was the first considering the number of participants.

This study aimed to examine adolescents' physical activity and body composition levels and body mass indexes according to various variables.

METHOD

Participant Group and Ethics

The participant group of this study consisted of a total of 1104 children, 551 girls and 553 boys between the ages of 10-14, who study and train in primary schools in Ankara (Table 1). The necessary permissions for the research were obtained from the Ministry of Education, Primary School Principals, and their families. Girls and boys between the ages of 10 and 14 have been included in research on a volunteer basis. This research was supported with the permission of Muğla Sıtkı Koçman University Human Research Ethics Committee with the number 190106 and with the permission number 14588481-605.99-E.1343045 of Ankara Governorship Directorate of National Education.

The inclusion criteria for the study were determined as the children participating in the study are of primary school age, are between the ages of 10-

14, have no health problems, voluntarily participate, have or use technological devices (mobile phone, computer, tablet, etc.), have parental consent. The exclusion criteria were determined as the child not being in primary school age, not between the ages of 10-14, having any health problems, not being voluntary, not using technological devices, and not obtaining permission from their parents.

Determination of Sample Size

G * Power 3.1.9.4 software was used to determine the sample size in the study. In the power analysis, the alpha significance level (Type I error) was taken as $\alpha = 0.05$, and the power value we want to obtain (Type II error) was taken as $\beta = 0.95$. The effect width was taken as $| \varrho | = 0.1$ for the high validity of our study. As a result, the number of people included in the study was determined to be at least 1084.

Bodyweight and Height: Body weight was measured with a Seka brand electronic scale with an accuracy of 0.1 kg, while the height was measured with a Seka brand digital height meter with an accuracy of 0.01 cm. Individuals were measured by barefoot or wearing socks. In measurements, the head was upright, the soles of the feet were flat on the scale, the knees were stretched, the heels were together, and the body was taken in an upright position (39).

Body Mass Index: It was evaluated according to the Body Mass Index (BMI) criteria determined by Cole et al. In their study on children aged 2-18. Body Composition was calculated using the formula kg/cm2 (9, 11). Body mass index is a method used to assess the risk of health problems at the population level and developed by Adolphe Quetelet in 1970 based on data and reports from 7 different countries.

Information Form: Information on the daily sleep and technological device (television, computer, smartphone) usage times of the children was collected with the information form created by the researcher. According to the consensus statement of the American Academy of Sleep Medicine (33) and the Canada 24-Hour Movement Guide for Children and Young People's Integration of Physical Activity, Sedentary Behavior and Sleep study (42), the importance of 8 hours of sleep in the age group of our study group is stated for optimal health. Paruthi et al. stated in their study that 8 hours of sleep had positive health outcomes, and less than or more than 8 hours of sleep had negative health consequences (33). The reference intervals we use for sleep duration were designed according to this study.

Physical Activity Questionnaire for Children (PAQ-C): In this study, The Physical Activity Questionnaire for Children-PAQ-C scale, which was developed for children, was used because interventions were planned directly for children. The reliability study (13) and validity study of the scale has been performed (26), and the Cronbach alpha reliability coefficient is 0.80. Psychometric analysis of the Turkish form of the questionnaire was performed, and the Cronbach alpha coefficient of the questionnaire was found to be 0.86 (16). A PAQ-C scale is a form developed to evaluate the physical activities of primary school children between the ages of 8 and 14, from the fourth grade to the eighth grade, and filled by the child. It consists of 10 questions that assess physical activity for the last seven days (17).

Implementation of Data Collection Techniques: While implementing the measurements and the questionnaire, the children who participated in the study were informed about the research measurement and techniques. The children answered the questionnaires in the classroom where they studied. Height and body weight measurements and questionnaires to determine the level of physical activity were administered to the children and their classroom teachers.

Analysis of Data: The data obtained were evaluated in the SPSS 25 package program. Normality analysis of the data was made, and it was determined that the distributions showed normal distribution. In our study, the arithmetic mean and standard deviation values of the descriptive data were calculated. One-way analysis of variance (ANOVA) was used to compare the groups. The differences were determined by the Tukey HSD test. In addition, correlation analysis was used to determine the relationship between the data. The level of significance was set at $p < 0.05$.

RESULT

Table 1. Characteristics of The Participants

Variables	Gender	N	$\bar{x}$	SD
Height (m^2)	Boy	553	1.55	0.10
	Girl	551	1.54	0.09
Weight (kg)	Boy	553	45.52	11.54
	Girl	551	43.43	11.10
BMI (kg/height m^2)	Boy	553	18.76	3.51
	Girl	551	18.02	3.38
Age (years)	Boy	553	12.08	1.18
	Girl	551	11.96	1.16

BMI: Body mass index, SD: Standard deviation

Table 2. Comparison of Physical Activity and BMI Values of Boys and Girls Depending on Transportation Type

Gender	Variables	Groups	N	$\bar{x}$	SD	F	Tukey HSD
Boys	BMI (kg/height m²)	By car or service	281	18.97	3.61	1.108	
		On foot	257	18.52	3.35		
		By bike or skate	15	18.83	4.29		
	Physical Activity Level (steps)	By car or service	281	3.36[a]	0.81	3.428*	1-2*
		On foot	257	3.24[b]	0.73		
		By bike or skate	15	3.33[a]	0.48		
Girls	BMI (kg/height m²)	By car or service	226	18.14	3.35	0.309	
		On foot	325	17.93	3.40		
	Physical Activity Level (steps)	By car or service	226	3.25	0.83	1.781	
		On foot	325	3.13	0.82		

[a,b] Means within the same column with different superscripts differ significantly BMI: Body mass index, SD: Standard deviation

No significant difference was found between BMI values of children according to school transportation. However, it is seen in table 2 that the BMI value of children who travel to school on foot is lower. A statistically significant difference was found in the physical activity levels of boys according to their transportation to school p <0.05. This difference is due to those who go to school by car or shuttle bus and those who walk to school. No significant difference was found between BMI and physical activity levels of girls according to the type of transportation to school. However, it is seen in the table that the BMI value of girls who travel to school on foot is lower.

Table 3. Sleeping Hours of Children

Gender	Variables	Groups	N	$\bar{x}$	SD	F
Boys	BMI (kg/height m²)	Over 8 hours	198	18.96	3.66	0.646
		8 hours	238	18.58	3.18	
		Lower than 8 hours	117	18.78	3.87	
	Physical Activity Level (steps)	Over 8 hours	198	3.31	0.86	1.214
		8 hours	238	3.34	0.71	
		Lower than 8 hours	117	3.21	0.70	
Girls	BMI (kg/height m²)	Over 8 hours	178	18.06	3.20	0.495
		8 hours	239	17.87	3.42	
		Lower than 8 hours	134	18.22	3.55	
	Physical Activity Level (steps)	Over 8 hours	178	3.21	0.80	1.303
		8 hours	239	3.14	0.84	
		Lower than 8 hours	134	3.29	0.85	

**=Significant at the 0.05 level, BMI: Body mass index, SD: Standard deviation*

According to Table 3, no statistically significant difference was found between the BMI and Physical activity levels of both boys and girls according to their sleep time.

Table 4. Daily Screen Time of Children

Gender	Variables Group	N	$\bar{x}$	SD	F	Tukey HSD
Boys	BMI (kg/m²)	I do not use	204	18.36[a]	3.30	6.733*	1-4* 1-3* 2-4* 2-3* 3-4*
		1-2 hour	207	18.50[a]	3.09		
		3-4 hour	77	18.78[a]	3.71		
		5-6 hour	35	20.97[b]	4.43		
		7 hours and over	30	20.61[b]	4.49		
	Physical Activity Level (steps)	I do not use	204	3.17[b]	0.74	4.088*	1-3*
		1-2 hour	207	3.37[b]	0.75		
		3-4 hour	77	3.41[a]	0.84		
		5-6 hour	35	3.17[b]	0.74		
		7 hours and over	30	3.63[a]	0.66		
Girls	BMI (kg/m²)	I do not use	265	17.82[a]	3.37	2.927*	1-4* 2-4*
		1-2 hour	180	17.95[a]	3.42		
		3-4 hour	73	18.15[a]	2.80		
		5-6 hour	27	20.12[b]	4.03		
		7 hours and over	6	17.90[a]	4.07		
	Physical Activity Level (steps)	I do not use	265	3.11[b]	0.84	4.347*	1-3* 2-3*
		1-2 hour	180	3.17[b]	0.81		
		3-4 hour	73	3.50[a]	0.85		
		5-6 hour	27	3.33[a]	0.62		
		7 hours and over	6	3.83[a]	0.40		

[a,b] Means within the same column with different superscripts differ significantly BMI: Body mass index, SD: Standard deviation

According to Table 4, a significant difference was found between the daily screen time in both boys and girls and the level of BMI and physical activity (p<0.05).

Table 5. Correlation Analysis of Variables

Gender	Variables	BMI	Physical Activity Level
Boys	Technological Device Usage Duration (hours)	.136*	-.118*
	Sleep Duration (hours)	.009	-.038
Girls	Technological Device Usage Duration (hours)	.100*	-.151*
	Sleep Duration (hours)	.031	-.029

**=Significant at the 0.05 level, BMI: Body mass index*

A significant positive low correlation was found between the boys' average screen time and BMI. Also there is significant negative low correlation was found between and the physical activity level of boys (p<0.05). When the data of girls are examined, a significant negative correlation was found between girls' average screen time and physical activities (p<0.05). Additionally significant relationship was found between the girls' average screen time and BMI (p <0.05). It was determined that there was no significant correlation in terms of sleep duration of girls and boys (p>0.05).

DISCUSSION AND CONCLUSION

This study aimed to investigate the effect of transportation type, sleep duration, and technological device usage duration on physical activity level and body composition in healthy Turkish children between 10 and 14 years old. For this purpose, we researched 1104 healthy children. It is seen in Table 1 that the height, body weight, BMI, and age values of boys and girls in the study show homogeneous distribution. Saygın and Ceylan stated that the mean age of boys was 12.61 ± 1.23 years, height value was 155.67 ± 10.96 cm, weight was 47.63 ± 12.81, and BMI was 19.42 ± 3.77, the mean age of girls was 12.41 ± 1.15 years, height was 153.62 ± 8.38 cm, weight as 46.00 ± 10.81 kg and BMI as 19.37 (38). Dağcı and Saygın found that the body mass index values of 12-year-old children were 19.63 ± 3.79 kg / cm2 (14). Estrogen in girls and androgen hormones in boys initiate puberty. Depending on these hormones, gender differences between boys and girls become clear. At this age, girls have more subcutaneous fat layers in some parts of their bodies than boys. Thus, a rapid increase in height and body weight is observed due to puberty and rapid growth (7).

Today, children travel more by vehicle than on foot (30) and cycling (45) and use elevators instead of stairs. As a result, children are less active in daily life (31), and their physical activity level and BMI are negatively affected. Although there is no statistically significant difference between male children's BMI in our study, it is seen that the BMI of children who travel to school by car and shuttle bus is higher. On the other hand, a significant difference was found between the levels of physical activity $p < 0.05$. Children who go to school by shuttle and bicycle have higher levels of physical activity. There was no significant difference in BMI and physical activity variables of girls. Physical activity decreases as societies become modern. Children today tend to use vehicles rather than walking or cycling (45). Yılmaz et al. stated in their study that children who walk to school walk less than 15 minutes and use transportation as the distance gets longer (46). Karadeniz stated in his study that the way children go to school (bus, bicycle, walking) does not affect their physical activity status and BMI (24.). Ulutaş stated that walking to school and attending physical education classes did not significantly affect obesity (43).

Sleep is a necessity for health. Despite this requirement, children's daily sleep duration directly affects their physical activity level and BMI. It is stated in the literature that 8 hours of sleep time contributes to general health, cardiovascular health, mental health, metabolic health, development of the immune system, performance (25), and longevity. They reported that sleep less than or more than 8 hours had negative health consequences (28; 33, 42). In our study, no significant difference was found between boys' and girls' physical activity levels and BMI values according to their sleep duration. In Table 3, it is seen that the physical activity levels and BMI levels of both boys and girls who have 8 hours of sleep are at a better level. Our table shows that a sleep duration of more than 8 hours or less negatively affects the level of physical activity and BMI. While sedentary behavior increases in children with poor sleeping habits, their level of participation in physical activity decreases (41). Ulutaş et al. determined the daily sleep time of children as 8.99 hours in their study (43). Although it was emphasized that short sleep duration increases the risk of obesity in students, Sancak et al. found in their study that the rate of obesity increased with the increase of sleep time (36, Dündar C, Totan M.). In a study conducted by Metinoğlu et al., no significant relationship was found between sleep duration and BMI in children aged 10-12 years (29). Ulutaş determined that the sleep time was more in the obesity group, and the difference was statistically significant (43).

Children need 3-4 hours of physical activity and social interaction a day to develop healthily. Ample screen time has been identified as an essential behavior associated with weight and obesity in children (20). In the study, a significant difference $p < 0.05$ was found between the BMI and physical activity levels of both boys and girls according to the daily screen time. It is seen in Table 4 that BMI levels and physical activity levels of boys and girls are negatively affected as the screen time increases. In a study of children aged 6 to 17 years, it was found that those with low levels of physical activity and who used technological devices (watching television or video and playing computer games) for a long time were two times more likely to be obese than those who did not use (40). Screen time has been reported as a typical sedentary activity, and the increase in watching time has been suggested to be associated with decreased physical activity in children (37). It has been suggested that excessive screen time is associated with lifetime obesity and cardiovascular risk (4, 8, 40), and this association now begins in early childhood (3).

It has been reported that there is a low but significant relationship between excessive screen time in childhood and BMI and that it paves the way for more weight gain in the future (1,10; 12, Fuller-Tyszkiewicz M, Hardy LL, 34). A significant relationship at $p < 0.05$ was found between age and physical activity in boys and between age and BMI and physical activity level in girls. A significant relationship at $p < 0.05$ was found between screen time, BMI, and physical activity in boys and girls. Studies have proven that modern technological devices such as computers, tablets, and smartphones, which have become widespread in recent years, pose health risks for children. Children who misuse technological devices for an unsuitable period and frequency appear to pose health risks such as physical inactivity, obesity, and poor sleep quality (34, 2).

As a result: The fact that most young people frequently use technological devices in their daily lives shows that digital life is an integral part of modern society. As a result of the findings of our study, it is thought that the prolongation of screen time negatively affects body composition and physical activity level. It was deduced that sleep time should be 8 hours and screen time should be less for BMI and physical activity level to be at appropriate levels. Therefore, the results of the study can be used to raise public awareness on how to maintain the healthy use of screen-based electronic devices. In addition, it is thought that the type of electronic device use (frequency, duration, content, location, time of day, etc.) will draw attention to the poor health consequences of how it affects sleep, body composition and physical activity level throughout life. It is anticipated that the results of the study can also be used for individual primary prevention strategies in the future.

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