



## The Effect of Body Mass Index on Physical Activity Level in Children between 10-11 Years of Age

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### Abstract

The aim of this study was to investigate the effect of body mass index on physical activity (PA) level in children between 10-11 years of age. This research is an experimental study. While the universe of the research is composed of children studying in primary schools in Ankara province in 2017-2018 education and academic year, the sample is composed of students studying and teaching in Gazi Primary School in Yenimahalle district. The study included 271 students between the ages of 10 and 11 who voluntarily participated. The necessary permissions were obtained from school principals and student parents before the investigation. This research were taken weight (kg), height (m), PA level (pedometer) and BMI (kg/height<sup>2</sup>) measurements. SPSS 23 package program was used in the analysis of the obtained data. The mean age of children was 10,57±0,49, mean height was 1,42±8,45 and body weight was 38,33±10,91. BMI was 17.64±3.07 in 10 age group and 19.43±3.94 in 11 age group. The level of PA was determined as 12288±1687 for 10 years and 11328±1721 for 11 years. There was a significant difference between the two groups (p<0.001). There was found to be negatively correlation with PA (r=-0,269) p<0.001, whereas a significant correlation was found between BMI level (r=0,240) p<0,001. A significant correlation was found between BMI and PA level (r=0.817) p<0.001. As a result, it can be said that the body mass indexes of children between 10-11 years of age are in good level and their PA levels are generally active.

**Keywords:** BMI, Physical activity, Sedantery, Pedometer, Fitness, Children.

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### Contents

1. Introduction .....	194
2. Methods .....	194
3. Findings .....	195
4. Conclusion and Discussion.....	195
References.....	196

## 1. Introduction

PA is associated with numerous immediate and long-lasting health benefits in children (Loprinzi *et al.*, 2012) and an increased amount of physical activity generally increases the benefits (Klakk *et al.*, 2013). PA is energy expenditure as a result of the body's movement through the skeletal muscles. Any PA requires energy expenditure. PA can be varied in different ways according to the characteristics of the training (aerobic, anaerobic or static, dynamic, etc.) PA is perceived synonymous with the word "sport" in the majority of society. However, physical activity is defined as activities that take place in daily life using muscles and joints with energy expenditure, increase heart and respiratory rate and result in fatigue at different intensity. In this context, as well as sports activities, exercise, games and various activities during the day are considered physical activity (Kutlu and Civi, 2013). Current recommendations on physical activity for children endorsed by the European Commission and the World Health Organization are for a minimum 60 minutes of daily moderate to vigorous physical activity (World Health Organization, 2010; Demirtas *et al.*, 2017).

The reported proportion of children actually achieving the recommendation varies across studies, partly due to dissimilar definitions of moderate to vigorous physical activity (Guinhouya *et al.*, 2013). Childhood is a period in which growth and development is fast. In this period, the intake of nutritional elements increasing the need is an important factor in preventing chronic diseases during adulthood. Healthy eating and lifestyle habits are shaped during childhood and become permanent. These habits are necessary for the protection and development of health. Being physically inactive, consuming "fast food" type foods frequently, spending a long time on television and computer, and consuming high calorie foods during these periods are the most important factors that affect being overweight and fat in children. Regular and balanced eating habits and regular physical activity are the most important factors for maintaining and improving health. Shaping healthy life habits in childhood can be achieved by education starting with childhood (Kutlu and Civi, 2013). Differences in neighbourhood characteristics could be another reason for the variety of physical activity levels in children. Positive effects of environmental factors in the neighbourhood, for example recreational facilities and parks, have been indicated for both physical activity levels and general health among children (Roemmich *et al.*, 2006).

A recent review concluded significant positive associations between access, density and proximity to parks and objectively measured physical activity among children in four out of eight studies included, whereas no significant associations were seen in the other four studies (Ding *et al.*, 2011). A lifestyle that includes physical activity plays an important role in disability and mortality in daily life. The fact that regular physical activity can prevent or delay different chronic diseases is well understood today (Pitta *et al.*, 2006). Socioeconomic factors have been associated with physical activity among children, albeit with conflicting results (Singh *et al.*, 2008) probably partly due to dissimilarities in the factors measured (e.g. income or education). Also seasonal factors may explain some of the differences (Rich *et al.*, 2012). This factor could be especially important in a Scandinavian context with large seasonal variations in weather conditions, temperature and hours of daylight (Hjorth *et al.*, 2013). Characteristics of the neighbourhood environment of children are likely to differ between countries and contexts. A majority of previous research that has found a relation between neighbourhood resources and physical activity in children has been performed in North America, while studies reflecting north European contexts are scarce (Davison and Lawson, 2006). In addition, lack of physical activity leads to obesity (Simşek, 2005).

Obesity is a disorder of energy metabolism resulting from excessive fat storage in the body, which can cause physical and mental problems. Taking more energy than consumed is the most important cause of obesity (Donohoue, 2004). The regulation of adipose tissues in the body and the etiology of obesity are multi-factor and are influenced by genetic structure, environmental warnings and developmental phenomena (Popkin, 2001). Changes in eating and activity habits cause obesity to be seen more frequently. Especially in genetically predisposed children, obesity is known to be caused by environmental factors (Donohoue, 2004). It is shown in a variety of studies in which the child's nutritional intake is shaped by the eating habits during the infancy period, the parents' nutritional properties and the family environment may cause obesity (Birch and Fisher, 1998). On the other hand, obesity and being overweight are closely related to sedentary lifestyle and lack of physical activity (Martinez-Gonzalez *et al.*, 2001).

The aim of this study was to investigate the effect of body mass index on physical activity level in children.

## 2. Methods

### 2.1. Participants

This research is an experimental study. While the universe of the research is composed of children studying in primary schools in Ankara province in 2017-2018 education and academic year, the sample is composed of students studying and teaching in Gazi Primary School in Yenimahalle district. The study included 271 students between the ages of 10 and 11 who voluntarily participated. The necessary permissions were obtained from school principals and student parents before the investigation.

### 2.2. 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).

### 2.3. Measurement of Physical Activity Level

Physical activity levels were measured on 5 weekdays and 2 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. They were made to wear these pedometers after getting up and kept them until going to bed. Daily step standards graphics were developed for youth by Tudor-Locke *et al.* (2008).

**Table-1. Physical Activity Levels Classification.**

Sedentary Lifestyle	Low Active	Somewhat Active	Active	Very Active
<5000	5000-7499	7500-9999	10000-12499	>12500

Source: Tudor-Locke *et al.* (2008).

#### 2.4. BMI (Body Mass Index)

BMI was calculated as body mass in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ). Body Composition was evaluated by using Body Mass Index criteria which were designed by Welk *et al.* (2000).

**Table-2. Body Mass Index Classification.**

Gender	Too low	Borderline	Good Fitness	Overweight	Obesity	BMI (weight/height <sup>2</sup> )
Male	12 or less	13-16	17-25	26-30	30+	
Female	12 or less	13-16	17-25	26-30	30+	

Source: Welk *et al.* (2000).

#### 2.5. Statistical Analysis

SPSS 23 package program was used in the analysis of the obtained data. The mean and standard deviation values of the subjects' age, height and body weight were calculated. Independent t test was applied according to age variables. Also a correlation analysis was performed to determine the relationship between physical activity and BMI.

### 3. Findings

**Table-3. Mean age, height and body weight of children.**

Variables	N	Mean	Standard Deviation
Age	271	10,57	,496
Height	271	142,30	8,454
Weight	271	38,33	10,913

According to Table 3, mean age of children was  $10,57 \pm 0,49$ , mean height was  $1,42 \pm 8,45$  and body weight was  $38,33 \pm 10,91$ .

**Table-4. Comparison of BMI and physical activity level by age.**

Variables	Age	N	Mean	Standard Deviation	t	p
BMI	10	116	17,64	3,07	-4,046	<0,00
	11	155	19,43	3,94		
Physical Activity Level	10	116	12288,05	1687,77	4,578	<0,00
	11	155	11328,44	1721,98		

P&lt;0,01\*\*\*.

In Table 4, BMI was  $17.64 \pm 3.07$  in 10 age group and  $19.43 \pm 3.94$  in 11 age group. The level of physical activity was determined as  $12288 \pm 1687$  for 10 years and  $11328 \pm 1721$  for 11 years. There was a significant difference between the two groups ( $p < 0.01$ ).

**Table-5. Relationship between age, BMI and physical activity levels of children.**

Variables	Methods	Age	Physical Activity Level
Physical Activity Level	Pearson Correlation	-,269**	
	Sig. (2-tailed)	,000	
BMI	Pearson Correlation	,240**	-,817**
	Sig. (2-tailed)	,000	,000

\*\*. Correlation is significant at the 0.01 level (2-tailed).

According to Table 5, there was found to be negatively correlation with physical activity ( $r = -0,269$ )  $p < 0,01$ , whereas a significant correlation was found between BMI level ( $r = 0,240$ )  $p < 0,001$ . A significant correlation was found between BMI and physical activity level ( $r = 0,817$ )  $p < 0,01$ .

### 4. Conclusion and Discussion

In our study, a significant difference was found at the level of  $p < 0.001$  in physical activity level and BMI values according to age. According to our research, as the level of physical activity increases, BMI is decreasing. As the age increases, the level of physical activity decreases and the BMI increases. In our study, the mean age of the children was  $10.57 \pm 0.49$ , the mean height was  $1.42 \pm 8.45$  and the body weight was  $38.33 \pm 10.91$ . In our study, BMI was determined as  $17.64 \pm 3.07$  for children aged 10 years and  $19.43 \pm 3.94$  for 11 years. Physical activity level was determined as  $12288 \pm 1687$  for 10 years and  $11328 \pm 1721$  for 11 years. A significant difference was found between the BMI and physical activity level at the level of  $p < 0.01$  according to age variable. A negatively significant correlation was found between age and physical activity ( $r = -0,269$ ) at a  $p < 0.01$  level while positively significant correlation with BMI ( $r = 0,240$ )  $p < 0,01$ . A negatively significant correlation was found between BMI and physical activity level ( $r = 0,817$ )  $p < 0,01$ .

Belton *et al.* (2010) has been determined that the height values of children between 6-9 years of age are 1.31 m., body weight 29.2 kg and BMI 17  $\text{kg}/\text{m}^2$ . As Duncan *et al.* (2007) the height values of children between 8-11 years

of age are 1.39 m., body weight 33,3 kg and BMI 17,5 kg/ m<sup>2</sup>. As Kolle *et al.* (2009) the height values of children in 9 years of age are 1.39 m., body weight 33,9 kg and BMI 17,2 kg/ m<sup>2</sup>. As Deforche *et al.* (2009) BMI of children between 6-10 years of age are 15,7 kg/ m<sup>2</sup>. As Gorely *et al.* (2009) BMI of children between 7-11 years of age are 17,5 kg/ m<sup>2</sup>. As Ridgers *et al.* (2007) the height values of children's years of age are 1.33 m., body weight 31,9 kg and BMI 17,8 kg/ m<sup>2</sup>. According to Stein *et al.* (2007) the height, body weight and BMI values of children between 10-12 years old have increased with the age. In the study of Komata (2002) conducted to 10 years old children with 6 months intervals it is indicated that the height and the body weight of boys have increased in terms of the age.

Le-Masurier *et al.* (2003) indicated that there was a negative correlation between BMI and body weight and physical activity levels, and that physical activity steps and levels from childhood to old age showed a steady decline.

According to Belton *et al.* (2010) the physical activity levels of 6-9 boys were defined as 16821 steps, Duncan *et al.* (2007) stated the physical activity levels of 8-11 year-olds as 12263 steps. Duncan *et al.* (2006) children have a level of 14124 daily steps. Gorely stated the physical activity level steps of children as 9789 per day. Raustorp and Ludvigsson (2007) indicated that children had a daily step level of 15991-16273. Cox *et al.* (2006) stated the average daily step levels of men as 15606, Craig *et al.* (2010) as 12259 steps. Deforche *et al.* (2009) indicated the physical activity levels of boys between 6-10 years of age as gold.

Tudor-Locke and Bassett (2004) indicated in the study named "how many steps are enough?" that 5000 steps and below sedentary, 5000-7459 steps are low active group, 7500-9999 steps are a little active, 10000-12499 steps are active, and 12500 steps and above are high active. Locke stated that children taking physical activity steps between 12000-15000 daily have a healthier and more positive BMI level, as well as children have an average of 8000-12000 steps, and men have an average of 13000 daily steps.

In the study of Tudor-Locke and Bassett (2004) they indicated that 5000 steps and below have really bad life quality, between 5000 and 7499 have sedentary, between 7500 and 9999 have low life quality, 1000 steps and above have good life quality.

According to our research; for the protection or enhancement of physical activity; it is recommended to make physical activity more fun and to create activities appropriate for age groups. The duration of use of television, computer and smartphone should be reduced, and regular sleep times should be encouraged. Foods sold in school canteens should be inspected and banned food such as cola and chips should be encouraged. Increasing the number of physical activity areas in playgrounds in schools and after school will play an important role in children's physical activity habits.

As a result, it can be said that the body mass indexes of children between 10-11 years of age are in good level and their physical activity levels are generally active.

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