Dietary habits, physical activity, sleep duration, and their association with overweight and obesity among children aged 6-10

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ABSTRACT

This study aimed to determine dietary habits, the time spent on sleeping and physical activity among primary school children and to compare the responses given by the children and their parents about their dietary habits. This cross-sectional study was conducted on 282 children. A questionnaire including demographic characteristics, dietary habits, and some anthropometric measurements were performed. Physical activity and sleep duration were statistically different between overweight/obese and normal-weight children groups. The consumption of breakfast, lunch, fresh vegetables, dessert with dairy products, meat and meat products, chocolates, wafer, instant cake, pastry, and fast food was statistically higher in the overweight/obese group. Additionally, a statistical difference was found between "lunch consumption", "junk food consumption" and "the child finishes all food on his/her plate" according to the responses of children and parents. It is important to raise awareness of healthy eating, exercise, and sleeping habits among primary school children.

Keywords: dietary habits, physical activity, sleep, children, body mass index

INTRODUCTION

Overweight and obesity are an increasing public health concern among chil-

dren worldwide[1]. In Turkey, the prevalence of childhood obesity has grown in the past few decades. According to the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative-2013, 22.5% of 7-8-year olds in the country were obese or overweight (14.2% overweight, 8.3% obese). In November 2017, the Turkish Minister of Health stated that the prevalence of obesity had grown to around 10%[2]. Childhood obesity considered by the WHO to be one of the most serious problems of the 21st century - is a well-known cause of non-communicable diseases (such as cardiovascular diseases, diabetes mellitus, and certain types of cancer) in adults[3]. In order to prevent childhood obesity, interventions should be made to gain healthy nutrition behaviors, increase the level of physical activity, and regulate sleep duration and hours[4,5].

Nutritional behaviors have considerably changed in recent years, and the consumption of high-energy-density and processed foods has increased[6]. According to a Turkish study, it was found that primary school children consume chocolate with added sugar at least once or twice a week, or even more. Additionally, most of them consumed crisps-potato and sugary drinks (such as cola)[7]. Appropriate dietary habits provide a basis for the healthy growth and development of children[8]. Since it is difficult to reshape eating habits in adulthood, it is important to provide healthy dietary habits to children, especially due to negative health effects on emotional and social life and irregular development[9,10]. Therefore, understanding the relationship between dietary and lifestyle habits is necessary for the treatment of overweight and obesity.

In recent years, the spent time on outdoor activities or sports has dramatically decreased among children, and the spent time on screen activities such as playing video games, watching TV, or using electronic devices has increased[11]. Specifically, positive associations were found between watching TV and various indices of adiposity in children in the literature[12]. The reasons for that are increasing consumption of snack foods while watching TV, and increased demand for high-energy and processed foods advertised on TV[13,14]. The fact that children spend more time with electronic devices prevents them from engaging in outdoor activities and sports activities[11].

Sleep plays a role in growth and development as well as health status in children, due to the control over the circadian rhythm, which is related to energy homeostasis[15]. Changes in the circadian clock are associated with temporal alterations in feeding behavior and increased weight gain[16]. A few studies showed that short sleep duration is related to childhood obesity[17,18].

For all these reasons, it is important to determine the actual prevalence of overweight and obesity in children and determine the relative contribution

of lifestyle habits (dietary habits, physical activity, and sleep duration). The present study aimed to determine dietary habits, the time spent sleeping and physical activity, and anthropometric measurements in primary school children. Additionally, the responses of both children and parents to questions about children's dietary habits were compared.

METHODOLOGY

Study design and participants

This cross-sectional study was conducted among children aged 6-10 years primary school students in Avcılar, Istanbul between October and December 2017. We used power analysis for sample selection. The prevalence was calculated as 20%, type 1 error rate α 0.05%, type 2 error rate β 0.05%, and test power 1-β = 0.95%. According to the calculation we included a total of 300 students (40.7% boys and 59.3% girls) in this study. However, since 18 parents did not complete the survey, a total of 282 children were included in the study.

The public primary schools were randomly selected from the institutional registry list of the Ministry of Education using online resources. Avcılar is a district on the European side of Istanbul. There are a total of 67,905 students studying in 53 primary schools (49,043 students) and 35 secondary schools (18,862)[19]. We randomly selected 19 primary schools located in the center of Avcılar. Also, children from these schools were randomly selected using a random list of the classes. Both children, parents, and school authorities gave their informed written consent for the study and approved the protocol. The Local Education Authority granted permission for the study.

A questionnaire including some demographic characteristics (gender, age, disease, time spent on physical activity, time spent on electronic devices, time spent on sleeping, and dietary habits was performed on the children. Before the study, expert opinion was obtained from 5 academicians specializing in nutrition and exercise for the survey questions. Some necessary changes were made to the questions by conducting a pilot study on a group of 20 students. Additionally, some anthropometric measurements were taken by a trained researcher to eliminate the bias.

Dietary habits

Dietary habits were determined using a questionnaire adapted version of the "Turkey Childhood Obesity Survey" (COSI TUR) study[20]. "WHO European Childhood Obesity Surveillance Initiative – COSI" study is a study initiated by WHO in 2007-2008. Turkey was included in the COSI program for the first time

in the 3rd round. The study was carried out in cooperation with the Turkey Ministry of Health, the Ministry of National Education, and Hacettepe University within the framework of the criteria and protocol determined by the WHO[20].

Questions about dietary habits were the number of meals, frequency, and place of main meals and snacks. Furthermore, questionnaire included 19 food items including fresh fruits (grown in season such as mandarin, orange, pomegranate, apple, pear, etc.), fresh vegetables and salads (grown in season such as spinach, leek, carrot, beet, radish, etc.), fruit juice (packaged, sold at the grocery store), fruit juice (freshly squeezed), soft drinks containing sugar (such as cola, ice tea, fanta, etc.), diet soft drinks (such as cola with zero sugar, diet cola, sprite with zero sugar, etc.), unflavored milk, flavored milk (such as cacao, fruit, etc.), cheese, yoghurt/ayran, dessert with dairy products (such as rice pudding, pudding, chicken breast), red meat/poultry, fish, egg, legumes (such as haricot, chickpeas, lentils, etc.), nuts (such as hazelnuts, peanuts, almonds, walnuts, etc.), bread/rice/pasta/bulgur, junk foods (such as chip, popcorn, chocolate, instant cake, pastry, etc.), and fast foods (such as sandwiches, pitas, hamburgers, fried chicken, french fries, chicken nuggets, pizza, hot dogs). Children reported how many times per day, week, or month they consumed these specific food items during the last month. The frequency of food consumption was recorded in five categories: never, 1-2 times per month, 1-3 times per week, 4-6 times per week, and every day. Additionally, a questionnaire including the same dietary habits of children was used for the parents, and the responses given by the children and parents were compared.

Anthropometric measurements

Anthropometric measurements (height, waist circumference, and hip circumference in centimeters) of the children were taken according to the standard procedures[21]. The height of patients was taken using a stadiometer (brand name: Tanita) with the nearest 0.1 cm, while each participant was standing erect against the wall with heels together touching the wall, without shoes. Waist circumference was measured using a non-stretch plastic tape within 1 mm after normal exhalation, at the umbilicus level, and without clothing in the area. The hip circumference was measured using a non-stretch plastic tape from the widest point between the waist and the thigh. Body composition in terms of weight (kg), body mass index (kg/m^2), fat (%), and skeletal muscle mass (kg) was measured using the Inbody 120 system (Inbody 120, Inbody, South Korea). Body mass index (BMI) <5 percentile indicates thinness, and BMI ≥85 overweight and obesity. BMI values between 5 and 85 percentiles refers to normal weight. The prevalence of wasted and short stature in children was also determined by

using weight-for-height percentile values by the WHO[22]. According to the WHO classification, <3 percentile refers to wasted, 3 and 15 percentiles as short, 15 and 85 percentiles as normal height, and ≥ 85 percentile as tall.

Sleep duration

To determine sleep duration, both weekdays and weekend mornings were asked to wake up and sleep time of the children. Total sleep time was calculated in hours as the difference between bedtime and wake-up time for weekdays and weekend days and as the mean duration of sleeping using the equation: (weekday time × 5 + weekend day time × 2)/7[5].

According to the National Sleep Foundation recommendations for school-age children, sleep duration was classified as low if less than 9 h mean per night, recommended if between 9 and 11 h per night or high if more than 11 h per night[23].

Physical activity

We asked about the time spent on physical activity such as outdoor activities or sports, on both weekdays and weekends for determining the physical activity behaviors. Total physical activity time was calculated in hours for weekdays and weekend days and as the mean duration of physical activity using the same equation for sleep duration: (weekday time × 5 + weekend day time × 2)/7[5].

According to the WHO and Turkey Physical Activity Guideline recommendations for children, physical activity duration was classified as low if less than 1 h per day, normal if equal to 1 h per day or high if more than 1 h per day[24,25].

Statistical analysis

Data were evaluated with the statistical program SPSS 23.0 (Statistical Package for the Social Sciences, Inc.; Chicago, Illinois, United States). Categorical data were expressed as the frequency (percentage), and differences were analyzed using the chi-square test. Quantitative variables were expressed as the mean ± SD (standard deviation), and the Kolmogorov-Smirnov test was used to assess whether the data were normally distributed. We also analyzed the homogeneity of the variables. Differences in quantitative variables were analyzed by the student's t-test or Mann-Whitney U-test, as appropriate. For all statistical tests, a p-value of ≤0.05 was considered statistically significant.

RESULTS and DISCUSSION

282 children (58.5% girls, 41.5% boys, mean age 8.34 ± 1.15 years) and their parents completed the study. The most three popular physical activity types were football (28.0%), running (25.3%), and basketball (16.0%) among chil-

dren. According to the height classification, the majority of children (52.5%) were in the normal range. Additionally, the majority of children (55.7%) were normal weight, 23.4% were overweight, and 12.0% were obese (Table 1).

Table 1. Characteristics of children (n=282)

Characteristics	Boys (n=117)	Girls (n=165)	Total (n=282)
Age (year)*	8.42 ± 1.04	8.46 ± 1.13	8.34 ± 1.15
Time spent on watching TV, playing video games, and using electronic devices (mean hour)*			
Weekdays	1.72 ± 1.51	1.50 ± 1.43	1.64 ± 1.43
Weekend days	2.47 ± 2.16	1.90 ± 1.56	1.99 ± 1.80
Time spent on physical activity (mean hour)*			
Weekdays	1.94 ± 0.69	1.76 ± 0.49	1.83 ± 0.51
Weekend days	1.64 ± 1.24	1.09 ± 0.51	1.42 ± 1.06
Type of physical activity**			
Football	42 (35.9)	-	42 (28.0)
Running	10 (13.5)	28 (36.8)	38 (25.3)
Basketball	14 (18.9)	10 (13.2)	24 (16.0)
Sleep duration (mean hour)*			
Weekdays	10.07 ± 2.00	10.22 ± 2.42	10.71 ± 3.05
Weekend days	11.37 ± 4.05	10.97 ± 2.46	11.79 ± 5.32
Body weight (kg)*	30.29 ± 8.47	30.12 ± 7.59	30.19 ± 7.94
Height (cm)*	129.96 ± 7.79	129.62 ± 8.38	129.76 ± 8.12
BMI (kg/m^2)*	17.74 ± 3.73	17.72 ± 3.29	17.73 ± 3.47
Classification of height			
Wasted	11 (9.4)	21 (12.6)	32 (11.3)
Short	31 (26.5)	47 (28.4)	78 (27.7)
Normal	66 (56.4)	82 (50.0)	148 (52.5)
Tall	9 (7.7)	15 (9.0)	24 (8.5)
Classification of BMI			
<5 percentile	9 (7.6)	16 (9.7)	25 (8.9)
5-85 percentile	68 (58.1)	89 (53.9)	157 (55.7)
≥85 percentile	22 (18.8)	44 (26.7)	66 (23.4)
≥95 percentile	18 (15.4)	16 (9.7)	34 (12.0)
Waist circumference (cm)*	61.60 ± 12.74	58.08 ± 12.69	59.53 ± 12.79
Hip circumference (cm)*	69.92 ± 12.36	68.48 ± 15.24	69.07 ± 14.10
Body muscle weight (kg)*	11.71 ± 2.27	11.80 ± 6.98	11.76 ± 5.54
Body fat percentage (%)*	22.04 ± 9.91	24.63 ± 8.61	23.56 ± 9.22

*Mean± standard deviation, **the first 3 most popular types of physical activity; BMI, Body Mass Index.

Classification of physical activity and sleep duration were statistically different between the two BMI groups (p<0.05). Additionally, the sleep duration in children with normal BMI was higher than the overweight and obese children, and similar results were found considering only weekdays or weekend days (Table 2).

Table 2. Classification of physical activity, sleep behaviors, and gender by BMI.

	5-85 BMI percentile (n = 157) n (%)	≥85 BMI percentile (n = 100) n (%)	Total (n = 257) n (%)	p value
Gender				0.78
Boy	68 (63.0)	40 (27.0)	108 (42.0)	
Girl	89 (59.7)	60 (40.3)	149 (58.0)	
Mean physical activity level	1.99 ± 0.96	1.93 ± 0.72	1.95 ± 1.75	0.06*
Weekdays	1.95 ± 1.75	1.60 ± 1.17	1.83 ± 1.58	0.90
Weekend days	2.31 ± 1.78	2.36 ± 2.01	2.33 ± 1.86	0.18
Classification of physical activity				0.04*
Low	67 (42.6)	34 (24.0)	101 (39.2)	
Normal	-	2 (2.0)	2 (0.8)	
High	90 (57.4)	64 (64.0)	154 (60.0)	
Sleep duration				
Mean sleep duration	10.46 ± 2.27	10.42 ± 1.81	10.44 ± 1.98	0.04*
Weekdays	10.23 ± 1.80	10.12 ± 2.93	10.16 ± 2.25	0.02*
Weekend days	11.19 ± 3.03	11.04 ± 3.54	11.13 ± 3.21	0.04*
Classification of sleep duration				0.03*
Low	4 (2.5)	4 (4.0)	8 (3.2)	
Recommended	78 (49.7)	47 (47.0)	125 (48.6)	
High	75 (47.8)	49 (49.0)	124 (48.2)	

*p<0.05, differences between the two BMI groups; p-values were computed with chi-square test for gender, classification of physical activity, sleep duration, and BMI groups; Student's T-test for mean sleep duration and BMI groups; Mann-Whitney U-test for mean physical activity and BMI groups; BMI, Body Mass Index.

According to the frequency of specific food groups, it was found that consumption of breakfast, lunch, fresh vegetables, dessert with dairy products, meat and meat products, chocolates, wafer, instant cake, pastry, and fast foods was statistically different between normal weight and overweight/obese groups (p<0.05) (Table 3).

Table 3. Frequency of children's consumption of certain foods by BMI

Foods	Everyday	4-6 per week	1-3 per week	1-2 per month	Never	p value
	n (%)	n (%)	n (%)	n (%)	n (%)	
Breakfast						
Normal weight	133 (84.8)	1 (0.6)	20 (12.7)	-	3 (1.9)	0.04*
Overweight and obese	60 (60.0)	6 (6.0)	22 (22.0)	9 (9.0)	3 (3.0)	
Lunch						
Normal weight	107 (68.2)	15 (9.5)	30 (19.1)	2 (1.3)	3 (1.9)	0.04*
Overweight and obese	64 (64.0)	7 (7.0)	11 (11.0)	8 (8.0)	10 (10.0)	
Dinner						
Normal weight	137 (87.3)	12 (7.6)	6 (3.8)	-	2 (1.3)	0.85
Overweight and obese	84 (84.0)	6 (6.0)	3 (3.0)	5 (5.0)	2 (2.0)	
Fresh fruit						
Normal weight	2 (1.3)	2 (1.3)	30 (19.1)	47 (29.9)	76 (48.4)	0.32
Overweight and obese	-	2 (2.0)	28 (28.0)	24 (24.0)	46 (46.0)	
Fresh vegetables						
Normal weight	15 (9.5)	9 (5.7)	40 (25.5)	40 (25.5)	53 (33.8)	0.04*
Overweight and obese	11 (11.0)	5 (5.0)	41 (41.0)	20 (20.0)	23 (23.0)	
Soft drinks containing sugar						
Normal weight	77 (49.0)	30 (19.1)	38 (24.2)	10 (6.4)	2 (1.3)	0.44
Overweight and obese	50 (50.0)	16 (16.0)	23 (23.0)	7 (7.0)	4 (4.0)	
Diet soft drinks						
Normal weight	127 (80.9)	15 (9.5)	9 (5.8)	4 (2.5)	2 (1.3)	0.27
Overweight and obese	89 (89.0)	9 (9.0)	1 (1.0)	-	1 (1.0)	
Milk						
Normal weight	22 (14.0)	2 (1.3)	36 (22.9)	26 (16.6)	71 (45.2)	0.36
Overweight and obese	10 (10.0)	4 (4.0)	21 (21.0)	18 (18.0)	47 (47.0)	
Flavored milk						
Normal weight	35 (22.3)	14 (8.9)	50 (31.8)	32 (20.4)	26 (16.6)	0.19
Overweight and obese	38 (38.0)	4 (4.0)	30 (30.0)	14 (14.0)	14 (14.0)	
Cheese						
Normal weight	16 (10.3)	3 (1.9)	31 (19.7)	28 (17.8)	79 (50.3)	0.10
Overweight and obese	6 (6.0)	5 (5.0)	18 (18.0)	23 (23.0)	48 (48.0)	
Yoghurt, ayran						
Normal weight	1 (0.6)	7 (4.5)	46 (29.3)	40 (25.5)	63 (40.1)	0.24
Overweight and obese	3 (3.0)	2 (2.0)	31 (31.0)	16 (16.0)	48 (48.0)	
Dessert with dairy products						
Normal weight	26 (16.6)	50 (31.8)	56 (35.6)	18 (11.5)	7 (4.5)	0.04*
Overweight and obese	26 (26.0)	40 (40.0)	22 (22.0)	4 (4.0)	8 (8.0)	
Meat and meat products						
Normal weight	15 (9.5)	21 (13.4)	70 (44.6)	30 (19.1)	21 (13.4)	0.02*
Overweight and obese	13 (13.0)	17 (17.0)	54 (54.0)	14 (14.0)	2 (2.0)	

Fish						
Normal weight	18 (11.5)	50 (31.8)	62 (39.5)	13 (8.3)	14 (8.9)	0.27
Overweight and obese	14 (14.0)	38 (38.0)	31 (31.0)	7 (7.0)	10 (10.0)	
Egg						
Normal weight	12 (7.6)	7 (4.5)	37 (23.6)	36 (22.9)	65 (41.4)	0.46
Overweight and obese	6 (6.0)	3 (3.0)	30 (30.0)	17 (17.0)	44 (44.0)	
Legumes						
Normal weight	21 (13.4)	20 (12.7)	58 (37.0)	30 (19.1)	28 (17.8)	0.39
Overweight and obese	7 (7.0)	11 (11.0)	49 (49.0)	15 (15.0)	18 (18.0)	
Nuts						
Normal weight	8 (5.1)	28 (17.8)	63 (40.1)	30 (19.2)	28 (17.8)	0.62
Overweight and obese	4 (4.0)	15 (15.0)	39 (39.0)	13 (13.0)	29 (29.0)	
Bread, rice, pasta, bulgur						
Normal weight	-	8 (5.1)	20 (12.7)	41 (26.1)	88 (56.1)	0.19
Overweight and obese	10 (10.0)	4 (4.0)	21 (21.0)	19 (19.0)	46 (46.0)	
Chips and Popcorn						
Normal weight	26 (16.5)	40 (25.5)	62 (39.5)	18 (11.5)	11 (7.0)	0.91
Overweight and obese	28 (28.0)	27 (27.0)	32 (32.0)	7 (7.0)	6 (6.0)	
Chocolate, wafer, instant cake, pastry						
Normal weight	1 (0.6)	49 (31.3)	61 (38.9)	23 (14.6)	23 (14.6)	0.06*
Overweight and obese	11 (11.0)	35 (35.0)	37 (37.0)	15 (15.0)	2 (2.0)	
Fast foods						
Normal weight	10 (6.4)	50 (31.8)	50 (31.8)	19 (12.2)	28 (17.8)	0.001*
Overweight and obese	26 (26.0)	38 (38.0)	31 (31.0)	3 (3.0)	2 (2.0)	

*$p < 0.05$, differences between the two BMI groups; p values were computed by chi-square test; BMI, Body Mass Index. Normal weight children ($n= 157$), overweight and obese children ($n=100$)

In the responses of children and parents about dietary habits, a statistical difference was found between "lunch consumption", "junk food consumption" and "the child finishes all food on his/her plate" ($p<0.05$). Parents said more when children said they consume less junk food; whereas parents said less when children said they finish more all food on his/her plate. Additionally, "the child continues to eat his/her favorite food even if he/she is full" was statistically different between the two BMI groups ($p<0.05$). Because overweight and obese children had a higher prevalence of continuing to eat "his/her favorite food even if he/she is full" than children of normal weight (not shown in table) (Table 4).

Table 4. Differences between children's and parents' responses to children's dietary habits

	Every day	4-6 per week	1-3 per week	1-2 per month	Never	p value*	p value**
Breakfast consumption						0.15	0.04**
Children	196 (69.5)	20 (7.1)	51 (18.1)	9 (3.2)	6 (2.1)		
Parents	181 (64.2)	37 (13.1)	29 (10.3)	21 (7.4)	14 (5.0)		
Lunch consumption						<0.001*	0.04**
Children	188 (66.7)	25 (8.9)	43 (15.2)	11 (3.9)	15 (5.3)		
Parents	211 (74.6)	38 (13.5)	15 (5.3)	11 (3.9)	7 (2.5)		
Dinner consumption						0.46	0.85
Children	235 (83.3)	20 (7.1)	17 (6.0)	5 (1.8)	5 (1.8)		
Parents	248 (88.0)	17 (6.0)	8 (2.8)	6 (2.1)	3 (1.1)		
Junk food consumption						0.004*	0.62
Children	21 (7.5)	31 (11.0)	127 (45.0)	60 (21.3)	43 (15.2)		
Parents	51 (18.1)	46 (16.3)	84 (29.8)	66 (23.4)	35 (12.4)		
The child continues to eat his/her favorite food even if he/she is full						0.62	0.01**
Children	40 (14.2)	32 (11.3)	56 (19.9)	33 (11.7)	121 (42.9)		
Parents	59 (21.0)	27 (9.6)	41 (14.5)	39 (13.8)	116 (41.1)		
The child consumes fast foods when he/she does not like the food						0.31	0.80
Children	9 (3.2)	12 (4.3)	37 (13.1)	31 (11.0)	193 (68.4)		
Parents	25 (8.9)	14 (5.0)	33 (11.7)	39 (13.8)	171 (60.6)		
The child finishes all food on his/her plate						0.001*	0.20
Children	122 (43.2)	38 (13.5)	70 (24.8)	27 (9.6)	25 (8.9)		
Parents	82 (29.1)	63 (22.3)	86 (30.5)	29 (10.3)	22 (7.8)		
The child likes to eat fast foods more than home-made meals						0.35	0.84
Children	26 (9.2)	16 (5.7)	29 (10.3)	44 (15.6)	167 (59.2)		
Parents	37 (13.1)	19 (6.7)	37 (13.1)	52 (18.5)	137 (48.6)		

*p<0.05, the difference between children and parents, **p<0.05, the difference between the two BMI groups; p values were computed by chi-square test; BMI, Body Mass Index.

The childhood obesity rate is increasing worldwide and has become a major global burden, particularly in developed countries.[1,4] Our findings showed that 23.4% of children were overweight and 12.0% were obese. Classification of physical activity and sleep duration were statistically different between the normal and overweight/obese groups. Additionally, the consumption of fresh vegetables, desserts with dairy products, meat and meat products, chocolate, wafer, instant cake, pastry, and fast foods were statistically different between the two BMI groups. We also compared the responses of children and parents about dietary habits and found that "lunch consumption", "junk food consumption" and "the child finishes all food on his/her plate" were statistically

different. Since parents said more when children said they consume less junk food; whereas parents said less when children said they finish more all food on his/her plate.

Obesity is a disease of modern life, and childhood obesity is one of the most serious global public health challenges of the 21st century according to the WHO[26]. Its prevalence has doubled in more than 70 countries since 1980.[27] Turkey, with a 10% increase in childhood obesity from 2013 to 2017, is one of these countries.[2] Our results showed that a total of 8.9% of children were underweight, 55.7% normal, 23.4% overweight and 12.0% obese according to the BMI classification. Also, the prevalence of overweight and obesity was found to be higher in girls than in boys (36.4% of girls and 34.2% of boys were overweight and obese). However, we did not find statistical differences between BMI classification and gender (p: 0.30). Considering that the prevalence of overweight and obesity is gradually increasing and may adversely affect, it is urgent to take measures to reduce obesity.

Regular consumption of main meals is an important process in weight control[28]. Breakfast is the most important dietary habit due to individuals who eat breakfast regularly are less likely to be obese[4]. According to the literature, it was found that the percentage of children eating breakfast daily decreased, and they skipped breakfast more frequently than other meals[4,29]. Additionally, studies showed that obese children tend to skip meals, particularly breakfast, more often than children with normal BMIs.[4,30] Our results showed that 28.4% of children skip breakfast, also 2.1% never had breakfast. Similarly to previous studies, we found that overweight and obese children are more tend to skip breakfast compared to normal-weight children (40.0%, and 15.2%, respectively). Furthermore, lunch meal supplies about 30% of the daily energy and represents the highest proportion of protein, fat, and carbohydrate intake[28]. According to a study, 53.9% of overweight and obese children skipped lunch[8]. In this study, the prevalence of overweight and obese children who skipped lunch (36.0%) was higher compared to normal-weight children (31.8%). This may be the result of not having time for lunch at school or a false belief that skipping meals is a weight loss control.

The WHO recommends a diet must be poor in fat, sugar, and salt, and rich in fruits and vegetables[31]. It has been reported that fruit and vegetable consumption reduces the risks of all causes of mortality and morbidity from cardiovascular disease, stroke, diabetes mellitus, metabolic syndrome, non-alcoholic fatty liver disease, and some types of cancer[32,33]. We found that 11.0% of overweight and obese children eat fresh vegetables every day, and there was a statistical difference between overweight/obese and normal-weight children. Additionally, the prevalence of both overweight/obese children who did not consume

fresh vegetables at 33.8% was higher compared to normal-weight children at 23.0%. Given that foods with lower energy density, such as fresh vegetables, can help with weight management when eaten in place of high-calorie foods, it is important that school-based nutrition intervention programs attempt to increase children's fresh vegetable intake[34].

Studies indicated that children were the main consumers of fast foods and junk foods[7,35]. The consumption of these types of foods will result in increased weight gain which, in turn, may cause many diseases such as diabetes mellitus, cardiovascular diseases, etc.[4,8] In the present study, a statistical difference was found between overweight/obese and normal-weight children in the consumption of desserts with dairy products, junk foods (such as chocolate, wafer, instant cake, and pastry), and fast foods. A total of 26.0% of obese children consumed fast food every day. Additionally, chocolate, wafer, instant cake, pastry, and dessert with dairy products consumption every day was 11.0% and 26.0%, respectively.

Furthermore, we analyzed the responses of children and parents about their dietary habits of children. A statistical difference was found between "lunch consumption", "junk food consumption" and "the child finishes all food on his/her plate" due to parents said more when children said they consume less lunch and junk food; whereas parents said less when children said they finish more all food on his/her plate. The reason for this difference may be that when the study was carried out, the children knew that the experts would ask questions about dietary habits, and they gave different responses from their parents in order to give the correct response according to them. Also, the fact that the education level of most of the parents on nutrition was generally low may have led to this difference. Moreover, the parents might have had inadequate observations of their children's nutritional status, and their failure to follow what children ate played a role.

The association between obesity and physical activity in children has been widely investigated[12,36,37]. According to the WHO and national guide recommendations for children, physical activity duration was classified as low if less than 1 h per day, normal if equal to 1 h per day, or high if more than 1 h per day[24,25]. We found that the mean hours of physical activity were 1.99 ± 0.96 h for normal weight and 1.93 ± 0.72 h for overweight and obese children, these values were at the recommended hours. Although most of the children were classified as having high physical activity (60.0%), it was found that the physical activity levels of overweight and obese children were lower and this value was statistically different. Physical inactivity is a major contributor to childhood obesity and health disparities throughout life[37]. Overweight and obese children might have passive hobbies (music, computer games, etc.) contrary to

normal weight/underweight counterparts who could be involved in more active hobbies such as basketball, football, athletics, etc.[29] Therefore, it is important to take measures to increase the level of physical activity at an early age.

Studies showed that short sleep duration is associated with inappropriate dietary habits[16,38]. Therefore, it may be related to childhood obesity.[5,17,18] For example, a study found that children with obesity had lower sleep duration compared to children with normal weight (7.48 h versus 7.52 h)[39]. A recent meta-analysis showed that short sleep duration was significantly associated with obesity in preliminary school children[40]. According to the National Sleep Foundation recommendations for school-age children, sleep duration was recommended between 9 and 11 h per night[23]. In our study, a total of 48.6% of children were in the recommended classification group. However, there was a statistical difference between normal weight and overweight/obese groups, the mean sleep duration of overweight and obese children was lower than normal-weight children. The possible mechanism of the relationship between sleep duration and obesity is that circadian clock changes are linked to temporal changes in feeding behavior and increased weight gain[26].

The present study had some limitations. First, this was a cross-sectional study. Therefore, a generalization based on the cause-effect relationship cannot be made. Second, we collected data on dietary habits, physical activity, and sleep duration by using a questionnaire. Additionally, our study was conducted among public primary schools only. Thus, we did not take into the socio-economic factors of children's dietary habits. However, the strength of the study is that it evaluated the responses of both children and parents in the face of childhood obesity, which is increasing day by day in our country.

Our study indicated that the prevalence of overweight and obesity among primary school children was high. Therefore, some strategies should be taken to decrease the prevalence of obesity. The prevention of childhood obesity requires a multidisciplinary approach. In addition to diet and physical activity, it is thought that the evaluation of sleep duration will be beneficial in the prevention of childhood obesity. Therefore, future studies are needed.

STATEMENT OF ETHICS

The ethics committee of Istanbul Gelisim University Non-Interventional Clinical Research Ethics Committee (Number:2017-19, date: 29.09.2017) and Provincial Directorate of National Education (Number:59090411-44E.18445641, date: 03.11.2017) approved the study, which followed the principles of the Declaration of Helsinki.

CONFLICT OF INTEREST STATEMENT

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

The authors contributed equally.

REFERENCES

1. NCD Risk Factor Collaboration. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. The Lancet, 2017;390(10113):2627-2642. Doi: 10.1016/S0140-6736(17)32129-3

2. World Health Organization. WHO contributes to new plans to tackle childhood obesity in Turkey. Geneva 2019. Available from: https://www.euro.who.int/en/countries/turkey/news/news/2018/3/who-contributes-to-new-plans-to-tackle-childhood-obesity-in-turkey

3. World Health Organization. Noncommunicable diseases: childhood overweight and obesity, 2020. Available from: https://www.who.int/news-room/q-a-detail/noncommunicable-diseases-childhood-overweight-and-obesity

4. Koca T, Akcam M, Serdaroglu F, Dereci S. Breakfast habits, dairy product consumption, physical activity, and their associations with body mass index in children aged 6–18. Eur J Pediatr, 2020;176(9):1251-1257. Doi: 10.1007/s00431-017-2976-y

5. Rosi A, Calestani MV, Parrino L, Milioli G, Palla L, Volta E, et al. Weight status is related with gender and sleep duration but not with dietary habits and physical activity in primary school Italian children. Nutrients, 2017;9(6):579. Doi: 10.3390/nu9060579

6. World Health Organization, Food and Agriculture Organization of the United Nation Expert Consultation. Diet, nutrition and the prevention of chronic diseases. *World Health Organ Tech Rep Ser*. 2003;916(i-viii):1-149.

7. Kutlu R, Çivi S. The assessment of nutritional habits and body mass indexes of the students attending a private primary school. Fırat Medical Journal, 2009;14(1):18-24.

8. Zalewska M, Maciorkowska E. Selected nutritional habits of teenagers associated with overweight and obesity. PeerJ, 2017;5:e3681. Doi: 10.7717/peerj.3681

9. Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. Fam Med Prim Care Rev, 2015;4(2):187-192. Doi: 10.4103/2249-4863.154628

10. Todd AS, Street SJ, Ziviani J, Byrne NM, Hills AP. Overweight and obese adolescent girls: the importance of promoting sensible eating and activity behaviors from the start of the adolescent period. Int J Environ Res Public Health, 2015;12(2):2306-2329. Doi: 10.3390/ijerph120202306

11. Granich J, Rosenberg M, Knuiman M, Timperio A. Understanding children's sedentary behaviour: a qualitative study of the family home environment. Health Educ Res, 2010;25(2):199-210. Doi: 10.1093/her/cyn025

12. Boyland EJ, Harrold JA, Kirkham TC, Halford JC. The extent of food advertising to children on UK television in 2008. Int J Pediatr Obes, 2011;6(5-6):455-461. Doi: 10.3109/17477166.2011.608801

13. Van den Bulck J, Van Mierlo J. Energy intake associated with television viewing in adolescents, a cross sectional study. Appetite, 2004;43(2):181-184. Doi: 10.1016/j.appet.2004.04.007

14. Halford JC, Gillespie J, Brown V, Pontin EE, Dovey TM. Effect of television advertisements for foods on food consumption in children. Appetite, 2004;42(2):221-225. Doi: 10.1016/j.appet.2003.11.006

15. Seo SH, Shim YS. Association of sleep duration with obesity and cardiometabolic risk factors in children and adolescents: a population-based study. Sci Rep, 2019;9:9463. Doi: 10.1038/s41598-019-45951-0

16. St-Onge MP. The role of sleep duration in the regulation of energy balance: effects on energy intakes and expenditure. J Clin Sleep Med, 2013;9(1):73-80. Doi: 10.5664/jcsm.2348

17. Chaput JP, Brunet M, Tremblay A. Relationship between short sleeping hours and childhood overweight/obesity: results from the 'Quebec en Forme' Project. IJO, 2006;30(7):1080-1085. Doi: 10.1038/sj.ijo.0803291

18. Touchette É, Petit D, Tremblay RE, Boivin M, Falissard B, Genolini C, et al. Associations between sleep duration patterns and overweight/obesity at age 6. Sleep, 2008;31(11):1507-1514. Doi: 10.1093/sleep/31.11.1507

19. Istanbul Provincial National Education Statistics. 2017. Available from: https://istanbul. meb.gov.tr/meb_iys_dosyalar/2017_04/12163411_2016-2017_Ystatistik_KitabY_Taslak.pdf

20. Turkish Ministry of Health. Turkish Childhood (Primary School Second Grade Students) Obesity Survey COSI-TUR 2016. 2017. Available from: https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-ve-hareketli-hayat-db/Dokumanlar/Ingilizce_Yayinlar/Turkey_Childhood_Obesity_Cosi_tur_2016.pdf

21. Pekcan G. Beslenme durumunun saptanmasi. Diyet El Kitabi, 2008;726:67-141.

22. World Health Organization. Growth reference data for 5-19 years. Geneva, 2007. Available from: https://www.who.int/tools/growth-reference-data-for-5to19-years

23. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, et al. National Sleep Foundation's updated sleep duration recommendations. Sleep Health, 2015;1(4):233-243. Doi: 10.1016/j.sleh.2014.12.010

24. Chaput JP, Willumsen J, Bull F, Chou R, Ekelund U, Firth J, et al. 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5–17 years: summary of the evidence. Int J Behav Nutr Phys Act, 2020;17(141). Doi: 10.1186/s12966-020-01037-z

25. Turkish Ministry of Health Turkey Physical Activity Guide. 2014. Available from: https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-hareketli-hayat-db/Fiziksel_Aktivite_Rehberi/Turkiye_Fiziksel_Aktivite_Rehberi.pdf

26. World Health Organization. Taking action on childhood obesity. Geneva, 2018. Available from: https://apps.who.int/iris/bitstream/handle/10665/274792/WHO-NMH-PND-ECHO-18.1-eng.pdf

27. Weihrauch-Blüher S, Wiegand S. Risk factors and implications of childhood obesity. Curr Obes Rep, 2018;7(4):254-259. Doi: 10.1007/s13679-018-0320-0

28. Akbarzade Z, Djafarian K, Saeidifard N, Majd SA, Garousi N, Samadi F, et al. The association between lunch composition and obesity in Iranian adults. BJN, 2022;127(10):1517-1527. Doi: 10.1017/S0007114521002543

29. Smetanina N, Albaviciute E, Babinska V, Karinauskiene L, Albertsson-Wikland K, Petrauskiene A, et al. Prevalence of overweight/obesity in relation to dietary habits and lifestyle among 7–17 years old children and adolescents in Lithuania. BMC Public Health, 2015;15:1001. Doi: 10.1186/s12889-015-2340-y

30. Baldinger N, Krebs A, Müller R, Aeberli I. Swiss children consuming breakfast regularly have better motor functional skills and are less overweight than breakfast skippers. J Am Coll Nutr, 2012;31(2):87-93. Doi: 10.1080/07315724.2012.10720013

31. World Health Organization. Global strategy on diet, physical activity and health. Geneva, 2004. Available from: https://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf

32. Cooper AJ, Forouhi NG, Buijsse B, Arriola L, Balkau B, Barricarte A, et al. Fruit and vegetable intake and type 2 diabetes: EPIC-InterAct prospective study and meta-analysis. Eur J Clin Nutr, 2012;66(10):1082-1092. Doi: 10.1038/ejcn.2012.85

33. Liu J, Wang J, Leng Y, Lv C. Intake of fruit and vegetables and risk of esophageal squamous cell carcinoma: a meta-analysis of observational studies. Int J Cancer, 2013;133(2):473-485. Doi: 10.1002/ijc.28024

34. Folkvord F, Naderer B, Coates A, Boyland E. Promoting Fruit and Vegetable Consumption for Childhood Obesity Prevention. Nutrients, 2021;14(1):157. Doi: 10.3390/nu14010157

35. Poti JM, Duffey KJ, Popkin BM. The association of fast food consumption with poor dietary outcomes and obesity among children: is it the fast food or the remainder of the diet? Am J Clin Nutr, 2014;99(1):162-171. Doi: 10.3945/ajcn.113.071928

36. Viner RM, Cole TJ. Television viewing in early childhood predicts adult body mass index. J Pediatr, 2005;147(4):429-435. Doi: 0.1016/j.jpeds.2005.05.005

37. Hubbard K, Economos CD, Bakun P, Boulos R, Chui K, Mueller MP, et al. Disparities in moderate-to-vigorous physical activity among girls and overweight and obese schoolchildren during school-and out-of-school time. Int J Behav Nutr Phys Act, 2016;13:39. Doi: 10.1186/s12966-016-0358-x

38. St-Onge MP, Shechter A. Sleep restriction in adolescents: forging the path towards obesity and diabetes? Sleep, 2013;36(6):813-814. Doi: 10.5665/sleep.2694

39. Skjåkødegård HF, Danielsen YS, Frisk B, Hystad SW, Roelants M, Pallesen S, et al. Beyond sleep duration: Sleep timing as a risk factor for childhood obesity. Pediatr Obes, 2021;16(1):e12698. Doi: 10.1111/ijpo.12698

40. Guerlich K, Gruszfeld D, Czech-Kowalska J, Ferre N, Closa-Monasterolo R, Martin F, et al. Sleep duration and problem behaviour in 8-year-old children in the Childhood Obesity Project. Eur Child Adolesc Psychiatry, 2022;31(3):519-527. Doi: 10.1007/s00787-021-01731-8