The Prevalence of Overweight and Obesity among Students between the Ages of 6 and 15 years in Konya

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BACKGROUND/AIMS
This study was conducted to determine the prevalence of overweight and obesity among primary school students.

MATERIAL and METHODS
A total of 10781 students (5622 boys, 5159 girls) aged 6–15 years participated in the study. Descriptive statistics of the data were expressed as mean, standard deviation, maximum, minimum, and range values. The Kolmogorov–Smirnov test was applied and Q-Q plot analysis was performed visually to determine if the data was normally distributed. Since the data were not normally distributed, the LMS (Lambda for the skew, Mu for the median, and Sigma for the generalized coefficient of variation) method was used to calculate the percentiles.

RESULTS
The prevalence of overweight was 7.4% in both sexes, while the prevalence of obesity was 5.8% for boys and 5.3% for girls. The age group with the highest prevalence of overweight was 13 years (9.6%) in boys and 15 years (13.5%) in girls, while that with the highest prevalence of obesity was found to be 8 and 10 years (6.6%) in boys and 8 years (6.5%) in girls.

CONCLUSION
It is remarkable that obesity is high in both sexes, especially in young children. Preventive interventions to stop this trend are recommended to focus on the early stages of childhood.

Keywords: Childhood obesity, students, overweight, prevalence

INTRODUCTION

Obesity is characterized by an increase in adipose tissue that leads to many chronic diseases and premature deaths and is a worldwide global epidemic (1). Obesity, which is an important cause of morbidity due to hypertension, dyslipidemia, insulin resistance, and severe psychological stress, is increasingly being observed in childhood (2). Childhood obesity is one of the most serious public health problems of the 21st century. The problem is global and affects many low and middle-income countries regularly, especially in urban settings. Overweight and obese children are more likely to become obese in adulthood and may develop noncommunicable diseases such as diabetes and cardiovascular diseases at a younger age (3). It also contributes to an increase in health expenditures. For all these reasons, it is important to prevent childhood and to identify overweight and obese children at an early stage, so that they can start treatment to gain and maintain a healthy weight (4).

One of the most reliable indicators for assessing a child's health is the weight and height measurements by age. Anthropometric measurements are the most commonly used methods for evaluating the nutritional status of not only individuals, but also the society. Although the standards proposed by the World Health Organization are suggested to be valid for almost every country in the first years of life, differences can be detected between societies at this early age (5).

This study was conducted to determine the prevalence of overweight and obesity among primary school students.

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TABLE I. Descriptive statistics of subjects

Gender	Age group	n	Height (cm)		Body Weight (kg)		Body Mass Index (kg/m²)	
			Mean±SD	Min-Max (Range)	Mean±SD	Min-Max (Range)	Mean±SD	Min-Max (Range)
Boys	6	77	119,59±5,44	110,0-134,0 (24,0)	23,73±4,22	16,5-42,7 (26,2)	16,51±2,05	11,9-23,8 (11,9)
	7	447	122,10±5,55	108,5-144,0 (35,5)	24,52±4,88	16,8-64,3 (47,5)	16,35±2,20	11,4-31,0 (19,6)
	8	441	127,30±5,60	111,0-148,5 (37,5)	26,95±4,96	17,2-54,4 (37,2)	16,53±2,08	12,3-27,4 (15,1)
	9	544	132,90±6,18	115,0-159,0 (44,0)	30,80±6,40	18,3-56,6 (38,3)	17,31±2,59	13,4-28,3 (14,9)
	10	1126	136,20±6,23	104,0-155,5 (51,5)	32,82±6,64	19,6-62,3 (42,7)	17,60±2,79	13,0-32,0 (19,0)
	11	1121	141,39±6,55	122,0-165,0 (43,0)	36,96±8,30	20,7-89,3 (68,6)	18,36±3,20	12,1-37,2 (25,1)
	12	873	147,39±7,54	123,0-173,0 (50,0)	41,90±10,26	24,1-91,1 (67,0)	19,11±3,50	12,9-34,8 (21,9)
	13	501	155,38±8,36	134,0-181,0 (47,0)	48,14±11,90	26,4-117,5 (91,1)	19,76±3,74	13,7-38,8 (25,1)
	14	440	162,77±8,49	142,0-192,5 (50,5)	55,57±12,43	32,7-105,8 (73,1)	20,85±3,88	14,9-36,7 (21,8)
	15	52	166,61±7,62	150,5-182,0 (31,5)	55,81±12,32	37,1-91,4 (54,3)	19,99±3,59	14,8-31,6 (16,8)
Girls	6	79	117,07±4,28	109,0-128,0 (19,0)	21,94±3,12	16,4-30,2 (13,8)	15,98±1,86	12,2-23,0 (10,8)
	7	465	120,98±5,36	101,0-141,0 (40,0)	23,83±4,46	14,5-45,9 (31,4)	16,20±2,26	12,2-29,6 (17,4)
	8	444	125,85±5,55	106,5-147,0 (40,5)	26,26±5,17	17,1-49,1 (32,0)	16,48±2,43	12,5-27,7 (15,2)
	9	461	131,69±5,87	117,0-155,0 (38,0)	30,05±6,75	18,5-63,0 (44,5)	17,21±2,99	12,5-30,2 (17,7)
	10	1089	135,48±6,71	113,0-162,0 (49,0)	32,38±7,19	17,0-72,0 (55,0)	17,51±2,89	11,0-34,7 (23,7)
	11	1007	141,56±7,24	119,0-169,5 (50,5)	36,55±8,29	21,2-85,9 (64,7)	18,10±3,03	12,1-32,5 (20,4)
	12	778	148,46±7,75	120,0-170,0 (50,0)	42,28±9,54	20,0-79,1 (59,1)	19,04±3,28	12,6-33,6 (21,0)
	13	387	156,04±6,41	129,0-177,0 (48,0)	49,16±10,50	27,9-100,0 (72,1)	20,09±3,55	12,0-33,7 (21,7)
	14	397	159,33±5,62	143,0-181,0 (38,0)	53,94±10,67	31,9-97,8 (65,9)	21,20±3,78	14,4-38,7 (24,3)
	15	52	159,01±5,40	149,0-179,0 (30,0)	53,89±11,2	34,5-94,8 (60,3)	21,25±3,82	15,1-30,3 (15,2)

MATERIAL and METHODS

The study was conducted on a total of 10781 (5622 boys, 5159 girls) students in the 6-15 years age group studying in 16 primary schools in Konya city center. The necessary permission for the study was obtained from the Provincial Directorate of National Education and the schools were informed before the study. Body weight measurements of children were obtained with light weight clothes and without shoes and jackets by electronic weighing with a sensitivity of ±100 gr. Height measurements were taken with the shoes removed, heels combined, hip, and shoulders based on the wall with 1-mm spacing.

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Selçuk University Faculty of Sports Science Non-interventional Clinical Research. Prior to the study, the subjects were informed about the study, and their written consent stating that they agreed to participate in the study were received.

Statistical Analysis

Considering the obtained data, mean and standard deviation values were used to calculate the percentile values (5, 10, 25, 50, 75, 90, and 95) for each sex and age group. For each category, based on statistical Z-scores, the expected BMI was calculated according to how many Z-points are away from the average. However, because the 85th percentile for BMI was the recommended threshold value for "overweight" classification for children and adolescents (6, 7), 85% was also included in the calculations and for the "overweight" category as the cut-off point. Descriptive statistics of the data are given as mean, standard deviation, maximum, minimum, and interval. The Kolmogorov-Smirnov test and Q-Q plot analysis were used to test the normal distribution of the data. The following formula (8) is used to calculate the values:

$$Z_{LMS} = \frac{1}{\sigma_L \lambda}\left[\left(\frac{y}{\mu}\right)^{\lambda} - 1\right]$$

Reference values were calculated for each age group using the calculated Z values for the obtained critical percentile values.

RESULTS

In Table l, average, minimum, maximum, and standard deviation values of height, body weight, and body mass index variables are given according to the age groups for girls and boys.

Main Points:

- Obesity is characterized by an increase in adipose tissue and is a worldwide global epidemic.
- In this study, the prevalence of overweight and obesity among primary school students were determined.
- The prevalence of overweight was 7.4% in both sexes, while the prevalence of obesity was 5.8% for boys and 5.3% for girls.
- As a result, it is striking that obesity is high in both genders, especially in young children.

It was found that BMI values did not meet the normal distribution assumption according to the Kolmogorov-Smirnov test results (p<0.01) (Table 2).

Table 3 shows the percentile values of the body mass index according to the age groups of the boys.

The distribution by the BMI categories for boys is shown in Table 4. Accordingly, the "overweight" prevalence of boys aged 6-15 years ranged from 2.6% to 9.6% (overall prevalence 7.4%), and the highest prevalence was found to be in the 13-year category (9.6%). When the obesity prevalence was examined, it was found that the children in the 8 and 10 years age groups had the

highest obesity prevalence (6.6%) and the overall obesity prevalence was 5.8% (Table 4).

Table 5 shows the percentile values of body mass index according to the age groups of girls.

The distribution by BMI categories for girls is shown in Table 6. Accordingly, the "overweight" prevalence of girls between the ages of 6-15 years ranged from 4.9% to 13.5% (overall prevalence 7.4%), and the highest prevalence was found to be in the 15-year category (13.5%). When the prevalence of obesity was examined, it was found that children in the 8-year age group had the highest obesity prevalence (6.5%) and the overall obesity prevalence was 5.3% (Table 6).

DISCUSSION

To determine the prevalence of overweight and obesity among primary school students, the prevalence of overweight was 7.4% in both sexes; the prevalence of obesity was 5.8% for boys and 5.3% for girls. The age group with the highest prevalence of overweight was 13 years (9.6%) in males and 15 years (13.5%) in females; The highest prevalence of obesity was found in the age range of 8 and 10 years (6.6%) in boys and 8 years (6.5%) in girls (Table 4, 6).

TABLE 2. Testing the appropriateness of BMI values to normal distribution

	Kolmogorov-Smirnov		
	Statistical Value	df	p
Boy	0.124	5622	0.00*
Girl	0.101	5159	0.00*

*p<0.01

TABLE 3. BMI percentile values for boys

	Percentiles							
Age	5%	10%	25%	50%	75%	85%	90%	95%
6	13.44	14.06	15.19	16.51	17.94	18.78	19.37	20.25
7	13.09	13.74	14.94	16.35	17.89	18.80	19.44	20.40
8	13.42	14.05	15.19	16.53	17.98	18.84	19.44	20.33
9	13.51	14.26	15.66	17.31	19.13	20.22	20.98	22.14
10	13.54	14.34	15.82	17.60	19.57	20.75	21.58	22.84
11	13.75	14.65	16.33	18.36	20.63	22.00	22.97	24.45
12	14.11	15.08	16.90	19.11	21.60	23.11	24.18	25.82
13	14.44	15.47	17.40	19.76	22.43	24.04	25.20	26.96
14	15.32	16.39	18.40	20.85	23.61	25.29	26.48	28.30
15	14.84	15.84	17.72	19.99	22.54	24.08	25.18	26.85

TABLE 4. Distribution by BMI categories for boys

	Weak		Normal		Overweight		Obese	
Age	n	%	n	%	n	%	n	%
6	1	1.3	69	89.6	2	2.6	5	6.5
7	2	0.4	400	89.5	22	4.9	23	5.1
8	8	1.8	377	85.5	27	6.1	29	6.6
9	5	0.9	464	85.3	40	7.4	35	6.4
10	12	1.1	971	86.2	69	6.1	74	6.6
11	13	1.2	953	85.0	96	8.6	59	5.3
12	10	1.1	743	85.1	72	8.2	48	5.5
13	7	1.4	424	84.6	48	9.6	22	4.4
14	9	2.0	369	83.9	35	8.0	27	6.1
15	1	1.9	44	84.6	4	7.7	3	5.8
General	68	1.2	4814	85.6	415	7.4	325	5.8

TABLE 5. BMI percentile values for girls

Age	Percentiles							
	5%	10%	25%	50%	75%	85%	90%	95%
6	13.18	13.75	14.78	15.98	17.27	18.03	18.56	19.35
7	12.86	13.53	14.75	16.20	17.78	18.72	19.38	20.38
8	12.91	13.62	14.93	16.48	18.19	19.20	19.92	21.00
9	12.90	13.74	15.32	17.21	19.33	20.61	21.52	22.90
10	13.32	14.14	15.67	17.51	19.55	20.78	21.65	22.97
11	13.72	14.57	16.18	18.10	20.24	21.53	22.45	23.83
12	14.31	15.23	16.96	19.04	21.37	22.76	23.76	25.27
13	14.99	15.98	17.84	20.09	22.61	24.13	25.21	26.86
14	15.78	16.83	18.81	21.20	23.88	25.51	26.66	28.41
15	15.77	16.84	18.83	21.25	23.96	25.61	26.77	28.55

TABLE 6. Distribution by BMI categories for girls

Age	Weak		Normal		Overweight		Obese	
	n	%	n	%	n	%	n	%
6	1	1.3	66	83.5	7	8.9	5	6.3
7	5	1.1	410	88.2	23	4.9	27	5.8
8	1	0.2	390	87.8	24	5.4	29	6.5
9	3	0.7	403	87.4	34	7.4	21	4.6
10	24	2.2	922	84.7	85	7.8	58	5.3
11	23	2.3	846	84.0	86	8.5	52	5.2
12	17	2.2	662	85.1	56	7.2	43	5.5
13	10	2.6	327	84.5	33	8.5	17	4.4
14	16	4.0	332	83.6	29	7.3	20	5.0
15	2	3.8	41	78.8	7	13.5	2	3.8
General	102	2.0	4399	85.3	384	7.4	274	5.3

According to the 2015-2016 data, the prevalence of obesity in the United States was higher among youths aged 6-11 years (18.4%) and adolescents aged 12-19 years (20.6%) compared with children aged 2-5 years (13.9%) (9). In Nigeria, with an average age of 14.6 years, 2.1% of children were overweight and 1.7% were obese (10). In a study that investigated a systematic review of childhood obesity in the Middle East and North Africa, the prevalence of overweight and obesity in Kuwait was 25.6% and 34.8% among young boys, and 20.8% and 20.5% among girls (11). In studies conducted in different regions of our country, 5%-13.8% of the children were found to be overweight and 4.9%-20.7% were obese (12-16). In a study conducted in semi-rural children aged 6-14, it was determined that approximately one out of every three children were overweight or obese, while boys were overweight and obese (17.7% and 15.2%) and girls (13.3% and 9.2%) (17). Our data support the fact that overweight and obesity are an increasing public health problem.

In these studies, the frequency of obesity among the students; sex, child's birth weight, parent's body mass index, high socio-economic level, high maternal education, number of obese relatives, feeding habits, parents' dissatisfaction with the child's weight, sport activity, time spent in front of a computer and television, and nutrition preferences were reported (13, 18-22). In a study, it was found that the prevalence of obesity increased significantly in rural areas and that the awareness of the families about their children's weight was low and it was concluded that the family-based approach to combating childhood obesity should be strengthened and the number of parental education should be increased (15). To detect the excess weight and obesity problems early and take the necessary precautions, it is necessary to monitor the body weight, height, and body mass index of the students from an early age. In addition, national health policies and social responsibility projects should focus more on combating child and adolescent obesity and developing solution-oriented policies (23). Öztürk and Aktürk (24) found that the prevalence of overweight and obesity was significantly higher in the 5-8 years age group and in students in schools classified as socioeconomically good. Therefore, they stressed the need to raise awareness of families and students about this problem, which is likely to increase in the coming years, by using other channels, such as health personnel and the media. In this study, physical activity levels and nutrition habits of 7-14 year-old students were examined to increase the level of physical activity and activities to be combined with healthy eating habits that

could prevent future health problems and healthy aging awareness in early ages, with the right interaction with other family members who are more active (25).

In conclusion, as a result, further research is needed to fully investigate the role of a sedentary life style, nutrition, and other specific risk factors, to manage this common and growing health problem, and to evaluate various interventions. There is an increasing tendency to obesity in our country, especially at young ages. We recommend that health policy makers prioritize early childhood to stabilize this rising trend and implement intervention strategies.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Selçuk University Faculty of Sports Science Non-interventional Clinical Research.

Informed Consent: Written informed consent was obtained from the students who participated in this study.

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