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ARAŞTIRMA / RESEARCH

Obesity risk factors in Turkish preschool children: a cross-sectional study

Okul öncesi Türk çocuklarında obezite risk faktörleri: kesitsel bir çalışma

Şebnem Özgen Özkaya[1], Volkan Özkaya[2], Muazzez Garipağaoğlu[1]

[1]Department of Nutrition and Dietetics, Fenerbahce University School of Health Sciences, Istanbul, Turkey.
[2]Department of Nutrition and Dietetics, Istanbul Medipol University School of Health Sciences, Istanbul, Turkey.

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Abstract

Purpose: The present study aims to identify the potential risk factors – pre and post-pregnancy, children's, parental, and environmental factors – concerning obesity in Turkish preschool children.

Materials and Methods: The cross-sectional study was conducted with 538 children aged 3-5 and their mothers in 25 private and public kindergartens using a face-to-face survey. Demographic, anthropometric, nutrition, sleep, and physical activity information during pregnancy, infancy, and preschool periods were evaluated. Two-day food records and anthropometric measurements of the children were collected.

Results: The prevalence of overweight and obesity in preschool children was found to be 27.0%. Among the 28 potential risk factors examined, pre-pregnancy obesity (odds ratios (OR):1.108, confidence interval (CI): 1.042-1.179), post-pregnancy obesity (OR:4.350, CI: 2.053-9.217), caffeine intake >200 mg/day during pregnancy (OR:1.588, CI:1.031- 2.446), father with obesity (OR: 1.089, CI: 1.027-1.155), enrolling a private rather than a public kindergarten (OR: 2.093, CI:1.298-3.376), fast eating (OR:3.355, CI: 1.175-9.583 min), short lunch duration (OR:0.966, CI:0.934-0.998), daily sleep of <10 hours (OR:2.522, 1.439-4.421), and finally screen time of >2 hours/day (OR:1.560, CI:1.012-2.405) were found to be significantly correlated with obesity in preschool children.

Conclusion: Parental obesity, caffeine intake during pregnancy, eating speed, daily sleep, and screen time were determined as obesity risk factors in Turkish preschool children. Identifying maternal and child risk factors in early childhood, regulating lifestyle and obesogenic environment can be protective against obesity.

Keywords:.Preschool children, obesity, risk factors, family, behavior

Öz

Amaç: Bu çalışma, Türk okul öncesi çocuklarında obezite ile ilgili potansiyel risk faktörlerini -gebelik öncesi ve sonrası, çocuk, ebeveyn ve çevresel faktörler- belirlemeyi amaçlamaktadır.

Gereç ve Yöntem: Özel ve devlete bağlı 25 anaokulunda 3-5 yaş grubu 538 çocuk ve anneleri ile yüz yüze görüşme yöntemi kullanılarak kesitsel bir çalışma gerçekleştirilmiştir. Gebelik, bebeklik ve okul öncesi döneme ait demografik, antropometrik, beslenme, uyku ve fiziksel aktivite bilgileri sorgulanmıştır. İki günlük besin tüketim kayıtları ve antropometrik ölçümleri alınmıştır.

Bulgular: Okul öncesi çocuklarda hafif şişmanlık ve obezite sıklığı %27 olarak saptanmıştır. Yirmi sekiz potansiyel risk faktöründen gebelik öncesi obezitesi [1,108 (1,042-1,179)], gebelik sonu obezitesi (OR:4,350, CI:2,053-9,217), gebelikte >200mg/gün kafein alımı (OR:1,588, CI:1,031- 2,446), obezitesi olan babaya sahip olma (OR:1,089 CI:1,027-1,155), devlet okulu yerine özel okula gitme (OR:2,093, CI:1,298-3,376), hızlı yeme (OR:3,355, CI:1,175-9,583), kısa öğle yemeği süresi (OR:0,966, CI:0,934-0,998), günlük uyku süresinin <10 saat olması (OR:2,522, CI:1,439-4,421) ve günlük > 2 saat ekran süresi (OR:1,560, CI:1,012-2,405) okul öncesi çocukluk obezitesi ile ilişkili bulunmuştur.

Sonuç: Ebeveyn obezitesi, gebelikte kafein alımı, yeme hızı, günlük uyku ve ekran süresi Türk okul öncesi çocuklarında obezite risk faktörleri olarak belirlendi. Erken çocukluk döneminde anne ve çocuğa ait risk faktörlerinin belirlenmesi, yaşam tarzının ve obezojenik çevrenin düzenlenmesi, obeziteden koruyucu olabilir.

Anahtar kelimeler: Okul öncesi çocuklar, obezite, risk faktörleri, aile, davranış

Yazışma Adresi/Address for Correspondence: Dr. Volkan Özkaya, Department of Nutrition and Dietetics, Istanbul Medipol University School of Health Sciences, Istanbul, Turkey. E-mail: volkan.ozkaya@medipol.edu.tr
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INTRODUCTION

Childhood obesity paves the way for some health problems in adulthood, such as type 2 diabetes, hypertension and lipidemia, cardiovascular disease, specific types of cancer, asthma and sleep apnea, run/walk difficulties, and peer stigmatization. Moreover, childhood obesity is also considered an important public health problem since it leads to specific psychosocial disorders such as low self-esteem and a reduced quality of life[1,2]. The number of obese children under 5 years of age has increased by approximately 50% in the last 40 years[3]. This number is estimated to reach about 70 million by 2025[4]. Approximately 23% of children and adolescents in developed countries and 13% in developing countries are overweight or obese[5]. Childhood obesity and its rising trend in Turkey are similar to those around the world. According to the Turkey Nutrition and Health Survey (2010), the prevalence of overweight or obesity in children aged 3-5 years is 22.4%[6]. On the other hand, this ratio was found to be between 14-24% in other studies examining the same age group in Turkey[7,8].

Obesity is a complex problem that is influenced by many factors, including genetics, nutrition, physical activity level, cultural norms, and social and physical environment[9]. In studies examining risk factors for early childhood obesity, maternal factors such as gestational age, BMI, and weight gain during pregnancy, history of diabetes, nutrition, stress, smoking, substance and drug use, as well as childhood factors such as fetal growth, birth weight, breast milk intake, sleep pattern, meal skipping and snack consumption in preschool-age were associated with early childhood obesity. In addition, family's socioeconomic status, educational status, and nutritional habits are also considered risk factors for obesity in preschool children[10-13].

Previous studies have found that early childhood obesity continues in later childhood and increases the probability of obesity in the following years by four times.[1] Since its frequency and severity have increased recently, identification, prevention, and treatment of obesity at an early age are reported to be easier. Therefore, recent studies on obesity have focused on the early years.

There are many studies assessing preschool obesity in the literature. However, studies evaluating maternal and child obesity risk factors in Turkish preschool children are limited. In our study, 28 factors shown to be among the potential risk factors of early childhood obesity in the literature were examined together. This study aimed to determine obesity risk factors in Turkish preschool children and contribute to childhood obesity prevention programs.

MATERIALS AND METHODS

The cross-sectional study was carried out between December 2017-May 2018 in Bursa, the 4th biggest city in Turkey. The research permission (dated 09/15/2017 and number 343) was obtained from Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee. The study conformed to the provisions of the Declaration of Helsinki. Written informed consent was obtained from all the participants.ü

Sample

For the sample of the study, the obesity rate of 22.4% given in the Turkey Nutrition and Health Survey (TNHS)-2010 was accepted as the reference value[6]. The sample size was determined using the database of the Bursa Provincial Directorate of National Education for children aged 3-5 years (14 232 children) at a significance level $\alpha=0.05$ and a margin of error of 4%. The sample size was determined to be 520 children, and a 10.0% sample increase was made considering the missing data. To create a sample according to the size of the district, the stratified sampling method was used. The number of students in public (65.8%) and private schools in 3 different districts with different socioeconomic (high, middle, and low socioeconomic status) levels were determined and the proportions were considered according to age and gender. Participants were selected by random sampling. Those with chronic diseases (thyroid, celiac, etc.) and using obesity-related drugs were excluded from the study. During the study process, 562 students were reached, but 7 parents did not want to give information, 15 children had missing survey data, and two children with thyroid disease were excluded from the study. The study was carried out with 538 children attending 25 private and public kindergartens and their mothers.

Data collection

The data for this study were collected by a researcher dietitian using the face-to-face interview method. The

first part of the questionnaire consists of questions about demographic and anthropometric characteristics of the family such as family income, the mother's education, employment status, BMI, and the number of siblings. Also, some information about the pregnancy period of the mothers such as pre-and post-pregnancy BMI, weight gain during pregnancy, use of vitamin-mineral supplements, nutritional habits, smoking status, caffeine intake, gestational diabetes and hypertension, and depression status (physician-diagnosed) were collected.

The second part of the survey includes questions about the infancy period of preschool children such as type of delivery, gestational week, birth weight, weight gain at 0-1 years, duration of exclusive breastfeeding, formula feeding, the timing of the start of complementary feeding and its pattern, fruit juice/sugar-added food intake, antibiotic use at 0-1 years, sleep duration, and screen time. In addition, children's nutrition, physical activity, and sleep habits in the preschool period were also evaluated.

To determine the nutritional status of children, a 2-day food record, one day at school, and one day at the weekend, was recorded in terms of type and amount of the food. These food consumption records were made by the researcher while children were at school. When the children were out of school, the food consumption was recorded by the families. In order to ensure the reliability and consistency of food consumption records, the Food and Nutrition Photo Catalog was used to inform families about spoons, cups, bowls, plate sizes and quantities, and examples were provided[14].

Procedure

Anthropometric measurements

Anthropometric measurements such as weight, height, and waist circumference of the children were taken by the researcher. Body weights were measured to the nearest of 0.1 kg using a professional scale (Seca-813). Heights were measured to the nearest of 1 mm using a portable stadiometer (Mesilife–13539) with subjects standing without shoes. Waist circumferences were measured over the naked skin while standing and the arms were hanging from the midpoint between the lowest rib and the iliac crest using non-flexible tape to the nearest of 0.1 cm.

The children's weight and height data were evaluated using the percentile curves developed by Neyzi et al. for Turkish children[15]. Weights-for-height were evaluated with the "Body Mass Index-BMI". Body Mass Index values were calculated by the equation: BMI = Body weight (kg)/height (meter)^2. BMI is defined by age and gender as 5th percentile underweight, 5th to less than the 85th percentile normal weight, 85th to less than the 95th percentile overweight, and >95th percentile obesity[16]. The children in our study were divided into two groups: the overweight/obese children (BMI ≥85%) as the obese group and the remaining children (BMI <85%) as the non-obese group.

As with children, the parents' weights for height were also determined by the Body Mass Index. According to the World Health Organization, a BMI under 18.5 is defined as underweight, 18.5–24.9 kg/m^2 normal weight, 25-29.9 kg/m^2 overweight, and ≥30 kg/m^2 is considered obesity[17]. Parents' BMI classifications were made as underweight, normal weight, and overweight/obese. The mother's pre-pregnancy body weights and weight gains during pregnancy were examined, and pre-and post-pregnancy BMIs were calculated. The weight gains of the mothers during pregnancy for BMI values were evaluated in accordance with the American College of Obstetricians and Gynecologists, which recommends a 12-16 kg weight gain for women with normal pre-pregnancy weight, 7-12 kg for overweight women, and 5-9 kg for obese women[18].

Other variables

The minimum wage levels in the year the research was conducted were 1500 TL[19]. Therefore, income grouping is planned as >1500 TL and its multiples. Daily caffeine intake was estimated using a questionnaire on the frequency of consumption of caffeine-containing products during pregnancy. Mothers were asked about their consumption of coffee, coffee drinks, tea, cola drinks, energy drinks, chocolate and cocoa. As a reference value, the Turkey Dietary Guideline's daily caffeine intake recommendation of <200 mg for pregnant women was used[20]. To assess children's nutritional status, the full version of Nutrition Information System software 7.2 (BeBiS 7.2) developed for Turkey was used[21]. The food consumption data were compared and evaluated according to the Turkey Dietary Guideline[20] and Dietary Reference Intake (DRI) [22].

The mothers were asked to provide the average daily sleep duration of their child in the last month. The American Academy of Sleep Medicine's recommendation of 10-13 hours of daily sleep

duration for preschool children was taken as a reference value and accordingly, children's sleep durations were classified into two groups as less than 10 hours and ≥10 hours[23]. The American Academy of Pediatrics recommends watching television no more than 2 hours a day and engaging in at least 1 hour of vigorous physical activity daily for children aged 2 years and older[24]. Children were also divided into two groups based on whether they engaged in ≥1 hour of vigorous-intensity physical activity per day and <2 hours and ≥2 hours of daily screen time.

Statistical analysis

The Shapiro-Wilk test was used to examine if the data was normally distributed. For the comparison of two independent groups, the independent sample t-test was used for normally distributed data (age, body weight, height, nutrient intake etc.) and the results were reported as means ± standard deviations ($\bar{x}$ ±SD). Mann-Whitney U test was used for non-normal data and the results were presented by median (minimum-maximum) values. Pearson chi-square, Fisher's exact chi-square, and Fisher-Freeman-Halton tests were used to compare categorical variables (gender, BMI percentiles etc.) and the results were reported as frequency (n, %) values. 28 potential risk factors for obesity were examined using univariate regression analysis.

All obesity risk factors that were found to be significant in the univariate analyses were evaluated by stepwise binary logistic regression (backward conditional stepwise regression, forward conditional stepwise regression) procedure. The significance level was considered to be $\alpha=0.05$[25]. All statistical analyses were performed using IBM SPSS with version 22.0 (IBM Inc, IL, USA) software.

RESULTS

As shown in Table 1, the mean weight and heights of boys were higher than girls ($p<0.05$). The obesity prevalence was calculated as 28.8% in girls, 24.9% in boys, and 27.0% in the whole group. No gender-related differences were found in the BMI values, school type, sleep duration, screen time, or vigorous-intensity physical activity ($p>0.05$). Boys had higher energy (kcal), carbohydrate (g), fiber, and protein (g) intakes than girls ($p<0.05$). According to Table 2 which presents the demographic characteristics of the families, no statistically significant relationship was found between child gender and the parents' BMI values ($p>0.05$).

As shown in Table 3, the obesity status of children does not differ according to gestational age, gender, or vigorous-intensity physical activity ($p>0.05$). Birth weights of the obese children (3.26±0.56g) were found to be higher than non-obese children (3.18±0.52g) ($p=0.034$). The obesity prevalence among children in private schools (%34.1) was found to be higher than those in public schools (23.2%) ($p=0.007$). Furthermore, we found that the ratio of screen time ≥2 hours ($p=0.022$) and daily sleep duration <10 hours ($p=0.021$) were higher among obese children than those non-obese. Obese children had longer lunch times ($p=0.015$) and faster eating rates ($p=0.031$) than non-obese children.

As seen in Table 4, children's obesity status does not differ according to the mother's education and employment, family income, number of children, parents' BMI and smoking, type of delivery, gestational diabetes, and hypertension ($p>0.05$). We found that the prevalence of overweight or obesity in the pre- and post-pregnancy period, weight gain during pregnancy, and daily caffeine intake of ≥200 mg were higher in mothers of obese children compared to those mothers of non-obese children ($p<0.05$).

All obesity risk factors that were found to be significant in the univariate analysis were examined by the stepwise binary logistic regression analysis (backward conditional stepwise regression, forward conditional stepwise regression) and the results showed that the risk of obesity in the child increases by 1.1 times with every 1 kg/m² increase in the mother's post-pregnancy BMI; 2.77 times if the mother is overweight in the post-pregnancy period; 4.35 times if the mother is obese in the post-pregnancy period; and 1.58 times with the mother's daily caffeine intake of ≥200 mg.

Furthermore, we determined that the risk of obesity in the child increases with every 1 kg/m² increase in the father's BMI; 2.1 times with enrolling in a private kindergarten rather than a public kindergarten; 3.35 times with too fast/fast-eating; by 0.96 times with a shorter lunch time; 2.52 times with a daily sleep duration of <10 hours, and 1.56 times with a daily screen time of ≥2 hours (Table 5). On the other hand, no correlation was obtained between obesity in children and daily energy, carbohydrate, protein, fat, and fiber intakes.

Table 1. Demographic characteristics of the children

	Girl (n=285)		Boy (n=253)		Total (n=538)		p
	x̄±SD		x̄±SD		x̄±SD		
Age (years)	4.75±0.70		4.71±0.75		4.73±0.72		0.806
Body weight (kg)	19.3±3.3		19.9±3.6		19.6±3.5		0.041
Height (cm)	109.1±6.3		110.3±6.9		109.7±6.6		0.042
BMI (kg/m²)	16.1±1.7		16.4±2.8		16.3±2.3		0.518
	n	%	n	%	n	%	
BMI percentile							
Underweight	24	8.4	25	9.9	49	9.1	
Normal	179	62.8	165	65.2	344	63.9	0.579
Overweight and obese	82	28.8	63	24.9	145	27.0	
Kindergarten							
Public	196	55.5	157	44.5	353	65.6	0.102
Private	89	48.1	96	51.9	185	34.4	
Sleep duration (hours/day)							
<10	59	20.7	52	20.6	111	20.6	0.998
≥10	226	79.3	201	79.4	427	79.4	
Screen Time (hours/day)							
<2	182	63.9	150	59.3	332	61.7	0.278
≥2	103	36.1	103	40.7	206	38.3	
Physical Activity (≥1 hour/day)							
Yes	73	25.7	76	30.0	149	27.7	0.289
No	211	74.3	177	70.0	388	72.3	
Energy Intakes from Nutrients	x̄±SD		x̄±SD		x̄±SD		
Energy (kcal)	1184.8±240.6		1235.8±258.9		1208.8±250.4		0.018
Carbs (g)	136.4±3.6		143.3±34.1		139.7±33.4		0.017
Carbs (%)	47.0±5.9		47.4±5.8		47.2±5.9		0.393
Fiber (g)	11.8±3.3		12.4±3.5		12.1±3.4		0.037
Protein (g)	40.5±9.6		42.7±10.4		41.5±10.0		0.011
Protein (%)	14.1±2.4		14.1±2.2		14.1±2.3		0.703
Fat (g)	51.9±12.9		53.5±14.1		52.7±13.5		0.188

BMI: Body Mass Index, Carbs: Carbohydrate,
x̄±SD: means ± standard deviations, Descriptive statistics are given with mean±SD for numerical and frequency (percentage) for categorical variables.

Table 2. Demographic characteristics of the families

	Girl (n=285)		Boy (n=253)		Total (n=538)		p
	x̄±SD		x̄±SD		x̄±SD		
Age (years)							
Mother	33.6±4.5		34.3±4.3		34.0±4.4		
Father	36.8±4.4		37.2±4.6		37,0±4,5		
	n	%	n	%	n	%	
Maternal Education							
High school and below	119	41,7	95	37,5	214	39,8	0.853
College and higher	166	58,3	158	62,5	324	60,2	
Mother Employment Status							
Yes	102	35,8	77	30,4	179	33,3	0.187
No	183	64,2	176	69,6	359	66,7	
Income (TRY)							
≤1500	6	2.1	10	4.0	16	3.0	

1501-3000	63	22.1	35	13.8	98	18.2	0.120
3001-4500	113	39.6	109	43.1	222	41.3	
>4500	103	36.2	99	39.1	202	37.5	
Number of children							
1	122	42,8	116	45,8	238	44,2	0.478
≥ 2	163	57,2	137	54,2	300	55,8	
Mother's BMI (kg/m^2)							
Underweight	42	14.7	34	13.4	76	14.1	
Normal	150	52.6	140	55.3	290	53.9	0.809
Overweight and obese	93	32.7	79	31.2	172	32.0	
Father's BMI (kg/m^2)							
Underweight	6	2.1	5	2.0	11	2.0	
Normal	80	28.1	84	33.2	164	30.5	0.435
Overweight and obese	199	69.8	164	64.8	363	67.5	

BMI: Body Mass Index, TRY: Turkish lira

Table 3. Factors affecting obesity in preschool children

Factors	**Obese (n=145)**		**Non-obese (n=393)**		**Total (n=538)**		**p**
	$\bar{x}$±SD		$\bar{x}$±SD		$\bar{x}$±SD		
Gestational Age (weeks)	38.2±2.2		38.2±2.1		38.2±2.1		0.923
Birth Weight (kg)	3.26±0.56		3.18±0.52		3.21±0.56		0.034
	n	%	n	%	n	%	
Gender							
Girl	82	56.6	203	51.7	285	52.9	0.313
Boy	63	43.4	190	48.3	253	47.1	
Kindergarten							
Public	82	23.2	271	76.8	353	65.6	0.007
Private	63	34.1	122	65.9	185	34.4	
Sleep duration (hours/day)							
<10	78	53.8	254	64.6	332	61.7	0.022
≥10	67	46.2	139	35.4	206	38.3	
Screen Time (hours/day)							
<2	40	27.6	71	18.1	111	20.6	0.021
≥2	105	72.4	322	81.9	427	79.4	
Physical Activity (≥1 hour/day)							
Yes	36	24.8	113	28.8	149	27.7	0.418
No	109	75.2	279	71.2	388	72.3	
Eating rate							
Too Fast/Fast	12	8.2	17	4.3	29	5.4	
Normal	92	63.4	223	57.0	315	58.8	0.031
Slow/Too Slow	41	28.4	151	38.6	192	35.8	
	$\bar{x}$±SD		$\bar{x}$±SD		$\bar{x}$±SD		
Meal duration (min)							
Breakfast	22.8±11.2		23.8±13.3		23.5±12.8		0.587
Lunch	21.4±10.3		23.7±11.6		23.1±11.3		0.015
Dinner	24.6±11.2		26.0±13.4		25.6±12.9		0.317

BMI: Body Mass Index, min: minute $\bar{x}$±SD: means ± standard deviations

Table 4. Family related factors affecting obesity in preschool children

Factors	Obese (n=145)		Nonobese (n=393)		Total (n=538)		p
Age (years)	x̄±SD		x̄±SD		x̄±SD		
Mother	34.4±4.7		33.8±4.3		33.9±4.4		0,201
Father	37.2±4.9		36.9±4.3		37.0±4.5		0.505
Maternal Education	n	%	n	%	n	%	
High school and below	67	46.2	147	37.4	214	39.8	0.064
College and higher	78	53.8	246	62.6	324	60.2	
Mother Employment Status							
Yes	94	64.8	265	67.4	359	66.7	0.570
No	51	35.2	128	32.6	179	33.3	
Mother's BMI							
Underweight	14	9.7	62	15.8	76	14.1	
Normal	76	52.4	214	54.5	290	53.9	0.078
Overweight and obese	55	37.9	117	29.8	172	32.0	
Pre-Pregnancy BMI (kg/m^2)							
Underweight	23	15.9	117	29.8	140	26.0	
Normal	88	60.7	225	57.3	313	58.2	0.00
Overweight and obese	34	23.4	51	13.0	85	15.8	
Post-Pregnancy BMI (kg/m^2)							
Underweight	3	2.1	5	1.3	8	1.5	
Normal	10	6.9	100	25.4	110	20.4	0.00
Overweight and obese	132	91.0	288	73.3	420	78.1	
Weight Gain During Pregnancy							
Insufficient	37	25.5	102	26.0	139	25.8	
Sufficient	41	28.3	155	39.4	196	36.4	0.025
Excessive	67	46.2	136	34.6	203	37.8	
Gestational Diabetes							
Yes	14	9.7	19	4.8	33	6.1	0.062
No	131	90.3	374	95.2	505	93.9	
Gestational Hypertension							
Yes	6	4.1	14	3.6	20	3.7	0.754
No	139	95.9	379	96.4	518	96.3	
Smoking During Pregnancy							
Yes	12	8.3	20	5.1	32	5.9	0.167
No	133	91.7	373	94.9	506	94.1	
Caffeine Intake during Pregnancy (mg/day)							
<200	50	41.0	191	54.9	241	51.3	0.008
≥ 200	72	59.0	157	45.1	229	48.7	
Type of Birth							
Normal Birth	39	26.9	138	35.1	177	32.9	0.072
Caesarean section	106	73.1	255	64.9	361	67.1	
Income of the Family (TRY)							
≤1500	7	4.8	9	2.3	16	3.0	
1501-3000	26	18.0	72	18.3	98	18.3	0.366
3001-4500	65	44.8	157	40.0	222	41.2	
>4500	47	32.4	155	39.4	202	37.5	
Number of Children							
1	66	45.5	172	43.8	238	44.2	
≥ 2	79	54.5	221	56.2	300	55.8	0.717
Father's BMI							
Underweight	1	0.7	10	2.5	11	2.0	
Normal	36	24.8	128	32.6	164	30.5	0.070
Overweight and obese	108	74.5	255	64.9	363	67.5	

BMI: Body Mass Index, TRY: Turkish lira, x̄±SD: means ± standard deviations

Table 5. Obesity risk factors in pre-school children

Factors	p	OR	95% confidence interval
Pre-pregnancy BMI > 30 kg/m² *	0.001	1.108	1.042-1.179
Post-pregnancy BMI 25- 30 kg/m² *	0.04	2.778	1.396-5.528
Post-pregnancy BMI > 30 kg/m² *	<0.001	4.350	2.053-9.217
Private school (ref: public school)	0.020	2.093	1.298-3.376
Father's BMI > 30 kg/m² *	0.005	1.089	1.027-1.155
Caffeine Intake during Pregnancy ≥200 mg/day (ref:< 200 mg/day)	0.036	1.588	1.031-2.446
Too Fast/Fast Eating (ref: Normal)	0.024	3.355	1.175-9.583
Lunch Duration	0.039	0.966	0.934-0.998
Sleep Duration <10 hours/day (ref: ≥10 hours/day)	0.001	2.522	1.439-4.421
Screen time > 2 hours/day (ref: <2 hours/day)	0.044	1.560	1.012-2.405

BMI: Body Mass Index, OR: Odds Ratio, ref: reference, * Reference BMI: <25 kg/m²

DISCUSSION

In the present study, the prevalence of obesity in Turkish children was determined and a total of 28 risk factors for obesity were identified. The prevalence of obesity was found to be 28.8% in girls, 24.9% in boys, and 27.0% in all participants. There are not enough studies with this age group in Turkey. Önal et al found the prevalence of overweight and obesity in Turkish preschool children as 11.4%[7]. On the other hand, the National Nutrition and Health Survey[6] found the prevalence of overweight and obesity in children aged 3-5 years in 2010 as %22.4. Similarly, according to the Childhood Obesity Surveillance Initiative (COSI) conducted in European countries in 2010, this ratio was reported as 19.3% in 6-year-old children[26]. The prevalence of obesity in preschool children was found to be 35% in the United States[27], 32.6% in Greece[28], 32% in Portugal[29], 35.7% in Iran[30], and 11% in Poland[2]. Although the obesity prevalence of 27% found in our study was the highest ratio calculated in Turkey, it is lower compared to Europe, the United States, and Iran. It is suggested that the variation in obesity prevalence among European countries is heterogeneous and the situation in Turkey fits this pattern. Turkey is one of the developed and developing countries and therefore, different obesity prevalence rates are observed depending on both regional and socioeconomic factors as in other countries.

To prevent childhood obesity, it is recommended to focus on obesity risk factors in the first 1,000 days[31]. It was reported that children whose mothers were obese are exposed to more obesogenic factors and children who have overweight and obese parents have a 1.9 times higher risk of obesity compared to children whose parents were normal weight[32,33]. The studies examining risk factors for obesity in preschool children mostly focus on gestational, infancy, and early childhood periods[31]. Obesity in children is linked with higher pre-pregnancy BMI in mothers[10]. Rathnayake et al.[32] and Zhou et al.[34] found that children whose mothers were obese before the pregnancy had 4.0- and 1.08-times higher risks of being overweight/obese, respectively. The positive correlation obtained in our study between the pre-pregnancy BMI of mothers and obesity in children is consistent with the previous reports. Babies born to overweight and obese mothers carry many factors that may contribute to obesity. In addition to genetic predisposition, lifestyle behaviors and dietary habits of the family shape the child's obesogenic environment. These findings highlight the importance of maternal weight control for the prevention of early childhood obesity.

Early childhood obesity is associated with excessive gestational weight gain, being overweight and obese during pregnancy[35]. A study conducted on 16,220 children aged 2-8 years from eight different European countries showed that the risk of obesity in children increases as maternal weight gain increases during pregnancy[36]. A cohort study conducted in China showed that the risk of being overweight has doubled in children whose mothers gained excessive weight during pregnancy[37]. In our study, we determined that mothers of obese children have

more weight gain during pregnancy. Furthermore, we found that being overweight or obese during pregnancy increases the risk of obesity in children by 2.778 times (95% CI: 1.396-5.528) and 4.350 times (95% CI: 2.053-9.217), respectively. Similar to our findings, Voerman et al.[38] found that maternal overweight and obesity increase early childhood obesity 2.43 and 1.39 times, respectively.

It was reported that caffeine intake during pregnancy affects the appetite and other metabolic mechanisms and therefore, can lead to abnormal fetal growth and early childhood obesity. A caffeine intake of ≥200 mg during pregnancy is associated with rapid weight gain until 8 years by Papadopulo et al.[39] and until 6 years by Voerman et al.[40] Furthermore, it was found that this risk increases as caffeine intake increases. Jin et al.[41] reported that the risk of obesity in preschool children increases by 1.31 times with every 100 mg/day increase in caffeine intake (95% CI: 1.11-1.55). Similarly, we found that a daily caffeine intake of ≥200 mg increases the risk of obesity in preschool children by 1.588 times (95% CI: 1.031-2.446). It is suggested that maternal caffeine exposure probably has an impact on children through epigenetic mechanisms. Determining the caffeine-content of foods and drinks, informing pregnant women about the caffeine amount of these foods and its possible side effects might be effective in decreasing the risk of obesity in preschool children.

It was reported that wrong dietary habits that lead to weight gains such as meal skipping, irregular meal patterns, fast eating, and unhealthy food choices may result in early childhood obesity[42]. Previous researchers have shown that fast eating in preschool children is positively correlated with BMI[43,44]. According to Zong et al., fast eating increases the risk of obesity in preschool children by 4.3 times[45]. Our findings showed that fast eating increases the risk of obesity in children by 3.355 times (95% CI: 1.175-9.583). Slow eating creates a feeling of satiety before consuming too much food, thus providing nutrient intake and weight control.

Studies conducted to examine and prevent obesity risk factors mostly focus on mothers. Therefore, the potential impact of fathers on the treatment and prevention of childhood obesity is not sufficiently presented. However, it is reported that fathers have a deep and independent impact on children's health and development[46]. Freeman et al.[47] found that obesity in fathers alone increases the risk of childhood obesity by 15 times. The results of epidemiological studies conducted in China showed that the father's obesity increased the risk of childhood obesity by 1.479 times (95% CI: 1.356-1.612)[45]. Similarly, we found that father's obesity increased the risk of childhood obesity by 1.089 times (95% CI: 1.027-1.155). Since Turkey is a male-dominated society, fathers' food choices and eating habits affect the nutritional habits of the family and naturally the child. Therefore, national interventions aiming to prevent early childhood obesity should be planned to include fathers as well.

A positive correlation between shorter sleep duration and early childhood obesity was reported[48,49]. A meta-analysis conducted by Li et al.[50] revealed that shorter sleep duration increases the risk of obesity by 45%. It was determined that preschool children who sleep less than 8 hours a day have a 2.2 times higher risk of obesity than those who sleep more than 9 hours[33]. Furthermore, Carter et al.[51] found that each additional hour of sleep at ages 3-5 was associated with a reduction in BMI of 0.48 and a reduced risk of being overweight of 0.39 at age 7. Consistent with previous studies, we obtained that shorter sleep duration (<10 hours) increases the risk of obesity in preschool children by 2.522 times (95% CI: 1.439-4.421). Chronic insomnia affects leptin and ghrelin levels, and physical activity decreases due to fatigue and increases appetite.

Excessive screen time among preschool children is associated with decreased physical activity and energy as well as higher snack consumption and therefore, results in energy imbalance and weight gain[52]. Goisis et al. in the United Kingdom and Armoon et al. in Iran reported a significant positive correlation between screen time and obesity among preschool children[53,54]. In a study conducted in China, Zong et al.[45] found that daily watching TV ≥2 hours increases the risk of obesity by 2.154 times. Similar to the literature results, we found that daily watching TV ≥2 hours increases the risk of obesity by 1.560 times. Excessive screen time may lead to the consumption of high-energy snacks without children feeling hungry. In addition, longer screen exposure might decrease daily sleep duration.

The strength of our study is that many obesity risk factors ranging from pregnancy to early childhood were evaluated. In addition, the risk of sampling bias was reduced by the stratified sampling method. The limitations of our study were that anthropometric data of mother's pre-post pregnancy and caffeine intake during pregnancy were obtained according to

the mother's statement. Although we have examined many risk factors for childhood obesity, the potential effect of determinants such as sociocultural, race/ethnicity, and physical activity level can not be measured because obesity is multifactorial. However, the results of our research were consistent with many previous studies evaluating risk factors for childhood obesity.

In conclusion, many potential obesity risk factors were evaluated in our study. Among these risk factors, parental obesity, caffeine intake during pregnancy, school type, eating speed and duration, sleep and screen time were strongly associated with childhood obesity. Future research should focus on the potential obesity risk factors of the mother and child starting from the pre-pregnancy period and monitor their effects with longitudinal studies. Providing lifestyle changes to children and families at high risk of early childhood obesity and regulating the obesogenic environment can help protect the child from obesity.

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