Assessment of Risk Factors for Obesity in Children Aged 6-17 Years Where Obesity Reaches Peak

Obezitenin Zirve Yaptığı 6-17 Yaş Aralığındaki Çocuklarda Obezite Gelişiminde Rol Oynayan Risk Faktörlerinin Değerlendirilmesi: Tek Merkez Deneyimi

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ABSTRACT

Objective: Obesity is an important health problem affecting 25-30% of children and adolescents. This study, it was aimed to determine the age intervals in which obesity reaches to peak incidence and risk factors playing role in the development obesity among children and adolescents aged 6-17 years who presented to pediatrics outpatient clinic of Ankara Keçiören Training and Research Hospital.

Material and Methods: This cross-sectional study included 3.000 children and adolescents aged 6-17 years and their parents who presented with any reason to pediatrics outpatient clinic of Ankara Keçiören Training and Research Hospital between October, 2019 and December, 2019.

Results: Obesity was detected in 21.4% of children while 78.6% were not obese. A significant correlation was detected between birth weight and obesity (p=0.001). A significant correlation was found between obesity and time spent for TV, computer and video games per day (p<0.001). The obesity was significantly decreased by increasing duration of physical activity. In the study, the obesity incidence was 1.77-folds (1.25-2.50) higher in children with obese mother and 2.01-folds (1.42-2.85) in children with obese father.

Conclusion: The obesity incidence is progressively increasing in childhood as with other age groups. To prevent such increase, measures should be taken as early as possible. An adequate and balanced nutrition and physical activity are of important in prevention and treatment of obesity. Although primary goal is to achieve lifestyle modifications, pharmacotherapy or surgery may be attempted in the presence of severe obesity-related complications.

Key Words: Childhood, Nutrition, Obesity, Physical Activity

ÖZ

Amaç: Obezite, çocuk ve adölesanların %25-30'unu etkileyen önemli bir sağlık problemidir. Bu çalışmada, Keçiören Eğitim ve Araştırma Hastanesi çocuk sağlığı ve hastalıkları polikliniğine başvuran 6-17 yaş aralığındaki çocuklarda hangi yaşlarda obezitenin zirve yaptığı ve obezite gelişiminde rol oynayan risk faktörlerinin (beslenme, aktivite, aile öyküsü) belirlenmesi amaçlanmıştır.

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Gereç ve Yöntemler: Çalışma kesitsel olarak planlanıp, Ekim 2019- Aralık 2019 tarihleri arasında Ankara Keçiören Eğitim ve Araştırma Hastanesi Pediatri Polikliniğine herhangi bir sebeple başvuran 3000 adet 6-17 yaş arası çocuklar ve velileri dahil edilmiştir.

Bulgular: Çocukların %78.6'sında obezite yok iken %21.4'ünde obezite mevcuttu. Doğum ağırlığı ile obezite arasında anlamlı ilişki bulunmuştur (p= 0.001). Televizyon izleme, bilgisayar ile uğraşma, video oyun oynama için ayrılan günlük sürenin ile obezite arasında anlamlı ilişki saptanmıştır (p<0.001). Spor, bisiklet sürme, dışarıda oynama gibi fiziksel aktiviteler ile obezite arasında anlamlı ilişki saptanmıştır (p=0.045). Obezite oranı fiziksel aktivite süresinin artması ile anlamlı derecede azalmıştır. Çalışmamızda annesi obez olan çocuklarda obezite 1.77 (1.25-2.50) kat, babası obez olan çocuklarda obezite 2.01 (1.42-2.85) kat daha fazla görülmüştür (p<0.001).

Sonuç: Tüm yaş gruplarında olduğu gibi çocukluk çağında da obezite görülme sıklığı giderek artmaktadır. Bu artışın önüne geçebilmek için gerekli önlemlerin en erken safhada alınması gerekmektedir. Çocuklarda obezitenin önlenmesi ve tedavisinin temelinde yeterli ve dengeli beslenme ve fiziksel aktivitenin önemi büyüktür. Öncelikli amaç yaşam tarzı değişikliği olmasına rağmen obeziteye bağlı ciddi komplikasyonların varlığında gereklilik halinde farmakoterapi veya cerrahi tedavi de denenebilmektedir.

Anahtar Sözcükler: Çocukluk Çağı, Beslenme, Obezite, Fiziksel Aktivite

INTRODUCTION

Obesity, affecting 25-30% of children and adolescents, is a complex, multifactorial metabolic disease defined as abnormal or excessive fat accumulation in the body due to high energy intake at a level which may impair health (1, 2). At childhood, the obesity incidence is progressively increasing worldwide. The obesity prevalence at childhood was increased from 4.2% in 1990 to 6.7% in 2010. It is estimated that the obesity prevalence will most likely continue to increase and that 9.1% of children will be obese in 2020 worldwide. The excessive consumption of fats in carbohydrates in the context of dietary patterns and tendency towards spending time for TV and video games rather than physical activity among children emerged by the contemporary life are playing important role in this increase of obesity prevalence. Besides, genetic, psychogenic and sociocultural factors as well as hormonal disorders also play important role in obesity. Moreover, it was shown that the prevalences of overweight and obesity was 2-folds higher in developed countries when compared to emerging countries (3).

Although obesity is seen at childhood, adolescence and adult life at varying rates, similar factors play role in all ages and obesity remains to be an important public health problem. Thus, we aimed to evaluate risk factors involved in the obesity among children and adolescents aged 6-17 years.

MATERIAL and METHODS

The study was approved by Ethics Committee of Ankara Keçiören Training and Research Hospital (2012-KAEK-15/1968 - 11.09.2019). All parents gave written informed consent before participation. The study was conducted between 01 October, 2019 and 31 December, 2019. The study included 3.000 children and adolescents aged 6-17 years who presented to pediatrics outpatient clinic of Ankara Keçiören Training and Research Hospital. All subjects completed a questionnaire including 25 items about age, gender, birth weight, type of infant feeding, age at onset of overweight, maternal age at birth, daily eating habits, additional food intake between meal and before sleeping, favorite foods as snack, food intake at school, activities in spare times, whether he/she walks to school, education level of parents, occupation of parents, economic status of family, maternal height and weight, paternal height and weight, family history of obesity, family type, caregiver at infancy, current diseases, previous diseases, medication, blood pressure as measured in a physician visit and family history of diabetes, hypertension or heart disease.

Physical Examination and Measurements

In children included, body weight measurement was performed with light clothing and without shoes at morning hours using an digital scale with sensitivity of ±100 g (Seca). Height measurement was performed using a portable stadiometer while he/she is at standing position without shoes; head, back, hip and heels being at contact to wall and hands by side. The height was recorded as the distance from the point over head to base. The body mass index (BMI) was calculated as body mass (kg) divided by square of height (m^2). The overweight and obesity were defined based on Centre for Disease Control (CDC2000) criteria according to age-specific BMI as follows: >85th percentile, overweight; and >95th percentile, obese (4). The age- and sex-specific height and weight percentiles were calculated using growth charts prepared for Turkish children (5).

Data Assessment and Analysis

All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) for Windows version 23.0 (IBM SPSS Inc., Chicago, IL, USA). The normality of data distribution was assessed using plots (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov test and Shapiro-Wilk test). All data were considered as parametric. The descriptive statistics are presented as median and maximum-minimum values (median ± max-min). The results are presented with 95% confidence interval. A p value<0.050 was considered as statistically significant.

RESULTS

The study included 3.000 subjects. The median age was 11 years (6-17 years). Of the subjects included, 59.4% were girls while 40.6% were boys. The median age at onset of overweight

Table I: Association between parameters at infancy and obesity.

	No Obesity*	Obesity*	Total*	Crude OR (%95CI)	p
Birth weight (n=2805)					
<2500 g	483 (21.9)	63 (10.6)	546 (19.5)	0.43 (0.26-0.71)	0.001
2500-4000 g	1596 (72.3)	477 (79.9)	2073 (73.9)	1.00	
>4000 g	129 (5.8)	57 (9.5)	186 (6.6)	1.47 (0.83-2.60)	
Type of infant feeding (n=2865)					
Exclusively breastfeeding within first 4-6 months	1605 (71.5)	447 (72.0)	2052 (71.6)	1	0.784
Breastfeeding plus formula within first 4-6 months	501 (22.3)	129 (20.8)	630 (22.0)	0.92 (0.63-1.35)	
Exclusively formula within first 4-6 months	138 (6.1)	45 (7.2)	183 (6.4)	1.48 (0.84-2.60)	
Maternal age at birth (n=2988)					
≥26 years	1254 (53.5)	324 (50.5)	1578 (52.8)	1	0.438
≤26 years	1092 (46.5)	318 (49.5)	1410 (47.2)	1.12 (0.83-1.52)	
Caregiver at infancy (n=2997)					
Mother at home	1659 (70.5)	477 (74.3)	2136 (71.3)	1	
Grandmother-grandfather at home	498 (21.1)	105 (16.4)	603 (20.1)	0.73 (0.48-1.09)	0.761
Nursery	144 (6.1)	39 (6.1)	183 (6.1)	0.94 (0.49-1.78)	
Caregiver	54 (2.3)	21 (3.3)	75 (2.5)	1.35 (0.55-3.29)	

**n (%)*

Table II: Association between family structure, dietary habiits and obesity.

	No Obesity*	Obesity*	Total*	Crude OR (%95CI)	P
Family structure (n=2994)					
Nuclear family	2028 (86.1)	504 (78.9)	2532 (84.6)	1	0.009
Extended family	327 (13.9)	135 (21.1)	462 (15.4)	1.66 (1.12-2.44)	
Having regular breakfast, lunch and dinner everyday (n=3000)					
Yes	1632 (69.2)	483 (75.2)	2115 (70.5)	1	0.087
No or sometimes	726 (30.8)	159 (24.8)	885 (29.5)	0.74 (0.52-1.04)	
Nutrition status at school (n=2943)					
Prepared at home	1605 (69.8)	477 (74.3)	2082 (70.8)	1	
Cafeteria	498 (21.6)	105 (16.3)	603 (20.5)	0.70 (0.47-1.06)	
Dining hall	144 (6.3)	39 (6.1)	183 (6.2)	0.91 (0.48-1.72)	0.405
From outside	54 (2.3)	21 (3.3)	75 (2.5)	1.30 (0.53-3.18)	
Does he/she eat snack or additional food between meals and before sleeping? (n=2997)					
Yes	1101 (46.8)	300 (46.7)	1401 (46.7)	1	0.995
No or sometimes	1254 (53.2)	342 (53.3)	1596 (53.3)	1.00 (0.74-1.35)	
Additional food as snack at school (n=3000)					
Fruit, milk, yoghurt	1515 (64.2)	387 (60.3)	1902 (63.4)	1	0.285
Candy, Chocolate, Cake etc.	843 (35.8)	255 (39.7)	1098 (36.6)	1.79 (1.35-2.38)	

**n (%)*

was 8 years (6-16 years). The median maternal age at birth was 26 years (15-45 years).

The correlation between obesity and gender was assessed by including all age groups. Of obese children, 55.1% of obese subjects were girls while 44.9% were boys. Similarly, of non-obese subjects, 60.6% were girls while 39.4% were boys. No significant difference was detected between obese and non-obese children regarding gender (p=0.152).

A significant correlation was detected between birth weight and obesity (p=0.001). When compared to children with birth weight between 2500 and 4000 g, the likelihood of obesity was lower 0.43-folds (0.26-0.72) lower in children with birth weight <2500 g. When compared to children with birth weight <2500 g, the likelihood of obesity was 2.29-folds (1.10-3.73) higher in children with birth weight between 2500 and 4000 g whereass 3.38-folds (1.67-6.86) higher in children with birth weight >4000 g. No significant correlation was found between obesity and type of infant feeding at infancy (exclusively breastfeeding, breastfeeding plus formula or only formula within first 4-6 months), maternal age at birth (<26 years or 26 years) and caregiver at infancy (mother, grandmother or grandfather at home or a caregiver or preschool) (p=0.780; p=0.430; p=0.760) (Table I).

When family type was assessed, 78.9% of children with obesity were from nuclear family while 86.1% of children without obesity were from nuclear family. Again, 21.1% of obese children were from extended family while 13.9% of non-obese children were

Table III: Association between daily activities and obesity.

	No Obesity*	Obesity*	Total*	Crude OR (%95CI)	p
Time spent with TV, computer or video games per day (n=3000)					
No	843 (35.7)	138 (21.5)	981 (32.7)	1	
0-1 hours	384 (16.3)	114 (17.8)	498 (16.6)	1.81(1.12-2.92)	<0.001
1-2 hours	573 (24.3)	171 (26.6)	744 (24.8)	1.82 (1.18-2.80)	
2-4 hours	282 (12.0)	84 (13.1)	366 (12.2)	1.81 (1.07-3.07)	
≥4 hours	276 (11.7)	135 (21.0)	411 (13.7)	2.98(1.86-4.79)	
Time spent for painting, homework and reading per day (n=3000)					
No	1524 (64.6)	405 (63.1)	1929 (64.3)	1	
0-1 hours	228 (9.7)	69 (10.7)	297(9.9)	1.13(0.68-1.88)	0.224
1-2 hours	360 (15.3)	93 (14.5)	453 (15.1)	0.97 (0.62-1.50)	
2-4 hours	159 (6.7)	30 (4.7)	189 (6.3)	0.71(0.35-1.43)	
≥4 hours	87 (3.7)	45 (7.0)	132 (4.4)	1.94(1.01-3.73)	
Time spent for sports, cycling and outdoor games (n=3000)					
No	1506 (63.9)	477 (74.3)	1983 (66.1)	1	
0-1 hours	126 (5.3)	33 (5.1)	159 (5.3)	0.82 (0.41-1.64)	0.045
1-2 hours	315 (13.3)	66 (10.3)	381 (12.7)	0.66 (0.40-1.08)	
2-4 hours	216 (9.2)	30 (4.7)	246 (8.2)	0.43 (0.22-0.87)	
≥4 hours	195 (8.3)	36 (5.6)	231 (7.7)	0.58 (0.30-0.95)	
Walking time to school (n=3000)					
Not walking	828 (35.1)	225 (35.0)	1053 (35.1)	1	
0-15 min	1134 (48.1)	306 (47.7)	1440 (48.0)	0.99 (0.70-1.38)	0.964
15-30 min	306 (13.0)	90 (14.0)	396 (13.2)	0.99 (0.70-1.38)	
>30 min	90 (3.8)	21 (3.3)	111 (3.7)	0.85 (0.36-2.03)	

**n (%)*

Table IV: Association between obesity and history of chronic and metabolic disease.

	No Obesity*	Obesity*	Total*	Crude OR (%95CI)	p
Blood pressure measured in previous physician visit (n=3000)					
Not measured	783 (33.2)	195 (30.4)	978 (32.6)	0.93 (0.67-1.30)	0.004
Normal	1530 (64.9)	408 (63.5)	1938 (64.6)	1	
High	45 (1.9)	39 (6.1)	84 (2.8)	3.25 (1.51-6.99)	
Cholesterol and lipid level in previous physician visit (n=3000)					
Not measured	1095 (46.5)	204 (31.8)	1299 (43.3)	0.61 (0.44-0.85)	<0.001
Normal	1215 (51.5)	369 (57.5)	1584 (52.8)	1	
High	48 (2.0)	69 (10.7)	117 (3.9)	4.73 (2.42-9.24)	
Family history ofdiabetes mellitus, hypertension and heart disease (n=2988)					
No	1737 (73.9)	438 (68.9)	2175 (72.8)	1	0.148
Ye	615 (26.1)	198 (31.1)	813 (27.2)	1.20 (0.91-1.77)	
Presence of chronic disease in child (n=3000)					
No	1974 (83.7)	519 (80.8)	2493 (83.1)	1	0.320
Yes	384 (16.3)	123 (19.2)	507 (16.9)	1.21 (0.82-1.79)	

**n (%)*

from extended family. The likelihood of obesity was 1.66-folds (1.12-2.44) higher in children from extended family when compared to those from nuclear family. There was a significant correlation between obesity and family structure. Table II presents associations between obesity and family structure, eating habits (regular intake of breakfast, lunch and dinner every day), nutrition status at school, eating snacks between meals and before sleeping, snacks at school and dietary patterns.

When association between physical activity and obesity was assessed, it was found that 21.5% of obese children were engaged to TV, computer and video games for ≥4 hours per day while only 11.5% of non-obese children for ≥4 hours per day. Again, 21.5% of obese children and 35.8% of non-obese children do not spend time with TV, computer and video games. When compared to children not spending time with TV, computer and video games, the likelihood of obesity

was 1.81-folds (1.12-2.92) higher in children spending 0-1 hours per day with TV, computer and video games whereas 1.82-folds (1.18-2.80) higher in children spending 1-2 hours per day, 1.82-folds (1.07-3.7) higher in children spending 2-4 hours per day and 2.98-folds (1.86-4.79) higher in children spending ≥4 hours per day. There was a significant correlation between obesity and daily time spent with TV, computer and video game activities. Table III summarizes associations between obesity and daily duration of TV, computer and video game activities; daily time spent with activities such as painting, homework and reading; daily time spent with cycling-playing outdoor games; and walking time to school.

There was obesity in 5.1% of children not spending no time for cycling-playing outdoor game whereas in 10.3% spending 1-2 hours per day, in 4.7% of children spending 2-4 hours per day, and in 5.6% of children spending ≥4 hours per day. The obesity rate was found as 35.1% in children not walking to school while it was 48.0% in children walking for 0-15 minutes to school, 13.2% in those walking for 15-30 minutes and 3.7% in those walking for >30 minutes. A significant difference was detected between daily time spent with TV, computer and video game activities and daily time spent for cycling-playing outdoor games (p=0.001; p=0.045).

When association between obesity and hypertension was assessed, it was found that there was hypertension in 2.8% of children; of these, obesity was detected in 6.1% while no obesity was observed in 1.9% (p=0.004). High cholesterol and lipid levels were found in 3.9% of children included; of these, there was obesity in 10.7% while no obesity in 2% (p=0.001). There was family history of diabetes mellitus, hypertension or heart disease in 27.2% of children included; of these, obesity was detected in 31.1%. There was a chronic disease in 16.9% of children included; of these, obesity was detected in 19.2% while no obesity was observed in 16.3% (p=0.148; p=0.320) (Table IV).

In our study, obesity was detected in 21.0% of mothers of children with obesity but not in 79.0%. Again, obesity was detected in 19.9% of fathers of children with obesity but not in 80.1% (p=0.001).

When education level of mothers was assessed in children, it was found that education level was university degree or higher among 18.2% of mothers of obese children and 12.6% of mothers of non-obese children. In addition, it was primary or secondary school degree in 47.7% of mothers of obese children and 51.1% of mothers of non-obese children. No significant correlation was detected between obesity in children and education level of mother (p=0.164; p=0.924). The occupation was housewife in 79.0%, self-employment 13.1% and worker or government official in 7.9% of mothers of obese children. These rates were 5.2%, 52.3% and 42.5% of fathers of obese children (p=0.092, p=0.264).

DISCUSSION

Obesity is a multifactorial disorder which is commonly seen among children. In order to identify underlying factors which are currently unknown and re-consider measures to be taken and treatment approaches, we aimed to determine the ages in which obesity reaches to peak incidence and risk factors (nutrition, activity, family history) playing role in the development obesity among children and adolescents aged 6-17 years who presented to pediatrics outpatient clinic of our hospital.

The obesity was detected in 21.4% while no obesity was detected in 78.6% of 3.000 children and adolescents included to the study. In parallel to our study, obesity rate was found as 21.8% in a study including children aged 11-16 years (6). In Turkey Childhood Obesity Surveillance Initiative trial including grade 2 students across Turkey, it was found that 1.5% of children were underweight whereas 14.6% were overweight and 9.9% were obese. According WHO criteria, overweight and obesity are assessed as a whole; based on this consumption, 24.5% of children were found to be obese in the study (7). In emerging countries, obesity incidence was found as 23.9% in boys aged 10-14 years in Saudi Arabia whereas 35% in children aged 12-17 years in Qatar, 28.8% in Northern Brazil and 25.7 % in Southern Brazil. It is proposed that the rapid socioeconomic transformation is the cause of high obesity incidence in emerging countries (8, 9). The obesity incidence was found as 22.5% in COSI TUR 2013 survey and was further increased up to 24.5% in COSI TUR 2016 survey (10), indicating that obesity is progressively increasing over years and that strict measures should be taken rapidly in order to prevent obesity.

When gender was assessed in the study population, it was found that 55.1% of obese children were girls and 44.9% were boys while 60.6% of non-obese children were girls and 39.4% were boys. In our study, no significant difference was detected in obesity according to gender. In another study including 82.661 children aged 6-16 years, no significant difference was detected in obesity incidence according to gender in agreement with our study (10.1% and 2.4% of girls were overweight and obese vs. 8.5% and 2.6% of boys were overweight and obese) (11). This may be due to fact that the hormonal fluctuations seen during pregnancy or menopause which are thought to lead higher obesity rates in adult women are lacking in the age groups studied in our study. On contrary, in European Childhood Obesity Surveillance Initiative (COSI) trials conducted in 2008 and 2013, it was reported that obesity was more common among boys than girls at primary school age group (3, 99). The higher obesity incidence in boys was attributed to excessive use of technology and internet; and resultant limitation of physical activity and intake of junk food (12-17).

In our study, a significant correlation was detected between obesity and birth weight. The birth weight was >4.000 g in 9.5% of obese children and in 5.8% of non-obese children

while it was <2.500 g in 10.6% of obese children and in 21.9% of non-obese children. The likelihood of obesity was 3.38 folds (1.67-6.86) higher in children with birth weight >4.000 g. In a study on 1.253 student aged 6-14 years, it was found that the obesity incidence was significantly higher among children with higher birth weight in agreement with our study (18). In a large-scale study on children aged 9-11 years, it was found that the obesity risk was higher in children with birth weight>4.000 g when compared to those with low birth weight (19). In a study by Leonard et al. (20), it was found that the birth weight of a child affects time needed to become adult and body structure in adult life.

The association between breastfeeding and obesity have been investigated in several studies. According to COSI TUR trial, 95.5% of children had been fed by breastfeeding while 3.6% of children had never been fed by breastfeeding. In many studies, it was shown that breastfeeding during first 6 months of life alone is protective against childhood obesity while lack of breastfeeding during first 6 months or early withdrawal of breastfeeding increases on obesity (21-24). In our study, 71.6% of the children were exclusively fed by breastfeeding while 22.0% were fed by breastfeeding plus formula and 6.4% were exclusively fed by formula within first 4-6 months of life. On contrary to literature, it was found that there was no association between obesity and type of infant feeding in our study. In similar studies, no association of breastfeeding or duration of breastfeeding with obesity has been shown (18-25).

The maternal age at birth was ≤26 years in 52.8% whereas >26 in 47.2% of the subjects in our study. No significant association was found between obesity and maternal age at birth. In a study by Saadet et al. (21), it was found that the rate of low birth weight infant was higher than normal weight infants among mothers aged >35 years and those aged<18 years; however no significant conclusion could be drawn. In a study by Sedat et al. (22), it was reported that maternal age at birth had influence on birth weight and potential short-term and long-term complications related to birth weight. They also reported that younger and older mothers were more likely to have low birth weight infant.

In our study, 70.5% of children were having regular breakfast, lunch and dinner every day. However, no significant correlation was found between obesity and having regular meals. On contrary, a significant correlation was observed between dietary pattern and obesity in another study. The obesity incidence was found to be higher in children not having regular breakfast, lunch and dinner at home (11). It is thought majority of children and adolescents misses breakfast; thus, a negative correlation was detected between obesity and having breakfast and energy intake from breakfast. It was found that the group missing breakfast had larger waist circumference. As supported by literature, behavioral factors such as consumption of carbonated or sweetened beverages and foods with high fat and energy content and insufficient consumption of fruit and vegetables have been linked to obesity (23-25). In a review including more than 50 studies worldwide, it was reported that children aged 6-19 years consumed healthy food such as fresh vegetables and fruits insufficiently; rather, they consumed unhealthy foods and sweetened or carbonated beverages excessively (26).

When the association between daily activities and obesity was assessed, it was found that 21.5% of children with obesity were engaged to TV, computer and video games for ≥4 hours per day while only 11.5% of children without obesity for ≥4 hours per day. Again, 21.5% of children with obesity and 35.8% of children without obesity do not spend time with TV, computer and video games. When compared to children not spending time with TV, computer and video games, the likelihood of obesity was 1.81-folds (1.12-2.92) higher in children spending 0-1 hours per day for TV, computer and video games whereas 1.82-folds (1.18-2.80) higher in children spending 1-2 hours per day, 1.82-folds (1.07-3.7) higher in children spending 2-4 hours per day and 2.98-folds (1.86-4.79) higher in children spending ≥4 hours per day. There was a significant correlation between obesity and daily duration of TV, computer and video game activities. In a study by American Academy of Pediatrics, a significant correlation was detected between BMI values and time spent for TV and computer among children; thus, it is recommended that children and adolescents should spend less than 2 hours per day for TV and computer (28). Again, in another study, it was observed that activities such as watching television or playing computer games enhanced likelihood of obesity by limiting physical activities and increasing consumption of foods with high energy content (29). In our study, no significant correlation was detected between obesity and activities such as painting, homework or reading and time spent for such activities. The likelihood of obesity was 0.43-folds lower in children spending 2-4 hours per day for physical activities such as sports, cycling or outdoor games when compared to those spending no time for such activities. It was 0.58-folds lower when time spent for these activities exceeded 4 hours.

In a study including 366 students aged 6-12 years (2005), it was observed that total cholesterol and LDL values were significantly higher in obese children. In our study, obesity incidence was 4.73-folds (2.42-9.24) higher in children with high cholesterol and lipid level as measured in previous visit when compared to those with normal cholesterol and lipid levels. This may be interpreted dyslipidemia due to obesity. In our study, blood pressure was high in 6.1% of obese children and in 1.9% of non-obese children. When compared to children with normal blood pressure, likelihood of obesity was 3.25-folds (1.51-6.99) higher in children with elevated blood pressure. No significant difference was found in obesity according to blood pressure. In a study conducted in a primary school from Sakarya province, obesity increased the risk for hypertension by 2.25 folds when (34). It is though that mechanisms such as autonomic dysfunction, increased insülin level, vascular impairment in

dysfunction and enhanced renin-angiotensin-aldosterone axis in the pathophysiology of obesity-related hypertension (30, 31).

The presence of obesity in family history implies a genetic component involved in the obesity in children; however, dietary habits and patterns of the family, food preference and insufficient physical activity also play important role in the development of obesity (32).

In our study, no significant association was detected between obesity development and education level or occupation of parents.

In conclusion, there was obesity in 21.4% of children included a significant association was found between birth weight and obesity. On the other hand, no significant association was found between obesity and type of infant feeding, maternal age at birth, caregiver at infancy, dietary patterns at home and school, family history of chronic disease, presence of chronic disease in child or education level and occupation of parents.

Of the families included 84.6% were nuclear families and the obesity incidence was found to be significantly lower in children from nuclear families. A significant correlation was detected with time spent for TV, computer and video games; physical activities such as sports, cycling or outdoor games; increased blood pressure; elevated cholesterol and lipid levels and presence of obesity in parents ($p<0.001$).

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