ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

THE IMPACT OF SOCIOECONOMIC STATUS (SES) OF FAMILIES ON THE CHILDHOOD OBESITY IN TÜRKİYE

TÜRKİYE'DE AİLELERİN SOSYOEKONOMİK DURUMUNUN (SED) ÇOCUKLUK ÇAĞI OBEZİTESİNE ETKİSİ

NAZAN YARDIM*

ABSTRACT

In Türkiye obesity is one of the public health problems. The study focuses on childhood obesity and socioeconomic status (SES), the linkages between socioeconomic status (SES) and childhood obesity. The data of the study are from the Turkey Childhood Obesity Surveillance 2016 with a representative sample. The dependent variable is obesity, the main independent variable is the SES index constructed to identify the socioeconomic status of the family. In this study, 1 out of 10 7-year-old children is obese. The results reinforce the importance of SES in determining the obesity status of children. The higher SES is found to be significantly related to a higher risk of childhood obesity. Male sex is a predictor of obesity both of univariate and multivariate analysis. To be male, children using a vehicle for school transportation, whose mother and/or father are/is obese, whose birthweight was over 3,500 gr are found to be under the elevated risk of obesity. Children who do not do a physical activity or make less than 1 hour a day, the risk of obesity is approximately two times higher. Children who eat pizza and other pastries frequently are 1.3 times more likely to be obese than children who seldom eat such dishes. The results of the study suggest that the tackle against obesity should start from childhood.

KEYWORDS: SES, obesity, childhood, diet, Türkiye

* Tıp Doktoru, Ankara İl Sağlık Müdürlüğü. Ankara. ORCID: 0000-0002-1186-7094. nazan.yardim@saglik.gov.tr
Makale Gönderim Tarihi / Received On: 24/02/2023.
Makale Kabul Tarihi / Accepted On: 13/07/2023.

ÖZET

Türkiye'de obezite halk sağlığı sorunlarından biridir. Çalışma çocuklukta obezite ve sosyoekonomik durum (SED) arasındaki bağlantılara odaklanmıştır. Araştırmanın verileri temsili bir örneklemle Türkiye Çocukluk Çağı Obezite Araştırması 2016'dan alınmıştır. Bağımlı değişken obezite, temel bağımsız değişken ise ailenin sosyoekonomik durumunu belirlemek için oluşturulan SED endeksidir. Bu çalışma 7 yaşındaki her 10 çocuktan birini obez olduğunu ortaya koymuştur. Sonuçlar çocukların obezite durmunun belirlenmesinde SED'un önemini güçlendirmektedir. Daha yüksek SED'un, çocuklukta obezite riskinin daha yüksek olmasıyla önemli ölçüde ilişkili olduğu bulunmuştur. Erkek cinsiyeti hem tek değişkenli hem de çok değişkenli analizde obezitenin bir göstergesidir. Erkek olan, okul ulaşımı için araç kullanan, anne ve/veya babası obez olan, doğum ağırlığı 3.500 gr'ın üzerinde olan çocukların yüksek obezite riski altında olduğu belirlendi. Fiziksel aktivite yapmayan veya etkinliğe günde bir saatten az zaman harcayan çocuklarda obezite riski yaklaşık iki kat daha fazladır. Pizza ve diğer hamur işlerini sık sık yiyen çocukların obez olma olasılığı, bu tür yemekleri nadiren yiyen çocuklara göre 1,3 kat daha fazladır. Araştırmanın sonuçları obeziteyle mücadelenin çocukluktan itibaren başlaması gerektiğini ortaya koymaktadır.

ANAHTAR KELİMELER: SED, obezite, çocukluk, diyet, Türkiye

INTRODUCTION

Childhood obesity is one of the most important public health problems in the 21st century. The problem is global and progressively affects many low and middle-income countries, particularly in the urban areas. The majority of overweight or obese children reside in developing countries, where the rate of increase is 30 percent higher than developed countries (WHO, 2017). The increase in obesity also affects some chronic diseases which are the metabolic syndrome, cardiovascular disease, type 2 diabetes and its retinal and renal complications, non-alcoholic fatty liver, obstructive sleep apnea, polycystic ovarian syndrome, infertility, asthma, some orthopedic complications, some psychiatric disease and cancers. Childhood obesity continues in the grown-up period. The literature suggests that childhood obesity may be a risk factor for cardiovascular diseases (CVD).

Efforts are made to take international measures for the growing problem at the global level. A series of prevention action plans have been prepared by WHO, the UN and the EU. These were declared in both the UN General Assembly (2011) and the 66th World Health Assembly (WHO, 2013). The Global action plan 2013–2020 for the prevention and control of non-communicable

diseases (WHO Global Action Plan, 2013) in the European Food and Action Plan (WHO Europe Food and Action Plan, 2015) were prepared in the following time. In parallel with international policies "Healthy Nutrition and Active Life Program: Prevention Adult and Childhood Obesity and Physical Activity Action Plan 2019-2023" has been updated and implemented in Türkiye by the Ministry of Health since 2010 (R. T. MoH Healthy Nutrition and Active Life Program, 2019).

Despite increasing numbers of studies on childhood obesity in Türkiye, studies on the associations between childhood obesity and SES are limited. Information on childhood obesity and its socio-economic determinants is crucial for government interventions to implement the national action plan. On the other hand, demography is the science of populations that examines: (1) the size and composition of populations (age, ethnicity, sex, marital, educational occupational status, etc. (2) dynamic life-course processes that change this composition: birth, death, migration, (3) relationships between population composition and changes, also in which they exist their social and physical environment (Lindquist et al., 2015). Understanding these processes and their relationship with each other helps and illuminates important social, political, economic, and environmental items and their impacts, such as growing population, urbanization, family structure changes, migration, and health and human life duration (Lindquist et al., 2015). The children growing up in good health, free from obesity, may reach the reproductive age and contribute more to the fertility of the society and then may live longer in a healthy life. Furthermore, the SES, which is a dependent variable of this study, is also a crucial component of the demography. As we know, when SES increases, the fertility, mortality, and migration levels decrease in all societies. In this manner the topic of this study (obesity among school-age children) and its main determinant (the SES) are intricately linked to the demography.

This study focuses on the prevalence of obesity including overweight in 7-year-old children and the socio-economic status of the family from the determinants of health perspective. In this context the study has three objectives: (1) To understand the impact of socio-economic status (SES) on the obesity and overweight among children under the control of other covariates. (2) To find out the impact of other covariates on obesity and overweight of children at age 7. (3) To provide inputs for the policy makers for evidence-based policy to revise national action plan, and to give an opportunity to evaluate the impact of governmental interventions.

MATERIALS AND METHODS

The Childhood Obesity Surveillance Initiative (COSI) was established under

the leadership of the WHO European Region. Türkiye joined the COSI family in 2013 with a protocol signed by the Ministry of Health. The data of this study comes from the Türkiye Childhood Obesity Surveillance 2016 (R. T. MoH, 2017). The study sample was selected by TURKSTAT. It was a representative sample for Türkiye and 12 NUTS regions.

The COSI TUR 2016 was conducted in primary schools, among second class 7-8 years old students. The sampling has been composed of 6 years old 13.9 %, 7 years-old 79.7 %, 8 years old 5.9 % and 9 years old is 0.5 %. In this study, 7 year old children have been selected.

The dependent variable is the obesity status of the children. According to the WHO obesity is defined as the proportion of children with weight-for-height z-score values more than +2 SDs (WHO, 2017). The main independent variable is the SES index. The other covariates are as follows: sex, physical activity status (transport to school, spending time on actively/ vigorously playing), birthweight, weight status of parents, some eating habits (consumption of pizza, soft drinks). Parents' BMI scores based on self-report. Since the main objective of the study is to understand the impact of the socio-economic status on children's obesity, a socio-economic status (SES) index was created, and then the parental and child-related factors were examined based on it. In the construction process of the SES Index, five different variables have been used which are mother's and father's educational and occupational status and relative welfare status of the household. Firstly, five different binary variables were created from these variables and then a new index variable that varies between 0 and 6 was produced by summing up the binary scores. The categories of the SES index were as follows: lowest (0), low (1), lower-middle (2), upper- middle (3), high (4), highest (5).

The study includes both descriptive analyses, and multivariate analyses with logistic regression in SPSS 23.0. In the analyses, descriptive statistics were conducted for bivariate relationships, and chi square test were done for the initial relationships between the independent and covariate variables and child obesity. Descriptive analysis, percent distribution and confidence intervals with %95 were calculated. Chi-Square tests were used to compare the characteristics of obese and non-obese children. To evaluate the relative contribution of each of these variables for the probability of a child being obese, logistic regression models that take the following basic form were used:

$$Z = \log (p/1-p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$$

Where p is equal to the probability of an event occurring, ß represents the regression coefficients, and x represents k independent variables, some of which are interactions.

The logistic regression analysis was performed to understand the impact of SES index on obesity status of children (dependent variable of the study) under the control of other covariates in an additive way.

The description of the model is as follows:

$Z = ß_0 + ß_1$(SES index) + $ß_2$(Sex) + $ß_3$(Transport to school, BMI mother, BMI Father) + $ß_4$ (Food consumption) + $ß_5$ (Sleep duration) + $ß_6$ (Birth weight) + $ß_7$ (Sugary drink) + $ß_8$ (Spending Time on Actively/vigorously Playing)

Ethics and Data Acquisition Process: The approval of the Ministry of National Education has been obtained for the survey to be conducted in the schools. Survey Ethics Committee approval has been obtained from the Ministry of Health Keçiören Training and Survey Hospital.

During the data collection phase of the study, the examiners:

- have obtained appointments from the school principals by conducting a preliminary meeting in which the objectives of the survey were explained, and information was provided on the questionnaire to be applied.
- received "Informed Written Consent Forms" from the parents.
- learned and recorded the reasons of the families, who have not consented to their children taking part in the survey, why they did not allow their children to take part.
- took care of confidentiality during the anthropometric measurements of the children, the measurements were made in a private room and alone. During the measurement, the field team, the leader and assistant examiner were present together.
- The anthropometric measurements of the students were made with the lightest clothes available on them.
- The names of the children have not been taken, the student's personal identification information has not been included in the form or in the electronic medium.

The questionnaires used in the survey were developed and standardized by WHO Euro. The Questionnaire consists of interviewer, family and school forms which have two parts as mandatory and voluntary. In our country mandatory and voluntary parts of the questionnaires were used together. The questionnaires have been translated into "Turkish", made preliminary testing for adaptation, and the number of questions and options remained without changing for comparison with other country data sets. Questionnaires were prepared as optical encoding and prescribed directives for each form.

• Interviewer Registry Form: This form was used at schools to measure children's weight and height by the interviewer. Each child's form was different. The interviewers were health workers consisting of doctors, dieticians, nurses, and health technicians, all of which were trained in Ankara.

• School Information Form: This form was used to reveal the nutrition and physical activity capabilities of schools. These answers have been given by a school manager and/or school official.

• Family Registry Form: This form has been filled by families which were sent to families with students in an enclosed envelope. There was a consent form in the envelope.

RESULTS

Table 1 shows that obesity was approximately %10.5 percent for the 7 year old children. The number of interviewed children at age 7 was 9.825, out of these 5.086 were males (51.8 percent) and 4.739 were females (48.2 percent). Children who are living in households were approximately 6 percent lowest, 13 percent low, 21 percent lower middle, 23 percent upper middle, 25 percent high and 12 percent highest SES Index. Around 57 percent of the children walk or use a bicycle when they go to school. 35 percent of the children use motor-vehicles, mostly in the form of the school bus. Approximately 8 percent of the children use mixed transportation modes on different school days. Approximately one third of children were inactive. 40 percent of children playing 1-2 hours/day were doing medium level exercises suggested by WHO and 34 percent of children did more than 2 h/day physical activity. Obesity and overweight were highest among the fathers (approximately 19 percent to 49 percent) than the mothers (16 percent to 35 percent). Mothers' normal BMI was higher (49 percent) than fathers' normal BMI which was 32 percent. Table 1 also shows that diet frequency based on family reports and consumption of pizza was as 12 percent never eaten, 39 percent less than a week, 34 percent rare (1-3 times a week), 12 percent mostly and 4 % every day. Consumption of sugary drinks was 25 % never drunk, 28 % less than a week, 28 % rare (1-3 times a week), 11 % mostly and 7 % every day. Table 2 shows univariate and multivariate analysis results. Variables are sex, physical activity, transport to school and spending time on actively/vigorously playing, mother and father BMI, consumption of pizza and sugary drink, birth weight to control the variation in SES index.

Table 1: Percentage Distribution of Obesity Related Variables in Children (Türkiye, 2016)

	Number	Case percent	95 % CI	
			Lower limit	Upper limit
Children Obesity	9825	10.48	9.87	11.09
Socio-economic status (SES)index	9099			
Lowest	569	6.25	5.75	6.75
Low	1141	12.54	11.86	13.22
Lower middle	1888	20.75	19.92	21.58
Upper middle	2093	23.00	22.14	23.86
High	2294	25.21	24.32	26.10
Highest	1115	12.25	11.58	12.92
Sex	9825			
Male	5086	51.77	50.78	52.76
Female	4739	48.23	47.24	49.22
Physical activity status Transport to school	9650			
Walk/Bicycle	5516	57.16	56.17	58.15
Motor vehicle	3327	34.47	33.52	35.42
Both	807	8.36	7.81	8.91
Birth weight of children (gr)	9023	3196.49	3183.76	3209.21
Physical activity status: Spending Time on Actively/vigorously Playing	9179			
Not at all or less than 1 h/day	2424	26.41	25.51	27.31
1–2 h/day	3620	39.44	38.44	40.44
More than 2 h/day	3134	34.15	33.18	35.12
Weight status of mother	8826			
Normal	4318	48.92	47.88	49.96
Overweight	3123	35.38	34.38	36.38
Obese	1385	15.69	14.93	16.45
Weight status of father	8589			
Normal	2767	32.21	31.22	33.20
Overweight	4207	48.98	47.92	50.04
Obese	1615	18.80	17.97	19.63
Every day	1059	11.82	11.15	12.49
Eating habits: pizza, hamburger, pasty, fried potatoes, salami-sausage, sandwiches consumption	9135			
Never	1073	11.75	11.09	12.41
Less than a week	3558	38.95	-56.63	134.53
Rare (1-3 times a week)	3071	33.62	-58.98	126.22
Mostly (4-6 days a week)	1093	11.97	-51.65	75.59
Every day	339	3.71	-33.36	40.78
Eating habits: soft drink consumption	8775			
Never	2232	25.43	24.52	26.34
Less than a week	2495	28.43	27.49	29.37
Rare (1-3 times a week)	2486	28.33	27.39	29.27
Mostly (4-6 days a week)	944	10.76	10.11	11.41
Every day	618	7.05	6.51	7.59

Obesity increases as socio economic status (SES) index increases. Obesity was found to be the lowest (5 percent) in the lowest SES index group vs the highest (15 percent) in the highest SES group. When the SES index was low, lower middle, upper middle and high group, obesity was found 8 percent, 9 percent, 11 percent, and 12 percent, respectively. Obesity is higher among male students (12 percent vs 9 percent) and using motor vehicles for transportation to school. Obesity increases when birth weight increases. If children go to school by walking or using a bicycle, obesity was found to be 9 percent. Obesity was found to be the lowest (8 percent) among the children with low birth weight (under 2499 g). The highest obesity ratio was found (16 percent) among the macrosomic babies (over 4000 g). It has been seen that when the BMIs of the mother and the father increase, the obesity of the children also increases. When mother's BMI is thin/normal, overweight, obese; childhood obesity was found to be 7 percent, 12 percent, and 18 percent respectively. When father's BMI is thin/normal, overweight, obese; childhood obesity was found to be 6 percent, 10 percent, and 19 percent respectively. There is a statistically significant relationship between BMIs of the mother and the father, and obesity. Children spending time on actively/vigorously playing status in a week was also influential. In this analysis if children whose spending time on actively/vigorously playing was not at all or less than 1 h/day, obesity was found to be approximately 14 percent. When children spent 1–2 h/day, obesity was found to be 11 percent. But if children spending time on actively/vigorously playing was more than 2 h/day, obesity was found to be 8 percent. When sugary drink's consumption was never, seldom, and frequently childhood obesity was found 10.4 percent,10.7 percent and 10.9 percent respectively. There is no statistically significant relationship between sugary drink consumption and obesity. When pizza, hamburger, pasty, fried potatoes, salami-sausage, sandwiches consumption was evaluated, childhood obesity was found 7 percent, 11 percent, 11 percent respectively when pizza consumption is never, 1-6 days and everyday per week. It means obesity increases as pizza consumption increases and there is a statistically significant relationship with pizza consumption and childhood obesity ($p < 0.000$).

Table 2. Univariate and Multivariate Logistic Regression Assessing the Risk of Children Obesity

Variables	Non- obese (%)	Obese (%)	Odds Ratio (95%CI)	Odds Ratio (95%CI)
SES Index				
Lowest	95.4	4.6	1.000	1.000
Low	92.1	7.9	**1.793 (1.145-2.807)**	1.562(0.881-2.768)
Lower middle	90.6	9.4	**2.157 (1.413-3.291)**	1.572(0.917-2.696)
Upper middle	89.2	10.8	**2.524 (1.664-3.830)**	**1.976** (1.163-3.359)
High	88.1	11.9	**2.803 (1.854-4.238)**	**2.064 (1.217-3.502)**
Highest	85.4	14.	**3.581 (2.336-5.488)**	**2.773(1.604-4.794)**
Sex				
Male	88.4	11.6	**1.273 (1.118-1.450)**	**1.376 (1.169-1.620)**
Female	90.7	9.3	1.000	1.000
Transport to school				
Walk/Bicycle	91.0	9.0	1.000	1.000
Motor vehicle	87.2	12.8	**1.486 (1.295-1.705)**	**1.307 (1.094-1.562)**
All	87.6	12.4	**1.427 (1.135-1.795)**	**1.458 (1.108-1.918)**
BMI mother				
Normal	92.6	7.4	1.000	1.000
Overweight	88.0	12.0	**1.707 (1.460-1.997)**	**1.714(1.425-2.063)**
Obese	82.5	17.5	**2.648 (2.214-3.168)**	**2.606(2.090-3.249)**
BMI father				
Normal	93.7	6.3	1.000	1.000
Overweight	89.9	10.1	**1.670 (1.391-2.005)**	**1.515(**1.223-1.877)
Obese	80.8	19.2	**3.508 (2.881-4.271)**	**3.042(**2.420-3.825)
Pizza, hamburger, pasty, fried potatoes, salami-sausage, sandwiches				
Never	93.0	7.0	1.000	1.000
1-6 day	88.8	11.2	**1.690 (1.320-2.164)**	1.152 (0.858-1.549)
Everyday	89.3	10.7	**1.599 (1.198-2.134)**	1.276(0.900-1.809)
Birth Weight				
< 2500	92.2	7.8	1.000	1.000
2500 thru 3499	90.3	9.7	1.263 (0.977-1.634)	1.165 (0.854-1.590)
3500 thru 3999	86.9	13.1*	**1.780 (1.362-2.326)**	**1.508(1.091-2.084)**
>=4000	84.2	15.8*	**2.213 (1.627-3.010)**	**1.595 (1.094-2.325)**

Sugary drinks				
Never	89.6	10.4	1.000	1.000
Seldom	89.3	10.7	1.031 (0.876-1.214)	0.904 (0.817-1.195)
Frequently	89.4	10.9	1.060 (0.860-1.307)	0.911(0.790-1.303)
Spending time on actively/ vigorously playing				
Not at all or less than 1 h/day	86.3	13.7	**1.832 (1.541-2.180)**	**1.950 (1.584-2.402)**
1–2 h/day	89.0	11.0	**1.430 (1.212-1.689)**	**1.423(1.165-1.739)**
More than 2 h/day	92.0	8.0	1.000	1.000

For Multivariate logistic regression Nagelkerke R^2=0.099 and model p value<0.001

Univariate model shows that if the SES level was low, lower middle, upper middle, high and highest, the risk of children obesity was found to be 1.8, 2.1, 2.5, 2.8, and 3.6 times higher, respectively. The risk of childhood obesity is 1.2 times higher among male children. Using only a motor vehicle to go to school, the risk of obesity increases 1.5 times but using all of the ways (walking/bicycle/motor vehicle) to go to school the risk increases 1.4 times. The nutritional status of parents seems to be related to the obesity of the children. If the mother is overweight, the risk of obesity increases by 1.7 times, but if the mother is obese, the risk of obesity increases 2.6 times. When a father is overweight, the childhood obesity risk increases 1.7 times, but if the father is obese, the risk increases 3.5 times. The risk of obesity increases 1.7 times when pizza, hamburger, pasty, fried potatoes, salami-sausage, or sandwiches consumption is 1-6 days, and 1.5 times when it is everyday. When children's birth weight is between 3500 g-3999 g, the risk of childhood obesity increases 1.8 times; but if children's birth weight is over 4000 g, the risk of children obesity increases 2.2 times. When children's time spent on actively/vigorously playing is not at all or less than 1 h/day in a week, the risk of obesity increases approximately 2 times; if children's spending time on actively/vigorously playing is 1–2 h/day in a week; the risk of obesity increases 1.4 times. Sugary drink consumption does not affect obesity.

According to the multivariate model when the SES level was upper middle, high and highest, the risk of children obesity was found to be approximately 2.0, 2.0, and 3 times higher, respectively. The risk of obesity is 1.3 times higher among male children. Using only a motor vehicle to go to school increases the risk of obesity by 1.3 times but using all of the ways (walking/bicycle/ motor vehicle) to go to school increases the risk of obesity by 1.4 times. The nutritional status of parents seems to be related to the obesity of the children. If the mother is overweight, the risk of obesity increases by 1.7 times, but if

the mother is obese, the risk of obesity increases by 2.6 times. When a father is overweight, the risk of obesity increases by 1.5 times, but if the father is obese, the risk of obesity increases by 3.0 times. When children's birth weight is between 2500-3499 g, the risk of childhood obesity increases by 1.1 times; for the children with birthweight 3500 g-3999 g, the risk of children obesity increases by 1.5 times, but if children's birth weight is over 4000 g, the risk of children obesity increases by 1.6 times. When children's time spent on actively/vigorously playing is not at all or less than 1 h/day in a week, the risk of obesity increases by approximately 2 times; if children's spending time on actively/vigorously playing is 1–2 h/day in a week; the risk of obesity increases by 1.4 times. Consumption of pizza, hamburger, pasty, fried potatoes, salami-sausage, or sandwiches and sugary drinks does not affect obesity.

DISCUSSION

In the USA, the average weight of a child has risen by more than 5 kg within three decades, to a point where one third of the country's children are overweight or obese. Some low-income and middle-income countries have reported similar or more rapid rises in children obesity with undernutrition (Lobstein et al., 2015). In Europe, the prevalence of childhood obesity is the highest in Spain and Greece (over 40 percent) followed by Portugal and Malta (over 30 percent). The prevalence of childhood obesity is around 25 percent in Türkiye (WHO Euro, 2018). Obesity is one of the public health concerns in Türkiye as in the world. Obesity is 31.5 percent of the population over 15 years old in Türkiye as shown in TBSA 2017 (R. T. MoH, 2019). The prevalence of obesity was reduced from 11 percent to 8 percent in the last five years among under five year old children as shown in TDHS 2018 Report (TDSB, 2019). The prevalence of 7-8 year old obesity is increasing steadily over the years between 2013 and 2016 from 23 percent to 25 percent in Türkiye as shown in COSI Reports (R. T. MoH, 2014 & 2017).

Some studies showed that obesity and SES associations vary from country to country. But remarkably obesity was higher for people living at the lower SES in industrialized countries e.g., the USA, UK. Wang (2001) showed that obesity is more common for people with high socioeconomic status in Russia and China while it is more common for people with low socio-economic status in the USA. It means obesity varies among countries according to socioeconomic status (Wang, 2001). Ogden et al. (2010) indicated that childhood and adolescent obesity are higher among people with low-income. They also showed that obesity is lower in households with members who are having higher education. A similar study has been done in England. Stamatakis et al. (2010) developed a composite score according to the income and social status which is "Socio- Economic Position (SEP) score". They

found that in England obesity in school children remained stable in 10 years (1997-2007) while this stability was not observed in low-income children.

SES-health relationships are present for the majority of illnesses and conditions, including obesity. SES, thus, is a go into as a "fundamental cause" of disease because it is associated with material and psychosocial resources– money, education, power, and social networks– that either constrain or enable a person to adopt healthy lifestyles (Link & Phelan, 1995; Pfingst, 2010).

Although SES is inversely associated with obesity in some studies, the evidence is complicated. The earliest relationship between obesity and SES in developed countries was evaluated by Sobal and Stunkard (1989). They found that in the developed countries there was a strong inverse relationship between socio-economic status (SES) and obesity among women, although there wasn't a consistent relation among men and children. But in developing countries, they found that there was a strong straight relationship between obesity and SES among men, women, and children (Sobal & Stunkard, 1989). After Sobal and Stunkard (1989) who found 36 percent inverse associations, 38 percent no associations, and 26 percent positive associations among children, the most recent review showed that the relationship between obesity and socio-economic status (SES) has become predominantly inverse, positive relations have just disappeared, and also parental education is the most consistent predictor (Shrewsbury & Wardle, 2008; Pfingst, 2010.) Pampel et al. (2012) found that the associations with SES and obesity shifted from positive to negative. The developments in the SES lead to improvement in health, on the other hand it can also cause rising obesity and SES inequalities (Pampel et al., 2012). Buoncristiano et al. (2021) results showed in COSI 2016 Europe Countries that an inverse relationship between prevalence of childhood overweight and obesity and parental education in high income countries, while the opposite relationship emerged in most of the upper-middle, low-middle- or low-income countries. The same was true for family perceived wealth, while parental employment status did not appear to influence prevalence (Buoncristiano et al., 2021). Khashayar et al. (2018) found in multivariate analysis that being a boy increases risk of obesity 1.58 times; having positive family history increases risk of obesity 2.04 times. Also, low birthweight increases risk of obesity 1.33 times, high birth weight increases risk of obesity 1.8 times compared to the normal birth weight. Compared to low socio-economic status (SES), moderate SES increases obesity risk 1.44 times and high SES increases 1.89 times (Khashayar et al., 2018). Wagner et al. (2018) found that the SES in childhood affects BMI, waist circumference and obesity in adults, high adiposity indicators were seen in men with high SES and but in women with low SES. Childhood obesity increased with maternal employment (OR = 1.26, $p = 0.0006$) in Kuwait Arab children and

adolescents (Elkum et al., 2019).

Our univariate and multivariate findings suggest that SES index is one of the important indicators and the main driver of childhood obesity. Univariate and multivariate analysis results are similar except pizza consumption. Because of that fact, this section discusses the results of multivariate analysis. When all variables have been included in the model, the effect of the SES index remains persistent and strong. SES index includes parent's education, parent's working status and welfare status of the household. These findings suggest that SES index, in other words parent's education, parent's working status and welfare status of the household affects childhood obesity. Obesity was found the least (O.R. 1.56, CI 0.88-2.76) in the low SES index group vs in the highest (O.R. 2.77, C.I. 1.60- 4.79) SES group. Higher obesity rate among the children with a working mother suggests that third party care systems like nannies or crèches/kindergartens may have an effect on the dietary habits of the children. Obesity is higher among male children (OR 1.37, CI 1.16-1.62) than female children. For adolescent to be male and higher parental BMIs have been found just as risk factors. (Furthner et al., 2017). In a multivariate analysis, being boy increases risk of obesity 1.58 times (Khashayar et al., 2018).

In our study there is a significant relationship between SES and obesity if school commuting is done by motor vehicle. Using motor vehicles to go to school increases obesity (OR. 1.30 CI 1.09-1.56). When comparing results in Türkiye children actively playing situation was similar to COSI Europe, children walking or cycling when they go to the school situation was better (Whiting et al., 2020). When a mother is overweight or obese, children's obesity increases (OR. 1.71 CI 1.42-2.06 and OR.2.60 CI 2.09-3.24). The same pattern was observed for father's BMI. (OR 1.51 CI 1.22-1.87; OR 3.04 CI 2.42-3.82). Parents who become overweight or obese are more likely to have poor nutritional diets and are less likely to get adequate physical activity. Their habits may affect their children's diet and physical activity. Further et al. showed that if parents have low education, high BMI children overweight- obesity increases among 10-year-old children (Furthner et al., 2017).

School children in Mexico were shown to be more likely to consume processed foods with higher socio-economic levels (García-Chávezet et al., 2018). Pearce et al. (2017) searched that childhood obesity and its relationship with fast-food consumption. Study results supported the previous research and indicated that fast foods were more prevalent in deprived areas and fast-food related behaviors help increase weight in the childhood period (Pearce et al., 2017).

In our study, the risk of childhood obesity increases when the birthweight is 3500g-3999 and over 4000g (OR. 1.50 CI 1.09-2.08 and O R.1.59, CI 1.09-2.32). In literature gestational weight gain affected directly on birthweight and associated with 88% greater odds of large-for-gestational age birth weight [95% confidence interval (CI): 1.80, 1.97] and 30% greater odds of obesity at 3 years old (95% CI: 1.24, 1.37) (Badon et al., 2020). Matthews at al. (2017) also indicated that risks of obesity are increased with birthweight. In Kuwaiti Arab children and adolescents the likelihood of childhood obesity increased with birth weights >4.0 Kg [odds ratio (OR) = 2.3; $p < 0.0001$] (Elkum et al., 2019). A meta- analysis study to assess the predictive ability of infant weight gain showed a consistent positive association with subsequent obesity. A risk score combining birthweight and infant weight gain (or simply infant weight), together with mother's body mass index and sex may allow early stratification of infants at risk of childhood obesity (Druet et al., 2012).

Univariate results show that childhood obesity risk increases 1.7 times, when pizza is consumed 1-6 days a week and 1.5 times when consumed daily. Interestingly, there was no relation between childhood obesity and sugary drink consumption. It depends on their sales restriction at the school canteens and awareness on sugar negatively effects on health since 2016.

Every day soft drinks **c**onsumption was found in Northern European countries' lowest levels which were zero % in Ireland, 2 % in Lithuania, and 2 % in Denmark, 7.5 % in Türkiye. Daily soft drink consumption was observed high in the Central Asian countries such as Tajikistan (32.8 %) and Turkmenistan (25.8 %). There was not statistically significant difference observed between boys and girls (Williams, 2020).

In our study when children's time spent actively/vigorously playing is not at all or less than 1 h/day in a week risk of obesity increases approximately by 2 times (OR 1.95, CI 1.58-2.40). About this issue WHO has suggested to make PA every day at least 1 hour per day for children. Physical activity (PA) has an important place in preventing children obesity (including being overweight). Also PA is effective for reducing adult obesity (Hills et al., 2011). Suter and Ruckstuhl (2006) examined the environmental, social, and cultural factors for children obesity which are caused by their sedentary lifestyle in Switzerland. They found that some social and cultural features are effective through the parent role model. For example, low physical activity which develops as a result of a sedentary parental role model such as watching TV, can continue in adulthood in children (Ruckstuhl, 2006). Parents as role models can cause unhealthy eating habits on children. In Poland, a study found that among boys there was a significant relationship between obesity and less physical activity. Also the possibility of obesity or overweight increases among inactive teenagers (Suter & Ruckstuhl, 2006). Vincente-Rodriguez et al. (2016) developed a list

of recommendations for physical activities and sports to help prevent and manage obesity for children and adolescents. Wang et al. (2015) stated that in children school-based interventions are effective in obesity prevention efforts. A life-cycle approach has been suggested where preventive interventions go back as far as affecting maternal, fetal, and early childhood nutrition and lifestyle (Wang et al., 2015). Family, school, and community involvement is important for long term results, so is the involvement of government policies that help to create an environment and opportunities for healthy diet and physical activity. Management of childhood obesity is difficult. A structured weight reduction program should be established individualized for every child, along with adoption of a healthy diet and lifestyle. Anti-obesity drugs have a limited role in childhood obesity and are not recommended. Bariatric surgery is reserved for morbidly obese older adolescents, but its long-term safety data is limited (Dabas & Seth, 2018).

CONCLUSION

In this study, 1 out of 10 7-year-old children is obese. In developed countries, childhood obesity is more common in households with low SES low income, lower education, while in developing countries it is more common in households with high SES (Wang, 2001; Ogden et al., 2010; Stamatakis et al., 2010). Our models reinforce the importance of SES and its components (education of mother and father, occupation of mother and father and welfare of family) for child obesity. In the group with high SES, the target group should be more educated families by increasing their parental awareness. It seems important to regulate their daily life in a way that increases healthy nutrition and physical activity. Educational messages that consider SES differences in childhood obesity prevention efforts can be enhanced by public support at school and outside. There is a need for further studies to understand the existing uncertainties about the effect of SES on childhood obesity. For this, population and health strategies should be considered at macro and micro (obesity) level.

Sex is a predictor of obesity. Mother and fathers'BMI play an especially important role. Birthweight is important and should be followed by weight gain during pregnancy. Salsberry and Reagan (2005) indicated that efforts for preventing overweight should begin in early childhood even before conception. Whitaker's (2004) findings showed that interventions against child obesity should start at birth, especially if the mother is obese. Clinical implications suggest that children at risk of obesity should be screened early as part of primary prevention and interventions efforts. Physical inactivity has been found to be a risk for childhood obesity.

Tackling obesity (including childhood obesity) is one of the key roles in reducing noncommunicable diseases (NCDs). Policy makers should be aware of socio-economic situations (SES) and obesity relations. Another point of attention on childhood obesity is affected by cultural differences. (Sobal, 1991; Caprio et al., 2008). Additional studies are needed to demonstrate the cause-consequences relationship between culture and childhood obesity.

Public health efforts have been included and strengthened to protect children from increasingly sophisticated marketing of sedentary lives and energy-dense, nutrient-poor food and beverages. The governance of food supply and food markets should be improved, and commercial activities should be subordinated to protect and promote children's health. According to the WHO interventions should include reducing the marketing pressure on children, high tax for foods which contain high fats, sugar and salt and providing better access to cheap and healthy food (WHO, 2017; WHO, 2010). The strategies should consider the effects of many socio-economic, demographic, and environmental items including to build an environment and urban planning (designed according to the walkability and suitable bicycle roads) with public health and health promotion perspective on childhood obesity including overweight. It would be the most effective way to prevent and manage this multifactorial health concern.

REFERENCES

Badon, S. E., Quesenberry, C. P., Xu, F., Avalos, L. A. & Hedderson, M. M. (2020). Gestational Weight Gain, Birthweight and Early-Childhood Obesity: Between- and Within-Family Comparisons. *Int J Epidemiol*, 1,49(5), 1682-1690. doi: 10.1093/ije/dyaa110

Buoncristiano, M. et al. (2021). Socio-Economic Inequalities in Overweight and Obesity Among 6-9-year-old Children in 24 Countries from WHO European Region. *Obes Rev.* 22(6), 13213. doi: 10.1111/obr.13213. Epub 2021 Jun 28.

Caprio, S., Daniels, S. R., Drewnowski, A., Kaufman, F. R., Palinkas, L. A., Rosenbloom, A. L. & Schwimmer, J. B. (2008). Influence of Race, Ethnicity, and Culture on Childhood Obesity: Implications for Prevention and Treatment. *Obesity (Silver Spring),* 16(12), 2566-77. doi: 10.1038/oby.2008.398.

Dabas, A. & Seth, A. (2018). Prevention and Management of Childhood Obesity. *Indian J Pediatr,* 85(7), 546-553. doi: 10.1007/s12098-018-2636-x.

Djordjic, V., Radisavljevic, S., Milanovic, I., Bozic, P., Grbic, M., Jorga, J. & Ostojic, S. M. (2016). WHO European Childhood Obesity Surveillance Initiative in Serbia: A Prevalence of Overweight and Obesity Among 6-9-year-old School Children**.** *J Pediatr Endocrinol Metab,* 1;29(9), 1025-30. doi: 10.1515/jpem-2016-0138.

Druet, C., Stettler, N., Sharp, S., Simmons, R. K., Cooper, C., Smith, G. D., Ekelund, U., Lévy-Marchal, C., Jarvelin, M. R., Kuh, D. & Ong, K. K. (2012). Prediction of

Childhood Obesity by Infancy Weight gain: An Individual-Level Meta-Analysis. *Paediatr Perinat Epidemiol,* 26(1), 19-26. doi: 10.1111/j.1365-3016.2011.01213.x.

Elkum, N, Alarouj, M., Bennakhi, A. & Shaltout, A. (2019). The Complex

Etiology of Childhood obesity in Arabs is Highlighted by a Combination of Biological and Socio-Economic Factors. *Front Public Health,* 2(7), 72. doi: 10.3389/fpubh.2019.00072.

Furthner, D., Ehrenmüller, M., Biebl, A., Lanzersdorfer, R., Halmerbauer, G., Auer-Hackenberg, L. & Schmitt, K. (2017). Gender Differences and the Role of Parental Education, School Types and Migration on the Body Mass Index of 2930 Austrian School Children: A Cross-Sectional Study. *Wiener klinische Wochenschrift* , 129, 786–792. https://doi: 10.1007/s00508-017-1247-2.

García-Chávez, C. G., Rodríguez-Ramírez, S., Rivera, J. A., Monterrubio-Flores, E. & Tucker, KL. (2018). Sociodemographic Factors are Associated with Dietary Patterns in Mexican Schoolchildren. *Public Health Nutr,* 21(4), 702-710. https://doi: 10.1017/S1368980017003299

Glinkowska, B. & Glinkowski, W. M. (2018). Association of Sports and Physical Activity with Obesity Among Teenagers in Poland. *Int J Occup Med Environ Health,* 31(6), 771-782. https://doi:10.13075/ijomeh.1896.01170

Hills, A. P., Andersen, L. B. & Byrne, N. M. (2011), Physical Activity and Obesity in Children. *Br J Sports Med*, 45(11), 866-70. doi: 10.1136/bjsports-2011-090199.

Kelsey, M. M., Zaepfel, A., Bjornstad, P. & Nadeau, K. (2014). Age-Related Consequences of Childhood Obesity. *Gerontology*, 60(3), 222-8. https://doi: 10.1159/000356023

Khashayar, P., Kasaeian, A., Heshmat, R., Motlagh, ME., Mahdavi Gorabi, A., Noroozi, M., Qorbani, M. & Kelishadi, R. (2018). Childhood Overweight and Obesity and Associated Factors in Iranian Children and Adolescents: A Multilevel Analysis; the CASPIAN-IV Study. *Front Pediatr*, 21(6), 393. https://doi: 10.3389/fped.2018.00393

Lindquist, H. J., Anderton, L. D. 6 Yaukey, D. (2015*). Demography The Study of Human Population* (4th Ed.). Waveland Press, Inc.

Link, B. G. & Phelan, J. (1995). Social Conditions As Fundemental Causes of Diseases. *Journal of Health and Social Behavior (Extra Issue: Forty Years of Medical Sociology: The State of the Art and Directions for the Future),* 15, 80-94.

Lobstein T., Jackson-Leach, R., Moodie, M. L., Hall, K. D., Gortmaker, S. L., Swinburn, B. A., James, W. P. T., Wang, Y. & McPherson, K. (2015).Child and Adolescent Obesity: Part of a Bigger Picture. *Lancet*. 20;385(9986): 2510-20. doi: 10.1016/S0140-6736(14)61746-3.

Matthews, E. K., Wei, J. & Cunningham, S. A. (2017). Relationship Between Prenatal Growth, Postnatal Growth and Childhood Obesity: A Review. *Eur J Clin Nutr,* 71(8), 919-930. doi: 10.1038/ejcn.2016.258.

Ogden C. L., Lamb, M. M., Carroll, M. D. & Flegal, K. M. (2010). Obesity and Socioeconomic Status in Children and Adolescents: United States, 2005-2008. *NCHS Data Brief.* 51, 1-8.

Pampel, F. C., Denney, J. T. & Krueger, P. M. (2012). Obesity, SES, and Economic

Development: A Test of the Reversal Hypothesis. *Social Science & Medicine*, 74(7), 1073–1081. https://doi.org/10.1016/j.socscimed.2011.12.028

Pearce, M., Bray, I. & Horswell, M. (2017). Weight Gain in Mid-Childhood and Its Relationship with the Fast Food Environment. *J Public Health (Oxf),* 10, 1-8. https:// doi: 10.1093/pubmed/fdx108

Pfingst, L. (2010). *Weighing in on Inequality: Obesity among Low and High SES Children.* (UMI Number: 3431655) Doctoral Dissertation, University of Washington, Washington.

Republic of Turkey Ministry of Health (R. T. MoH). (2014). *Turkey Childhood (Ages 7-8) Obesity Surveillance Initiative (COSI-TUR) 2013.* Sistem Ofset Bas. Yay. San ve Tic. Ltd. Şti.: Ankara.

Republic of Turkey Ministry of Health (R. T. MoH). (2017). *Turkey Childhood (Ages 7-8) Obesity Surveillance Initiative (COSI-TUR) 2016.* Efe Matbaacılık: Ankara.

Republic of Turkey Ministry of Health (R. T. MoH). (2019).*Türkiye Beslenme ve Sağlık Araştırması (TBSA 2017).* Tiraj Basım ve Yayın Sanayi Ticaret Ltd. Şti.: Ankara.

Republic of Turkey Ministry of Health (R. T. MoH), Public Health General Directorate (2019). Healty Nutrition and Active Life Programme, Adult and Children Obesity Prevention and Physical Activity Action Plan 2019-2023. *Ministry of Health.* ISBN:978-975-590-777-2

Salsberry P. J. & Reagan P. B. (2005). Dynamics of Early Childhood Overweight. *Pediatrics,* 116(6):1329-38. doi: 10.1542/peds.2004-2583

Shrewsbury, V. & Wardle, J. (2008). Socioeconomic Status and Adiposity in Childhood: A Systematic Review of Cross-Sectional Studies 1990-2005. *Obesity (Silver Spring),* 16(2), 275-84. doi: 10.1038/oby.2007.35**.**

Sobal, J. & Stunkard, A. J. (1989). Socioeconomic Status and Obesity: A Review of the Literature. *Psychological Bulletin*, 105(2), 260–275. https://doi.org/10.1037/0033-2909.105.2.260

Sobal, J. (1991). Obesity and Socioeconomic Status: A Framework for Examining the Relationship between Physical and Social Variables. *Medical Anthropology,* 13, 231-247.

Stamatakis, E., Wardla, J. & Cole, T. J. (2010). Childhood Obesity and Overweight Prevalence Trends in England: Evidence for Growing Socioeconomic Disparities. *International Journal of Obesity*, 34, 41–47.

Suter, P. M. & Ruckstuhl N. (2006). Obesity During Growth in Switzerland: Role of Early Socio-Cultural Factors Favouring Sedentary Activities. *Int J Obes (Lond)*, 4(4), 10. https://doi: 10.1038/sj.ijo.0803513

T.R. Presidency of Turkey Directorate of Strategy and Budget (TDSB) and TÜBİTAK, Hacettepe University Institute of Population Studies. (2019). *Turkey Demographic and Health Survey 2018.* Elma Teknik Basım Matbaacılık Ltd. Şti.: Ankara.

Umer, A., Kelley, G. A., Cottrell, L. E., Giacobbi, P. Jr., Innes, K. E. & Lilly, C. L. (2017). Childhood Obesity and Adult Cardiovascular Disease Risk Factors: A Systematic Review with Meta-Analysis. *BMC Public Health*. 29;17(1): 683. https://doi: 0.1186/s12889-017-4691-z

UN General Assembly (2011). *High Level Meeting on Prevention and Control NCD's.*

Vicente-Rodriguez, G., Benito, P. J., Casajús, J. A., Ignacio A., Aznar, S., Castillo, M. J. Dorado, C. & González-Agüero, A. (2016). Physical Activity, Exercise and Sport Practice to Fight Against Youth and Childhood Obesity. *Nutr Hosp*, 7;33(Suppl9), 1-21. https://doi: 10.20960/nh.828

Wagner, K., Jakovljevic, P., Bastos, DJL., Navarro, A., Alejandro Gonzalez-Chica, D. & Boing, A. F. (2018). Socioeconomic Status in Childhood and Obesity in Adults: A Population-Based Study. *Rev Saude Publica*, 52,15. https://doi: 10.11606/s1518-8787.2018052000123

Wang Y. (2001). Cross-National Comparison of Childhood Obesity: The Epidemic and the Relationship Between Obesity and Socioeconomic Status. *International Journal of Epidemiology*, 30 (5), 1129–1136. https://doi.org/10.1093/ije/30.5.1129

Wang, Y., Cai, L., Wu, Y., Wilson RF, Weston, C., Fawole, O. & Bleich, SN. (2015). What Childhood Obesity Prevention Programmes Work? A Systematic Review and Meta-Analysis. *Obes Rev*, 16(7), 547-65. https://doi: 10.1111/obr.12277.

Whitaker R. C. (2004). Predicting Preschooler Obesity at Birth: The Role of Maternal Obesity in Early Pregnancy. Pediatrics, 114(1), 29-36. doi: 10.1542/peds.114.1.e29

Whiting, S., Buoncristiano, M., Gelius, P., Abu-Omar, K., Pattison, M., Hyska, J. & Duleva, V. (2020). Physical Activity, Screen Time, and Sleep Duration of Children Aged 6–9 Years in 25 Countries: An Analysis within the WHO European Childhood Obesity Surveillance Initiative (COSI) 2015–2017. *Obesity Facts*, 14(1), 32-44. https://doi: 10.1159/000511263

Williams, J. (2020). A Snapshot of European Children's Eating Habits: Results from the Fourth Round of the WHO European Childhood Obesity Surveillance Initiative (COSI). *Nutrients,* 12(8), 2481. https://doi.org/10.3390/nu12082481

World Health Organization (WHO). (2010). *Set of Recommendations on the Marketing of Foods and Non-Alcoholic Beverages to Children.* WHO Press: Switzerland. (ISBN 978 92 4 150021NLM classification:WS 130).

World Health Organization (WHO). (2013). *The Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013–2020*. WHO Document Production Services: Switzerland (ISBN 978 92 4 150623 6). https://www.who.int/publications/i/item/978924150623611 .

World Health Organization (WHO). (2013). *World Health Assembly / A66.* https://apps.who.int/gb/ebwha/pdf_files/WHA66-REC1/A66_REC1-en.pdf#page=25

World Health Organization (WHO) Regional Office for Europe. (2015). *European Food and Nutrition Action Plan 2015–2020.* World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/329405

World Health Organization (WHO). (2017). *Report of the Commission on Ending Childhood Obesity. Implementation Plan: Executive Summary.* WHO Press: Geneva. NMH/PND/ECHO/17.1 License: CC BY-NC-SA 3.0 IGO

World Health Organization (WHO) Euro. (2018). *European Childhood Obesity Surveillance.* WHO Press.