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Impact of the COVID-19 Pandemic on Childhood Obesity Prevalence

COVID-19 Pandemi Sürecinde Çocukluk Çağı Obezite Prevalansının Etkisi

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Abstract

Objective: The global obesity pandemic among children was defined at the beginning of the millennium. It has been shown that childhood obesity has increased with the deterioration of behavioral and environmental factors during the Coronavirus disease-2019 pandemic in various studies. This study aimed to evaluate childhood obesity rates and their underlying causes in İstanbul.

Method: Children born in İstanbul in 2015 and who continue to reside in İstanbul with Turkish Nationality were our target population. The study population comprised 241,121 children, and the sample was calculated as 191 children using the online sample size program. A stratified cluster sampling approach was used to select participants from every district in İstanbul. Parents were contacted by telephone, and those who agreed to participate in the study were invited to the family health centers where they were registered. The frequency analysis, chi-square test, t-test, and correlation analysis were conducted. The statistical significance level was set as $p<0.05$.

Results: Of the children, 36.6% (n=70) were obese and overweight (obesity prevalence was 23.3%); and among those 60% (n=42) were female. Father's low educational level (p=0.016), eating 3 main meals more often (p=0.004), and regular consumption of packaged food regularly (p=0.034) were significantly associated with being overweight or obese. There was a significant increase in the body mass index of children in 2021 compared with 2019 (t=47,24; p<0.001).

Conclusion: During the pandemic, childhood obesity was increased among six-year-old children in İstanbul. Considering that the probability of the occurrence of pandemics and disasters will increase in the coming years, public health interventions such as applications to increase children's physical activity should be planned and prepared.

Keywords: Childhood obesity, COVID-19, overweight

Öz

Amaç: Bu milenyumun başında çocuklar arasında obezite salgını küresel bir boyut aldı. Koronavirüs hastalığı-2019 pandemi sürecinde yapılan çalışmalarda, davranışsal ve çevresel faktörlerin bozulmasıyla birlikte çocukluk çağı obezitesinin arttığı gösterilmiştir. Bu çalışmada amacımız, İstanbul'da çocukluk çağı obezite oranlarını ve altında yatan nedenleri değerlendirmektir.

Yöntem: 2015 yılında İstanbul'da doğan ve İstanbul'da ikamet etmeye devam eden Türkiye Cumhuriyeti vatandaşı çocuklar hedef kitlemizdi. Çalışmanın evreni 241.121 çocuk oluşturmakta olup örneklem çevrimiçi örneklem hesabı programı kullanılarak 191 çocuk olarak hesaplanmıştır. Katılımcıların seçiminde İstanbul'un her ilçesinden tabakalı küme örnekleme yaklaşımı kullanılmıştır. Ebeveynlere telefonla ulaşılmış ve çalışmaya katılmayı kabul edenler kayıtlı oldukları aile sağlığı merkezlerine davet edilmiştir. Frekans analizi, ki-kare, t-testi ve korelasyon analizi yapıldı. İstatistiksel anlamlılık düzeyi $p<0,05$ olarak kabul edildi.

Bulgular: Çocukların %36,6'sı (n=70) obez ve fazla kiloluydu (obezite prevelansı %23,3); ve bunların %60'ı (n=42) kızdı. Babanın eğitim düzeyinin düşük olması (p=0,016), 3 ana öğünü beslenmesi (p=0,004) ve düzenli olarak paketli gıda tüketmesi (p=0,034) fazla kilolu veya obez çocuk olma ile anlamlı düzeyde ilişkiliydi. 2021 yılında çocukların vücut kitle indeksinde 2019 yılına göre anlamlı bir artış oldu (t=47,24; p<0,001).

Sonuç: Pandemi döneminde İstanbul'da 6 yaşındaki çocuklarda çocukluk çağı obezitesinde artış gözlendi. Önümüzdeki yıllarda pandemi ve afetlerin ortaya çıkma ihtimalinin yüksek olduğu göz önünde bulundurularak çocukların fiziksel aktivitelerini artırmaya yönelik uygulamalar gibi halk sağlığı müdahaleleri planlanmalı ve hazırlanmalıdır.

Anahtar kelimeler: COVID-19, çocukluk çağı obezitesi, fazla kiloluluk

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Introduction

A global pandemic of obesity among children was defined, with a significant increase in obesity prevalence at the beginning of the millennium. In parallel, an increase in obesity-associated early clinical onset-chronic diseases was determined (1). Childhood obesity, which was initially described as a problem in high-income countries, has now become a global public health problem that affects the whole world. In 2016, 124 million children and adolescents were classified as obese, representing a 10-fold increase compared with the 1970s (2,3). In the Turkey Nutrition and Health Survey, which was conducted in 2010, obesity and overweight rates were 26.4% in the 0-5 age group and 22.5% in the 6-18 age group (4).

Childhood obesity can have major effects on physical health, social and emotional well-being, and self-esteem in children. Previous studies have shown that obese children have a higher possibility of developing fatty liver disease, sleep apnea, type 2 diabetes, asthma, cardiovascular disease, hypercholesterolemia, cholelithiasis, glucose intolerance and insulin resistance, skin conditions, menstrual abnormalities, impaired balance, and orthopedic problems. Overweight and obese children can be bullied, discriminated against, or socially marginalized. These negative social interactions may result in low self-esteem and self-confidence. Poor academic performance and poor quality of life are the other consequences of childhood obesity (5). Furthermore, obese children are more likely to work in lower-paid and poorly-employed jobs in adulthood (3).

Obesity develops in combination with one or more genetic, behavioral (emotional state), and environmental factors. It has been observed that childhood obesity has increased with the deterioration of behavioral and environmental factors during the Coronavirus disease-2019 (COVID-19) pandemic (6,7). During the COVID-19 pandemic, lockdowns and movement restrictions increased the consumption of non-perishable and processed foods, decreased physical activity, and difficulties in accessing fresh foods and health care services were some of those factors. Quarantine, home confinement, and social distancing caused an increase in psychological stress and stress-related eating. In-person contact with classmates/teachers and access to physical activity decreased due to school closures. Increasing screen time and disrupted sleep patterns also negatively affected eating habits (8). In this population-based study, we aimed to evaluate childhood obesity rates and their underlying causes; also reveal the change in the obesity prevalence during the COVID-19 outbreak in İstanbul.

Materials and Methods

The study was planned in two stages, retrospectively and prospectively, to include children who were born and still residing in İstanbul with Turkish nationality. Although there are many studies on school-age childhood and adolescence in the literature, obesity studies on play-age children are less common. In our study, measurements at the ages of 4, 5, and 6 years, including during childhood, were used.

Study Population

According to Turkish Institute of Statistics data, 241,121 children were born in İstanbul born in 2015 with Turkish nationality is 241,121. The target population of this study is composed of children who were born in İstanbul in 2015 and who continue to reside in İstanbul. The sample was formed by weighting the data according to district populations to create the target population representation. The sample included 191 children using the online sample size program. A stratified cluster sampling approach was used in the selection of participants from every district of İstanbul (a total of 39 districts in İstanbul, the district of Adalar was not included in the study due to its low population). All children whose parents provided written permission to participate in the study were included. Instead of the people who did not consent participating in the study, the previous respondents on the list were called.

Data Gathering Tool and Process

Routine well-child examinationsare performed by family physicians nine times from the age of 0 to 1 year old starting at birth, twice a year at age 1-3, and once a year at age 3-5 in Turkey, and this information is recorded on a nation al health system (NHS) database. Birth information and the four- and five-year health data of the children were obtained from the NHS. Six-year-old readings were performed by the researchers of this study prospectively.

Parents were contacted by telephone, and those who agreed to participate in the study were invited to the family health centers where they were registered. Through a questionnaire, the socio-demographic information of the participants, such as birth information, nutrition, daily eating habits, periods of screen exposure, and the mother and father's height and weight, were recorded. Children's weight measurements were performed by researchers using the Tanita SC 240 model, and their heights were measured using measuring plates affixed to the wall.

Obesity was determined by calculating the body mass index (BMI). BMI indicates whether a child's weight is right for

their height, and the result is given as a percentile. The BMI calculation takes into account age, sex, height, and weight. Children with 95th percentile or higher are considered obese, and 85th to 95th percentile are considered overweight.

Statistical Analysis

The data were analyzed using SPSS Version 22.0. Frequency analysis was conducted; also, the relations between variables were evaluated using chi-square, t-test, and correlation analysis. The statistical significance level was set as $p<0.05$.

Ethics

This study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki (2000) and was approved by the Ethics Committee of the Kanuni Sultan Süleymen Training and Research Hospital, İstanbul, Turkey (2021.04.131).

Results

The study included 191 children. The characteristics of the children and their families are presented in Table 1.

Of the children who participated in the study, 8.9% (n=17) reported having chronic diseases, such as thalassemia, allergic asthma, vesicoureteral reflux, glucose-6-phosphate dehydrogenase deficiency, hearing loss, congenital adrenal hyperplasia, and congenital heart disease. Among the children, 56.5% (n=108) were born by cesarean section, and 43.5% were born naturally. Nutritional information at birth and after birth of the children included in the study are presented in Table 2.

It has been stated that 46.3% of children started consuming packaged foods after age 2, and 39.2% started after age 1. The average time children spend per day in front of the television is 1.83±1.45 hours and on tablets is 2.59±2.05 hours. The daily diet and activity habits of the children included in the study are presented in Table 3.

Table 1. The demographic of the children and their families

Variables		n	%
Gender	Female	106	55.5
	Male	85	44.5
Family income status	Income less than expense	115	60.2
	Income to expensein balance	76	39.8
Health insurance	Yes	182	95.3
	No	9	4.7
Maternal education level	Primary education	130	68.1
	High school	39	20.4
	University and above	22	11.5
Paternal education level	Primary education	109	57.1
	High school	46	24.1
	University and above	36	18.8
Maternal work status	Working	25	13.1
	Not working	161	86.9
Paternal work status	Working	184	96.3
	Not working	7	3.7
Total number of children in the family	One child	15	7.9
	2 children	88	46.1
	3 children	61	31.9
	4 and more	27	14.1
Long-term disease in the child	Yes	18	9.4
	No	173	90.6
COVID-19 infection status	Yes	1	0.5
	No	190	99.5

COVID-19: Coronavirus disease-2019

The average age of the mothers of the children who were participating in the study was 35.1±5.8 years and their average BMI was 27.55±4.8, while these were 38.41±5.7 and 27.26±3.6 for the fathers, respectively. There were no significant relationships between maternal and paternal BMI and children's BMI.

Of the children, 36.6% (n=70) were obese and overweight (obesity prevelance was 23.3%); and among those 60% (n=42) were female. There is no significant differences in BMI measurements between girls and boys. Some of the participants' BMI measurements are presented in Table 4.

The children's BMI mean was 15.74±1.81(10.85-23.27) in 2019, 15.81±2.2 (9.26-27.21) in 2020, and 16.70±3.2 in 2021 (11.75-29.17). Evaluation of children's growth measurements in 2021 is presented in Graphic 1.

In the measurements of the participants in 2021, the mean weight was 23.31±5.68 (min=12.5; max=41.7), weight SDS was 0.54 ±1.47, height mean. 117±5.67 (min=101; max=136), height SDS 048, and BMI mean. 16.7±3.2 (min=11.75; max=29.17).

Table 2. Nutritional information at birth and after birth

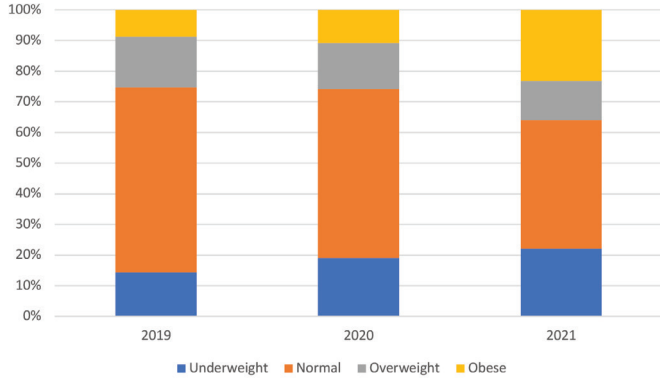
	Mean	SD
Birth week	38.54	2.88
Birth weight (grams)	3100.24	699.308
Exlusive breastfeeding (month)	4.09	2.51
Total breastfeeding duration (month)	17.17	10.97
Formula feeding duration (month)	12.89	7.13
Complementary feeding time (month)	6.0	0.6

SD: Standard deviation

The average height was 117.74 cm, the average weight was 23.24 kg, and the body fat ratio was 21%. The mean BMI in 2021 was significantly higher than that in 2019 (t=47.24; p<0.001). The BMI changes of children by years are presented in. In addition, Table 5 presents the chi-square analysis of the BMI measurements in 2019 and 2021.

Discussion

In the last measurements of the children participating in the study, their average height was 117.74 cm, their average weight was 23.24 kg, and their body fat percentage was 21%. Compared with 2019 measurements, our study showed that the overweight/obesity frequency statistically increased from 2019 to 2021. We also found that father's low educational level, eating 3 main meals, and more frequent



Graphic 1. Distribution of child participants based on BMI classificiation

Table 3. Daily diet routines and activity habits of the children

		n*	%
Daily eating three main meals	Yes	147	77.0
	No	44	23.0
Regular packaged food consumption	Everyday	90	50.3
	1-3 days a week	89	49.7
Regular pastry consumption	Everyday	86	47.5
	1-3 days a week	92	50.8
Regular use of vitamin supplements	Everyday	6	3.1
	Nothing	179	92.3
Time spent in the playground	Days a week	140	72.2
	Nothing	54	24.8
Daily television watching time	3 hours and more	50	25.8
	Nothing	20	10.3
Daily tablet/phone using time	3 hours and more	85	43.8
	Nothing	24	12.4

*: Those who gave full answers to the questions were included in the analysis

Table 4. Some characteristics of the participants regarding their BMI measurements

		Normal BMI* n=121 (%)	High BMI** n=70 (%)	p	χ^2
Gender	Female	64 (60.4)	42 (67.1)	0.341	0.91
	Male	57 (39.6)	28 (32.9)		
Income status	Income less than expense	72 (62.6)	43 (37.4)	0.390	1.88
	Income equal to the expense	49 (65.3)	26 (34.7)		
Father has a university degree or higher	Yes	29 (80.6)	7 (19.4)	0.016	5.78
	No	92 (59.4)	63 (40.6)		
Daily eating three main meals	Yes	85 (70.2)	62 (88.6)	0.004	8.30
	No	36 (29.8)	8 (11.4)		
Regular packaged food consumption	Yes	110 (90.9)	69 (98.6)	0.034	4.47
	No	11 (9.1)	1 (1.4)		

*: Normal BMI and low BMI children are grouped as normal BMI, **: Overweight and obese children are grouped as high BMI, BMI: Body mass index

Table 5. BMI changes between 2019 and 2021

	2021 normal BMI and low BMI in	High BMI in 2021	Total
2019 normal BMI and low BMI in	110 (91.7)	32 (45.1)	141 (74.2)
2019 normal BMI and low BMI in	10 (8.3)	39 (54.9)	49 (25.8)
Total	120 (100)	71 (100)	191 (100)

χ^2: 50.78 p<0.001, BMI: Body mass index

consumption of packaged food were predictors for being overweight or obese.

As a result of the measurements in our research, 23.3% of 6-year-old children were obese. This indicates that our country may already pass the estimation of the World Obesity Federation which declared the prediction of percentage children aged 5-9 with obesity will be 22.9% by 2030 (9). This disturbing situation clearly reveals the effects of the pandemic on childhood obesity.

Our study results are in the same line with previous reports. A study from Korea showed that during the first year of the pandemic, the BMI of preschool and school-aged children increased significantly. Obesity frequency was risen to 18.6% from 14.6% and overweight frequency to 12.8% from 9.3% (10). Another study reported similar results. Among 2000 Indian children, the post-lockdown frequency of obesity was 7.8% and overweight was 17.8%; respectively, they were 5.4% and 13.8% pre-lockdown (11). A study conducted in Turkey revealed the effect of the pandemic among primary school students and demonstrated an increase in the frequency of obese students from 3.4% to 13.8% (12).

Ecological factors, such as social distancing, fewer physical activity options, and obesogenic environments; and biological factors like chronic stress and decreased immune function, were suggested as causes of obesity and COVID-19 collisions (13). Factors like lack of in-person contact with classmates, friends, and teachers; feelings such as frustration and boredom; and a potential lack of personal space at home may worsen the childhood obesity epidemic. Adverse childhood events resulting from a major increase in domestic violence during the pandemic are likely to have a considerable impact on childhood obesity and eating disorders in the future (14). Therefore, the pandemic's huge effect on childhood obesity should not be overlooked, and appropriate interventions must be implemented before it causes further damage.

Previous studies have shown that low parent education was associated with higher BMI and odds of overweight and obesity in children (7-11,15-19). Our results were partly coherent with those reports because we only revealed a significant relationship between paternal education and childhood obesity. Through their behaviors, parenting methods, and roles in defining the shared family environment of diet and physical exercise, both parents' educational levels are linked to their children's weight status and lifestyle. Furthermore, increased parental education may enhance family income, enabling more educated parents to access material resources more easily and effectively (19). Hence, public health interventions targeting

parents with low education levels should be considered to prevent childhood obesity.

Depending on the mode of birth, the microbial composition of the infant's gut may affect the risk of obesity and metabolic disorders (20). Most previous studies reported that cesarean section may increase the risk of both overweight and obesity in children (21-23) although some suggested that there are no significant relationships (24,25). Similarly, our analysis did not reveal any differences between the delivery modes.

Previous studies have revealed a link between childhood obesity with metabolic comorbidities and parental obesity (26,27). In one study, the obesity rate of children whose parents were obese was reported to be 32.5% (20). It has been reported that environmental-gene interactions might play a major role in the consequences of parental obesity on offspring's body fat gain (28). However, we were not able to identify any relationship between maternal and paternal overweight/obesity and overweight/obesity in children.

Study Limitations

The main strength of our study is that we can generalize our results to all children in İstanbul because we selected the appropriate sample using scientific methods. Therefore, our results provide an accurate perspective on childhood obesity in children aged 6 years old. An important limitation of the study is that we measured the number of children only in 2021; we obtained data for 2019 and 2020 from the Ministry of Health database. Hence, there is a possibility of measurement bias.

Conclusion

We were able to show an increase in childhood obesity among six-year-old children in İstanbul during the pandemic. Considering that the probability of the occurrence of pandemics and disasters will increase in the coming years, public health interventions, such as applications to increase children's physical activity, should be planned and prepared to prevent the increase in childhood obesity during these periods.

Ethics

Ethics Committee Approval: This study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki (2000) and was approved by the Ethics Committee of the Kanuni Sultan Süleymen Training and Research Hospital, İstanbul, Turkey (2021.04.131).

Informed Consent: All participants provided informed consent.

Authorship Contributions

Concept: P.Ş.E., P.E.T., A.E.G., Design: P.Ş.E., P.E.T., A.E.G., Data Collection or Processing: P.Ş.E., Analysis or Interpretation: P.Ş.E., P.E.T., A.E.G., Drafting Manuscript: P.Ş.E., P.E.T., Critical Revision of Manuscript: P.Ş.E., P.E.T., A.E.G., Final Approval and Accountability: P.Ş.E., P.E.T., A.E.G., Writing: P.Ş.E., P.E.T., A.E.G.

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