



Factor for Changes in Eating Habits and Development of Obesity in Children in The Late Period?

Erhan Berk^{1,a}, Muhammed Selçuk Sinanoğlu^{1,b,*}, Nuriye Aslı Melekoğlu^{1,c}

¹Department of Pediatrics, Malatya Turgut Ozal University Faculty of Medicine, Malatya, Turkey

*Corresponding author

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ABSTRACT

Objective: This study aims to determine how the COVID-19 pandemic process and restrictions affect eating behaviors and habits in children in the late period and the late period effects of this process on childhood obesity.

Method: The study group was composed of students living and continuing their education in the province of Malatya. The survey was conducted in May 2021 on 4324 students who agreed to participate in the study and met the inclusion criteria. The way of measuring height and body weight was described, and new communication technology was used with the Google survey platform. Centers for Disease Control and Prevention Standards were used for the evaluation of height and body weight measurements.

Results: 1839 (42.5%) of the participants were male. The ages of the students ranged from 9-17, and their mean age was 13.38±2.06 years. The current mean body weight of the students was 51.56 ± 15.105 kg, and the mean bodyweight one year ago was calculated as 46.02 ± 13.728 kg. When the current body mass index percentiles of the students were evaluated according to the Centers for Disease Control and Prevention standards, 1.2% were found to be thin, 87.9% normal and 10.8% obese. When the percentiles of body mass index one year ago were evaluated, 2.5% were found to be thin, 89.6% normal and 7.9% obese. When the body weights of the previous year and current were compared, there was a significant difference between the thin patients (p<0.05) and the obese ones, as well (p<0.05). In the development of obesity during the pandemic process and the restriction period, it was determined that the changes in their regular eating habits, the conditions of their place and home, the time spent with technological devices, the daily physical activity time, mother's education and working status, the time they spent asleep and the fear they experienced were effective (p<0.05). It was observed that this effect of pandemic process and restrictions increasing the development of obesity was independent of personal data such as the child's blood group, breastfeeding and nutritional status in infancy, chronic disease, and birth type (p>0.05). We found that during the pandemic process and the restriction period, their regular meal habits were negatively affected, their appetite increased, convenience food and fast food consumption did not increase significantly, and fruit and vegetable consumption increased (p <0.05).

Conclusions: We determined that the COVID-19 pandemic and restrictions triggered the development of obesity in children in the late period. It can be said that the effect on the development of obesity is due to the restriction of physical activities of children, changes in eating habits, increased time spent inactive by using technological devices more, and psychological effects related to the stress experienced.

Keywords: COVID-19 pandemic, restriction, obesity, eating habits

Pandemi Süreci ve Kısıtlamalar Çocuklarda Yeme Alışkanlıklarında Değişim ve Obezite Gelişimi Üzerine Geç Dönemde Risk Faktörü Müdür?

Süreç

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ÖZ

Amaç: COVID-19 pandemi süreci ve kısıtlamaların geç döneminde çocuklarda yeme davranışları ve alışkanlıklarını nasıl etkilendiğini ve bu sürecin çocukluk çağında obezite gelişimi üzerine geç dönem etkilerini tespit etmek.

Yöntem: Çalışma grubu Malatya il sınırlarında yaşayan ve eğitimini sürdüren öğrencilerden oluşturuldu. Anket Mayıs 2021 tarihinde, çalışmaya katılmayı kabul eden ve çalışmaya dâhil edilme kriterlerini karşılayan 4324 öğrenci üzerinde gerçekleştirildi. Boy ve vücut ağırlığı ölçülme şekli tarif edilerek birlikte Google anket platformu ile yeni iletişim teknolojisi kullanıldı. Boy ve vücut ağırlığı ölçümlerinin değerlendirilmesinde Centers for Disease Control and Prevention standartları kullanıldı.

Bulgular: Katılımcıların 1839(%42,5)'i erkekti. Öğrencilerin yaşları 9-17 arasında değişmekte olup, yaş ortalamaları 13,38±2,06 yıl idi. Öğrencilerin günümüzdeki vücut ağırlığı ortalaması 51,56±15,105 kg, bir yıl önceki vücut ağırlığı ortalaması 46,02±13,728 kg olarak hesaplandı. Öğrencilerin şuan ki vücut kitle indeksi persantilleri Centers for Disease Control and Prevention standartlarına göre değerlendirildiğinde %1,2'si zayıf, %87,9'u normal ve %10,8'i obez olarak saptandı. Bir yıl önceki vücut kitle indeksi persantilleri değerlendirildiğinde %2,5'i zayıf, %89,6'sı normal ve %7,9'u obez olarak saptandı. Bir yıl öncesindeki ve günümüzdeki vücut ağırlıkları karşılaştırıldığında zayıf olanların arasında anlamlı bir fark vardı(p<0,05) ve yine obez olanlar arasındaki fark anlamlı idi(p<0,05). Pandemi süreci ve kısıtlama döneminde obezite gelişiminde düzenli yeme alışkanlıklarında olan değişimler, yaşadıkları yer ve evlerinin yapısı, teknolojik aletler ile geçirilen süre, günlük fiziksel aktivite süresi, anne eğitim ve çalışma durumu, uykuda geçirdikleri süre ve yaşadıkları korku durumunun etkili olduğu tespit edildi(p<0,05). Pandemi sürecinin ve kısıtlamaların obezite gelişimini artırıcı bu etkisinin çocuğun kan gurubu, bebeklik döneminde anne sütü alma ve beslenme durumu, kronik hastalığı, doğum şekli gibi kişisel verilerden bağımsız olduğu görüldü(p>0,05). Beslenme alışkanlıklarında pandemi süreci ve kısıtlama döneminde düzenli öğün alışkanlıklarının olumsuz etkilendiği, iştahlarının arttığı, hazır gıda ve fastfood tüketiminin anlamlı artmadığını, bunun yanında meyve ve sebze tüketiminin arttığını tespit ettik(p<0,05).

Sonuç: COVID-19 pandemisi ve kısıtlamaların çocuklarda geç dönemde obezite gelişimini artırıcı yönde tetiklediğini tespit ettik. Obezite gelişimi üzerine etkisi çocukların fiziksel olarak aktivitelerinin kısıtlanmasına, yeme alışkanlıkları ve düzenlerindeki değişime, teknolojik cihazları daha fazla kullanıp hareketsiz geçirilen zamanın artmasına ve yaşanan strese bağlı psikolojik etkilerinden kaynaklandığı söylenebilir.

Anahtar sözcükler: COVID-19 pandemisi, kısıtlama, obezite, yeme alışkanlığı

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^a erhan.berk@ozal.edu.tr
^c aslimelekoğlu@gmail.com

^b https://orcid.org/0000-0002-5558-6489
^d https://orcid.org/0000-0002-3491-2337

^b selcuk.sinanoglu@ozal.edu.tr

^d https://orcid.org/0000-0003-1596-4323

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Introduction

Recently, the increase in urbanization, increased use of convenience food, increased calorie intake, and reduced physical activity in a sedentary lifestyle increase the risk of obesity in children and cause changes in eating habits¹. Studies have shown that the prevalence of childhood obesity in our country varies between 6.5% and 15.4%^{2,3}. Genetic factors, sedentary lifestyle, and diet are among the main factors in the development of obesity. Apart from these well-known reasons, feeding styles of parents and eating behaviors of children also play an active role in the development of obesity in children^{4,5}. The Childhood Obesity Survey in Turkey is defined as COSI-TUR (Childhood Obesity Surveillance Initiative). According to COSI-TUR 2016 data, obesity rate in children in this age group was found to be 9.9% in this study, which was conducted among primary school second grade students within the framework of the WHO European COSI protocol jointly prepared by the World Health Organization (WHO) European Regional Office and member countries⁶.

In March 2020, when the COVID-19 infection was defined as a pandemic by the WHO, the Government of the Republic of Turkey took various restrictions and isolation measures for epidemic control⁷. This situation has caused a significant change in the lifestyle of people of all age groups. Although we know very little about the effects of quarantine on obesity, it is considered that quarantine and restrictions correspond to a period of severe stress and that stress may increase the risk of obesity by causing changes in lifestyle and eating habits⁸⁻¹¹. Our aim in this study is to draw attention to the long-term effects of the pandemic process and restrictions on the development of eating habits and obesity in children.

Material and Methods

Selection of Participants, Study Design, and Data Collection

A cross-sectional descriptive study was conducted based on a survey to be administered by parents and children together. Survey participants was composed of students living and continuing their education in the province of Malatya. The data obtained from the Malatya Provincial Directorate of National Education on April 1, 2021 were taken as a reference in order to calculate the sample size. 5-12. It was understood that the total number of students between classes consisted of 119,374 people. In the power analysis performed to calculate the sample size, as the expected change rate in the population was not known, when the effect power was taken as 0.5, α : 0.05, when taken β -1 0.80, a minimum of 156 people were considered to participate in the study.

The study was performed in accordance with the international ethical recommendations in the Declaration of Helsinki. Necessary permissions were obtained from Malatya Turgut Özal University Clinical Research Ethics Committee. The parents were informed about the study and their consent forms were sent. The parents and their

children, who agreed to participate in the study and signed the informed consent form, were included in the study. A pilot study was conducted among 20 subjects to verify the effectiveness of the survey, to find out if it provided the necessary information, and to find out if we needed to change any of the questions. After this pilot study, some questions were changed that could cause commentation errors due to lack of understanding.

The method of measuring height and body weight for parents and children was described, and the Google survey platform and new communication technology were used, and the survey form was filled in. Those who gave a standardized answer and those who filled in the demographic data incompletely were determined as exclusion criteria from the study. Students who agreed to participate in the study and met the inclusion criteria composed the population of the study.

Body Mass Index (BMI) was calculated with the formula [body weight (kg)/height (m)²]. BMI, percentile of BMI, and Z score were evaluated according to CDC standards¹². Thin was evaluated as <5. percentile; normal between 5.-95. percentiles; obese: ≥ 95 .

Statistical Analysis

Statistical Package for Social Sciences (SPSS) for Windows Version 25 package program was used for statistical analysis in the study. The data has been loaded into the SPSS program. Shapiro Wilk, Chi-square, Mann-Whitney U, One-way Anova, One-sample/Independent T-Test, and Pearson Correlation analyzes were used. The results were evaluated in a confidence interval of 95% and by the significance level of $p < 0.05$.

Results

A total of 4594 students participated in the survey. 270 students were excluded due to standardized response or lack of demographic data. 1839 (42.5%) of the 4324 students included in the study were male. The age range was 9-17, and the mean age was 13.38 ± 2.06 . The current mean height of the students was calculated as 159.02 ± 12.359 cm, and their mean height one year ago was 154.66 ± 13.362 cm. The current mean body weight of the students was 51.56 ± 15.105 kg, and the mean body weight one year ago was calculated as 46.02 ± 13.728 kg (Table 1).

When the current BMI percentiles of the students were evaluated according to the CDC standards, 1.2% were found to be thin, 87.9% normal, and 10.8% obese. When the BMI percentiles of the previous year were evaluated according to CDC standards, 2.5% were found to be thin, 89.6% normal and 7.9% obese. When the body weight of the previous year was compared with the current body weight, there was a significant difference between the thin patients ($p < 0.05$) and the obese ones ($p < 0.05$). Considering the change between genders in the development of obesity, there was no significant

difference between the previous body weight and the current body weight ($p > 0.05$).

When we analyze the places where students live in our study, 69% were living in the city center, 19.8% in the district center, and 11.2% in the rural areas. When the current BMI was compared with the previous BMI, it was seen that the place where they lived was effective in the development of obesity during the pandemic process ($p < 0.05$). When the residence structure was analyzed, it was seen that the place of residence had an effect on the development of obesity during the pandemic process when the structure of the residence and the BMI of today and the previous year were compared ($p < 0.05$). Considering the number of individuals living at residence, those between 2-4 were 37.1%, those between 5-8 were 60.4%, and those living more than nine people were 2.5%. When the number of individuals living at residence was compared with the current BMI and the previous year, it was observed that there was no effect on the development of obesity ($p > 0.05$).

When the education level of the parents was analyzed, there was a significant effect on the development of obesity when the education level of the mothers was compared with the current BMI and the previous year's BMI ($p < 0.05$). When the educational status of the fathers was analyzed, there was no effect on the development of obesity when the father's education level was compared with the current BMI and the previous year's BMI ($p >$

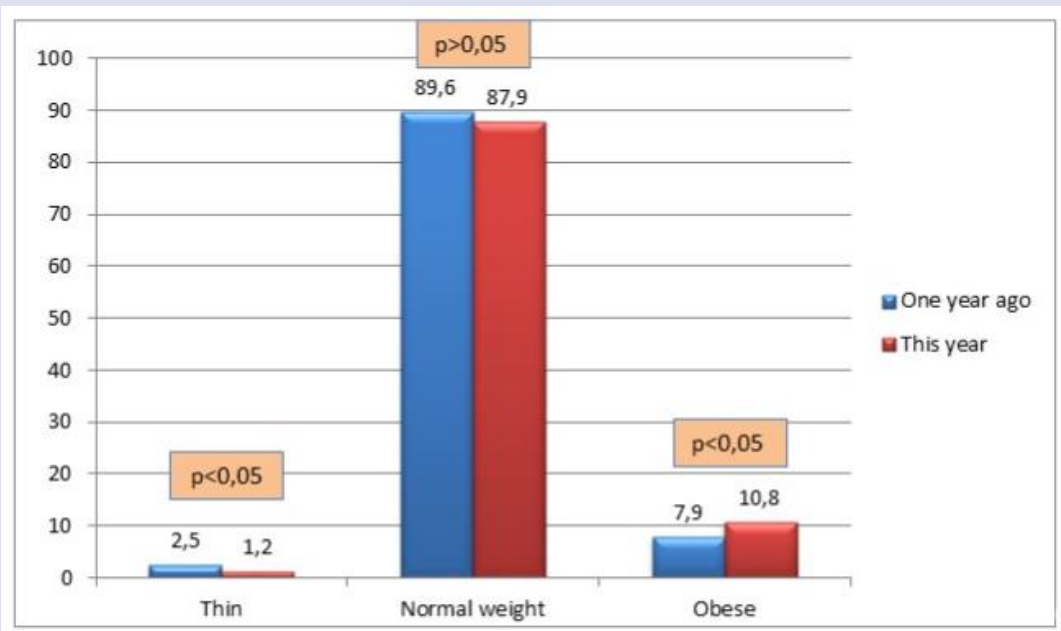
0.05). When the working conditions of the mother and father are evaluated and the father's employment status and current BMI were compared with the previous year's BMI, it was seen that there was no effect on the development of obesity ($p > 0.05$). Working status of mothers was found to be effective in the development of obesity when the current BMI was compared with the previous year's BMI ($p < 0.05$).

The monthly income of the families was asked to the parents and children. When monthly income level was compared with current BMI and previous year BMI, it had a significant effect on the development of obesity ($p < 0.05$). It was determined that in the family of 17.6% of the participants in the survey had individuals who lost their jobs during the pandemic process. This situation has a significant effect on the development of obesity when current BMI is compared with the previous year's BMI ($p < 0.05$).

The COVID-19 infection status was questioned. When the current BMI was compared with the previous year's BMI, it was seen that this situation had no effect on the development of obesity. ($p > 0.05$). When asked whether there is a healthcare professional in the family, 12.4% of the participants had a healthcare professional, 87.6% did not have. When the current BMI was compared with the previous year's BMI, it was seen that this situation had an effect on the development of obesity ($p < 0.05$) (Table 2).

Table 1. Students' gender, age, mean height, and body weight

	Number of Participants	Age (years)	Height (cm)	Height one year ago (cm)	Body weight (kg)	Body weight one year ago (kg)
Female	2485 (57.5%)	13.43±2.06	157.69±10.147	154.26±11.942	49.51±12.898	45.00±11.804
Male	1839 (42.5%)	13.32±2.06	161.01±14.576	155.39±15.475	54.36±17.295	47.47±15.831
General	4324 (100%)	13.38±2.06	159.02±12,359	154.66±13.362	51.56±15.105	46.02±13.728



Graphic 1. Change in study groups according to CDC standards within one year

Table 2. Sociocultural characteristics of the study group

	(n)%	CO	OYA	P
Parents' living together status				p>0.05
Parents are both alive and living together	92.7% (4008)	10.61%	8.65%	
Mother and/or Father are not alive or living separately	7.3% (316)	9.45%	7.62%	
Place they live in				p<0.05
Province Center	69.0% (2984)	11.21%	9.05%	
District Center	19.8% (856)	8.55%	7.33%	
Rural Area	11.2% (484)	8.09%	6.86%	
The Structure Of Their Residence				p<0.05
Residence with social area or garden	61.5% (2659)	9.51%	8.29%	
Residence without social area or garden	38.5% (1665)	11.59%	8.62%	
Education Level Of Mother				p<0.05
Illiterate	7.2% (311)	10.09%	7.92%	
Primary School	55.5% (2400)	9.42%	7.66%	
High School	25.6% (1107)	9.71%	8.21%	
University	11.7% (507)	14.98%	11.45%	
Education Level of Father				p>0.05
Illiterate	1.6% (69)	10.25%	8.01%	
Primary School	42.5% (1838)	10.06%	8.29%	
High School	37.1% (1604)	10.29%	8.56%	
University	18.8% (813)	10.67%	8.63%	
Employment Status of Mother				p<0.05
Yes	13.3% (676)	13.67%	10.09%	
No	86.7% (3748)	9.66%	8.16%	
Employment Status Of Father				p>0.05
Yes	82.5%(3565)	10.56%	8.56%	
No	17.5% (759)	9.76%	8.33%	
Monthly Income*				p<0.05
Minimum wage or below	60.7% (2625)	8.39%	7.25%	
Middle Income Level	33.2% (1463)	11.92%	9.28%	
High Income Level	6.1%(236)	15.78%	10.96%	
Covid-19 Infection Status				p>0.05
Yes, I was infected	5.0% (216)	10.15%	8.48%	
Yes, one or more family members were infected	25.1% (1085)	10.26%	8.14%	
Neither I nor any of my family members were infected	69.9% (3023)	10.91%	8.35%	

CO: Current Obesity; OYA: Obesity one year ago; *The minimum wage was 2825.90 Turkish Liras during the study. The status in the income query were determined on average by the researchers

When blood groups and current BMI were compared with the previous year's BMI, no significant correlation was found between the development of obesity ($p > 0.05$). Besides, no significant correlation was found between the personal background and family history of the study group and the development of obesity within the past year (Table 3).

When asked whether the eating habits of the students were affected by the pandemic and restrictions, there was no change in 50.3%, 36.4% more food, and liquid consumption, 13.3% consume less liquid and food. When the current BMI was compared with the previous year's BMI, it was seen that it had a significant effect on the development of obesity ($p < 0.05$).

When asked how they feel about their health today, 22.96% stated that they felt moderate-bad, 77.04% good-excellent, when the same question was asked a year ago 12.09% replied as moderate-bad and 87.91% as good-excellent. There was a statistically significant difference between these two situations ($p < 0.05$). When the current BMI was compared with the previous year's BMI, it was

seen that this situation had an effect on the development of obesity ($p < 0.05$).

When asked about regular meals a day during the pandemic, 55.0% stated that they ate regularly, 45.0% stated that they ate sometimes or very little. When the same question was asked before the pandemic, 64.0% were eating regularly, 36.0% sometimes, or very little. There was a significant change in eating habits ($p < 0.05$). When the current BMI was compared with the previous year's BMI, it was seen that this situation had an effect on the development of obesity ($p < 0.05$).

The time spent by students asleep is 29.23% less than 8 hours, 63.45% between 8-10 hours, 7.32% more than 10 hours today. When this question is asked before the pandemic, 34.61% is less than 8 hours, 59.52% is between 8-10 hours, 5.87% is more than 10 hours. The change in sleep routines was statistically significant ($p < 0.05$). When sleep routine and current BMI were compared with the previous year's BMI, it was effective on the development of obesity ($p < 0.05$).

When students' consumption of convenience food, fast food, and instant drinks are questioned, 8.8% of students consumed one or more convenience food, fast food, and instant drinks every day during the pandemic, 37.2% consumed convenience food, fast food, and instant drinks several times a week, and 53.9% consumed very little or no convenience food, fast food, and instant drinks. When the same question was asked before the pandemic, 9.8% of the students consumed one or more convenience, fast food and drink every day, 36.4% consumed convenience food, fast food, and instant drinks several times a week, and 53.7% had little or no convenience foods, fast food, and instant drinks. There was no significant change in the consumption of convenience food, fast food, and instant drink ($p > 0.05$). When the

current BMI was compared with the previous year's BMI, the relationship between the use of convenience food, fast food, and instant drinks was not significant ($0.05 < p$).

When asked about their exercise status, 43.07% did not exercise at all, 39.15% exercised for one hour, and 17.78% exercised more than one hour during the pandemic and restrictions. When the same question was asked before the pandemic, it was found that 25.37% did not exercise at all, 42.15% exercised for one hour, and 32.48% exercised more than one hour. The pandemic had a significant effect on exercise ($p < 0.05$). Comparison of exercise status and current BMI with the previous year's BMI was significant on the development of obesity ($p < 0.05$) (Table 4).

Table 3. Personal background and family history of the study group

	(n)%	CW	WYA	P
Birth Type				$p > 0.05$
C-Section	43.1% (1864)	11.22%	9.21%	
Vaginal Delivery	56.9% (2460)	9.39%	7.67%	
Breastfeeding Status				$p > 0.05$
Never	5.6% (242)	12.22%	10.29%	
Breastfed up to six months	24.1% (1042)	9.79%	7.33%	
Breastfed up to a year	20.6% (891)	9.58%	7.88%	
Breastfed over a year	49.7% (2149)	10.43%	8.83%	
Birth Weight				
Less than 2000 grams	6.2% (268)	8.93%	6.50%	$p < 0.05$
Between 2000-4000 grams	86.2% (3727)	10.34%	8.53%	$p > 0.05$
Over 4000 grams	7.6% (329)	16.00%	11.50%	$p < 0.05$
Birth Time				$p > 0.05$
Premature, hospitalized	3.9% (169)	9.59%	7.31%	
Premature, not hospitalized	13.5% (584)	9.78%	7.24%	
Mature, hospitalized	9.3% (402)	11.08%	8.21%	
Mature, not hospitalized	73.3% (3169)	11.14%	8.63%	
Chronic Disease				$p > 0.05$
Yes	8.9% (385)	10.04%	8.10%	
No	91.1% (3939)	12.26%	10.52%	
Chronic Disease or Patient Being Cared For in Family				$p > 0.05$
Have Chronic Disease, No Being Cared Patient	29.6% (1280)	8.14%	7.14%	
Both have Chronic Disease and Being Cared Patient	6.3% (272)	11.67%	9.92%	
No Chronic Disease, No Being Cared Patient	64.1% (2772)	10.23%	8.45%	
Familial Relationships				$p > 0.05$
I Get Along Much Better	16.3% (705)	10.01%	7.97%	
I Argue More Than Before	24.5% (1059)	11.26%	8.96%	
Same As Before	59.2% (2560)	9.92%	8.46%	

CW: Current Weight; WYA: Weight One Year Ago

Table 4. Relationship of BMI, Exercise Status and Pandemic

BMI	Current exercising status			Exercising status for a year ago		
	I do not (%)	One hour (%)	<One hour (%)	I do not (%)	One hour (%)	<One hour (%)
Thin	44.00%	38.00%	18.00%	30.00%	44.00%	26.00%
Normal	40.55%	39.61%	19.84%	25.26%	41.95%	32.79%
Obese	47.48%	35.87%	16.65%	25.79%	43.48%	30.73%
General	43.07%	39.15%	17.78%	25.37%	42.15%	32.48%

Table 5. The relationship between BMI's use of technological devices and the pandemic

BMI	Current technological device use					Technological device use a year ago				
	0 hours	0-1 hours	1-3 hours	4-6 hours	<7 hours	0 hours	0-1 hours	1-3 hours	4-6 hours	<7 hours
Thin	4.00%	32.00%	40.00%	12.00%	12.00%	4.00%	38.00%	40.00%	6.00%	12.00%
Normal	2.76%	24.84%	43.46%	23.36%	6.58%	5.89%	34.73%	42.62%	13.53%	3.23%
Obese	2.15%	17.46%	36.84%	26.79%	16.74%	3.67%	25.91%	36.92%	24.21%	9.29%
General	2.84%	24.45%	42.41%	21.72%	8.58%	5.48%	34.21%	41.93%	14.46%	3.92%

When the students were asked how many hours they spent with technological devices during the pandemic except for online education, 2.84% did not use it at all, 24.45% used almost one hour, 42.41% used one to three hours, 21.72% used four to six hours, and 8.58% used it for seven hours or more. When the same question was asked before pandemic, 5.48% never used, 34.21% used almost one hour, 41.93% used one to three hours, 14.46% used four to six hours and 3.92% used seven hours or more. There was a significant difference in the use of technology compared to the previous year ($p < 0.05$). When current BMI and previous year's BMI were compared regarding the use of technology, it was observed that it was effective on the development of obesity ($p < 0.05$) (Table 5).

When students are asked about their food preferences before the pandemic and during the pandemic, regarding the products such as meat, fish, chicken, legumes, milk and products, vegetables, fruits, fast food (hamburger, toast, pizza) and market products (biscuits, chocolate, chips, etc.), there was a statistically significant difference as an increase only in the consumption of fruits and vegetables solely ($p < 0.05$).

Discussion

It is not exactly known how the pandemic and restrictions will affect our lifestyle radically on childhood obesity, which will be a significant child health problem today and in the future. Quarantine restrictions such as social distance, mask applications, closing of school and various business activities, banning group meetings and physical activities in open areas and private facilities have disrupted people's traditional lifestyle. This situation has also had effects on the psychological and emotional structure of people all over the world (13). The pandemic and restrictions cause short-term changes in physical activity reduction and sedentary lifestyle development, which may develop permanently, leading to an increased risk of obesity, diabetes, and cardiovascular disease in children ¹⁴.

The region where the respondents lived was in a way that reflected the demographic structure of Malatya. It has been determined that while the rate of thin students a year ago was 2.5%, this year it decreased to 1.2%, while the rate of obesity was 7.9% a year ago, it has increased to 10.8% today. Studies have shown that the rate of obesity development increased in children and adolescents in the early stages of the pandemic and restrictions ¹⁵. In our study, we also observed that the pandemic process and restrictions had an effect on the

normalization of body weight and the development of obesity in children who were thin in the late period. In our study, we could not find a significant difference between the genders of those who developed obesity within a year, according to the previous obesity rates.

During the quarantine period, there have been changes in the regular eating habits of the children due to their changing lifestyles, as well ¹⁶. In our study, we found that there were changes in eating habits, and the rate of those who have eaten three meals regularly decreased significantly. Besides, when it is analyzed at the time spent by children asleep, we have found that their sleeping time increased compared to before the pandemic, and this situation increased significantly in thin and obese patients compared to those with normal body weight. In the studies conducted, we also know that the sleep routine is affected due to the stress conditions and lifestyle changes caused by the restrictions and pandemic ¹⁵.

Insufficient physical activity and excessive sedentary lifestyle among children can cause a significant public health problem. Because the physical activity behaviors in childhood probably continue into adulthood, and this can cause a number of serious health problems in adulthood ¹⁷. In a study conducted in the USA, it was found that children had less physical activity and showed more sedentary behavior at the beginning of the COVID-19 period compared to before the pandemic ¹⁴. In our study, we also found that there was a significant decrease in physical activity durations compared to before the pandemic. Obesity development and increase in body weight were higher during the restriction process in those who did less physical activity.

In a study, it was understood that children with reduced physical activity spent most of their time by watching television, videos, movies, meeting online with their families or friends, doing school-related work, and playing computer or video games in the early period of COVID-19. Interestingly, their sedentary time spent on school, including online conversations about the school and school-related work, merely consisted of about 90 minutes a day ¹⁴. In our study, we also determined that the time spent with technological devices except school increased significantly compared to before the pandemic, and this situation was statistically significantly associated with developing obesity.

Considering the residence structure and the place where they live, it may be that people with sports and exercise areas are less affected by physical activity restrictions. Likewise, many studies have shown that the social area of the residence affects physical activity in the

early stages of the pandemic^{14,18,19}. In studies conducted before the pandemic, it was determined that the place of residence and the structure of it had an effect on obesity due to physical activity restriction and economic situation^{20,21}. When the place they live in and the structure of their residences were questioned, we found that those living in rural areas and those with a residence structure with a garden or a playground were less affected by the pandemic and restrictions in terms of obesity development.

It is known that particularly the children of educated working mothers use convenience foods and spend more time with technological devices. This situation poses a risk for the development of obesity in children^{22,23}. Considering the education and working status of the mother and father, we found that the pandemic and restrictions in the children of working mothers and university graduate mothers pose a risk for the development of obesity. This may be due to the higher employment rate of university graduate mothers and the less interest of working mothers in the eating habits of their children and the high consumption of convenience food. It has been shown that the socioeconomic situation has an impact on the development of obesity, especially in developing countries, and the rate of obesity is high in those with high income levels^{21,24}. In our study, when the monthly income level and the status of losing their job were questioned, we also found that the rate of obesity development in the last year was higher in those with high income and those who lost their jobs.

Studies have shown that stress and mental state pose a risk in the development of obesity^{13,25}. The relationship between the mother and father and the child and the experiences in the home environment affect the individual's mental structure and cause eating disorders²⁵. We have found that there is an increase in the development of obesity during the pandemic and restrictions in children whose families are healthcare professions. This may be due to the stress and mental state of the child. On the other hand, in our study, the condition of the child or family members having COVID-19 infection did not constitute a risk factor for the development of obesity during the pandemic process and restrictions. Relationship between mother and father or separation of parents was not a risk for obesity.

In some studies, an increase in appetite, an increase in food intake, and body weight were detected in children and adolescents during the COVID-19 period^{26,27}. In our study, we also observed that there is a relationship between children's food consumption amount and appetite and the development of more obesity in the pandemic process and restrictions.

It should not be forgotten that psychological and emotional effects will be experienced and pandemic restrictions will also affect eating habits²⁸. Once again, we agnize that stress-related eating is significantly associated with obesity²⁹. In our study, when we asked students how they felt about their health, the rate of those who felt bad in the first year of the pandemic process was significantly

higher than before the pandemic, and its relationship with obesity in the last year was statistically significant.

Compared to the week before the restrictions, women, and adolescents from Spain, Brazil and Chile consumed more vegetables and fruits, while adolescents with higher education mothers also consume more vegetables and fruits¹⁹. In our study, we also determined an increase in fruit and vegetable consumption. The reason why there is no significant increase or decrease in convenience food consumption or fast food consumption may be due to food safety problems or the closure of restaurants or cafes.

We have found that there is a relationship between the pandemic period and the development of more obesity during the restriction process in children with low and high birth weight. In the studies conducted, it has been reported that low birth weight and high birth weight lead to obesity by causing insulin resistance in the future³⁰.

No relationship was found with the development of obesity in children during the pandemic and restriction process, with the blood groups of the students, their breastfeeding and feeding status in infancy, chronic disease, type of delivery, and their relationships within the family. It has been shown that only 1-2% of childhood obesities develop due to underlying diseases and syndromes, and a large percentage of them are exogenous obesity³¹.

Limitations

The fact that measurements could not be made with fixed measurement devices as a standard can be commented as the most important limitation of our study. Obtaining height and body weight data from parents and children a year ago is a limitation brought by the pandemic process. Moreover, the surveys in the study were filled with the opinions of the families and some biased answers might have been given. Perceptions of families may be higher/less than the actual situation (for instance, the time spent by the child with technological devices other than online lessons, etc.).

Conclusion

We agnize that obesity will be a significant health problem in children as in adults today and in the future. The effects of the COVID-19 pandemic and restrictions on human health, which have caused radical changes in our lives for more than a year, have begun to emerge.

We determined that the COVID-19 pandemic and restrictions triggered the development of obesity in children in the late period. It can be said that the COVID-19 pandemic and restrictions, which we found to have an increasing effect on the development of obesity, were caused by the restriction of children's physical activities, changes in eating habits, increased use of technological devices, and increased time spent inactive, and the psychological effects of the stress experienced. This effect of the pandemic and restrictions that increase the

development of obesity is independent of personal data such as the child's blood group, breastfeeding, and nutritional status during infancy, chronic disease, and type of delivery.

The late period of the pandemic process and restrictions, which we found to increase obesity rates in children and change eating habits, may cause more serious health problems in the future.

Conflict of interest

There is not a conflict of interest

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