

IMPACT OF THE COVID-19 PANDEMIC ON CHILDHOOD OBESITY IN NORTH MACEDONIA: A COMPARATIVE STUDY

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ABSTRACT

Childhood obesity is an escalating global health concern, with North Macedonia ranking among the top 10 European countries with a high prevalence of overweight and obesity. This study aimed to assess the impact of the COVID-19 pandemic on children's Body Mass Index (BMI) by comparing data collected before and after the pandemic.

A prospective cross-sectional study was conducted between February and April 2022, involving 1,004 children (ages 6–13) from the northwestern region of North Macedonia. These findings were compared with retrospective data from 2019, which included 1,034 participants of the same age group.

Our results indicate that restrictive measures contributed to an increase in overweight prevalence from 13.5% in 2019 to 15.9% in 2022 and obesity from 19.6% to 21.9%. Overall, the combined prevalence of overweight and obesity rose from 33.0% to 37.4% during this period. The statistical analysis confirmed a significant association between the pandemic and increased childhood obesity rates (Pearson's Chi-Square test: $X^2 = 13.813$, $df = 3$, $p < 0.003$). Gender disparities were also observed. In 2019, overweight and obesity were 1.42 times more common in boys than in girls (OR = 1.42; 95% CI: 1.09–1.84). By 2022, this ratio had slightly increased to 1.45 (OR = 1.45; 95% CI: 1.12–1.88). Furthermore, a general decrease in undernutrition was observed in 2022 compared to 2019. A significant reduction in undernutrition was noted among boys aged six ($p = 0.008$) and overall among boys ($p = 0.017$).

According to the World Obesity Federation (WOF), if no effective prevention and intervention strategies are implemented, North Macedonia could see childhood overweight and obesity rates rise to 52.4% by 2030—meaning that one in two children would be affected.

These findings highlight the urgent need for targeted public health initiatives to mitigate the long-term consequences of childhood obesity.

Keywords: Childhood obesity, Prevalence, Covid-19 pandemic, N. Macedonia

INTRODUCTION

Childhood obesity is a growing concern and a worldwide pandemic. It has been a global health concern affecting various regions globally. It refers to a condition where children and adolescents have an excessive amount of body fat, leading to potential negative health consequences. Childhood obesity is usually determined by using the body mass index (BMI), which is defined as a child's weight in relation to height and is used to compare weight across age and gender groups.

Prevalence rates of obesity in Europe have been on the rise over the past few decades, and the region has seen a significant increase in the number of overweight and obese children. While Europe is considered to have a lower overall prevalence of obesity compared to regions like North America and some parts of the Middle East, it still faces substantial challenges related to the obesity epidemic. The prevalence of obesity can vary significantly between different European countries. Some countries in Northern and Western Europe tend to have lower rates compared to those in Southern and Eastern Europe [1].

North Macedonia, a small middle-income country with a population of around 2 million, is among the top 10 countries in Europe with a high prevalence of overweight and obesity. According to Lobstein et al., ten European countries are ranked in the following order regarding the highest prevalence: Hungary, Turkey, Croatia, Greece, Bulgaria, Serbia, Albania, N. Macedonia, Slovenia, and Romania. On the other hand, the same study presented the lowest prevalence of obesity, ranked from the lowest in the countries as follows: Tajikistan, Belgium, Armenia, Denmark, Moldova, Switzerland, Kyrgyzstan, Sweden, Uzbekistan, and Turkmenistan [2].

In January 30, 2020, the World Health Organization (WHO) declared the outbreak of the novel coronavirus SARS-CoV-2 a public health emergency of international concern and later declared a pandemic on March 11, 2020. The implementation of various measures was necessary to curb the spread of COVID-19. The changes in daily routines and limited access to outdoor activities may have influenced eating habits and reduced physical activity levels, potentially contributing to weight gain and other health issues [3].

The aim of this study was to observe how the COVID-19 pandemic affected children's BMI compared to an earlier study conducted just before the pandemic in the northwestern part of N. Macedonia.

MATERIAL AND METHODS

Between February and April 2022, we conducted a prospective cross-sectional study in healthy 1,004 children of both genders aged 6-13, from four different ethnicities in the northwestern part of North Macedonia. We measured their weight, height, calculated their BMI percentile and z score, and compared them with the Centers for Disease Control and Prevention (CDC) 2000 growth charts for weight by gender and age classification [4]. The classification of BMI in children was based on the following percentiles: Underweight: BMI below the 5th percentile for age and gender; Normal weight: BMI between the 5th and 85th percentiles; Overweight: BMI between the 85th and 95th percentiles and Obese: BMI at or above the 95th percentile.

We compared the prospective study database with 1,004 participants with the retrospective cross-sectional study database which was conducted just before COVID-19 pandemic in the period from March 2019 to March 2020 [5]. The retrospective study included 1,034 healthy children of both sexes, 6-13 years old from four different ethnicities. The two databases were analyzed and compared for their BMI classification.

The data obtained in the study were processed with the SPSS software, version 22.0 for Windows. The prevalence of the examined parameters of interest was shown as the ratio between the representation and the whole mass expressed as percentage. Shapiro-Wilk W test was used to determine the normality of the frequency distribution of the examined variables such as height, weight, BMI.

Pearson's Chi square test, Fisher exact test, and Fisher Freeman Halton exact test were used to determine the association between certain characteristics in the groups of respondents with different treatment. Difference test was used to compare the proportions. Risk factors were

quantified using odds ratios (Odd ratio – OR) and confidence intervals (CI). The comparison of two or more independent numerical parameters with irregular distribution of frequencies was done by the consequent Mann Whitney U test, i.e., Krushal Wallis H test.

A two-sided analysis was used to determine a statistical significance level of $p < 0.05$.

RESULTS

The analysis of the prevalence of classified BMI for the entire sample of school children indicated that the restrictive measures of isolation and social distancing during the COVID-19 pandemic decreased the prevalence of underweight children from 10.1% in 2019 to 5.9% in 2022. However, it increased the prevalence

of overweight children from 13.5% in 2019 to 15.9% in 2022 and obese from 19.6% in 2019 to 21.9% in 2022. Overall, overweight and obesity increased from 33% to 37.4% during the COVID-19 pandemic. A significant association was established with an increased prevalence of overweight and obesity in 2022 (Pearson's Chi Square test: $X^2=13.813$; $df=3$; $p < 0.003$).

The gender difference was striking, as boys had a greater increase in the prevalence of overweight and obesity in the majority of age groups surveyed in 2022 compared to 2019. Comparing the overweight, boys went from 15% in 2019 to 17.7% in 2022, with an increase of 2.7%, while girls had a smaller increase, from 12.1% in 2019 to 13.1% in 2022, with an increase of 1%. The gender difference also persisted when comparing obesity, with a higher prevalence of obesity among boys, increasing from 22.1% in 2019 to 23.9% in 2022, com-

Parameters		Classification of BMI				All
		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
PRE Covid 2019	6+	40 (18.5%)	124 (57.4%)	13 (6%)	39 (18.1%)	216
	7+	1 (12.5%)	6 (75%)	0 (0%)	1 (12.5%)	8
	8+	17 (6.8%)	141 (56.6%)	30 (12%)	61 (24.5%)	249
	9+	2 (18.2%)	2 (18.2%)	2 (18.2%)	5 (45.5%)	11
	10+	22 (9%)	143 (58.6%)	38 (15.6%)	41 (16.8%)	244
	11+	3 (10.3%)	13 (44.8%)	4 (13.8%)	9 (31%)	29
	12+	18 (7.1%)	143 (56.6%)	48 (19%)	44 (17.4%)	253
	13+	1 (4.2%)	15 (62.5%)	5 (20.8%)	3 (12.5%)	24
	Вкупно	104 (10.1%)	587 (56.8%)	140 (13.5%)	203 (19.6%)	1034
POST Covid 2022	6+	5 (5.8%)	55 (64%)	8 (9.3%)	18 (20.9%)	86
	7+	15 (7.9%)	98 (51.6%)	27 (14.2%)	50 (26.3%)	190
	8+	4 (4.2%)	53 (55.8%)	15 (15.8%)	23 (24.2%)	95
	9+	11 (6%)	107 (58.5%)	27 (14.8%)	38 (20.8%)	183
	10+	5 (6.5%)	38 (49.4%)	18 (23.4%)	16 (20.8%)	77
	11+	9 (6.6%)	78 (56.9%)	19 (13.9%)	31 (22.6%)	137
	12+	2 (3.4%)	35 (60.3%)	6 (10.3%)	15 (25.9%)	58
	13+	8 (4.5%)	105(59%)	36 (20.2%)	29 (16.3%)	178
	Вкупно	59 (5.9%)	569 (56.7%)	156 (15.5%)	220 (21.9%)	1004
Age 6+: 6,00-6,99 years						
Pearson Chi square test: X ² =13,813; df=3; p<0,003*						
*significance p<0,05						

Table 1. Classified BMI of school children by age and year (2019/2022)

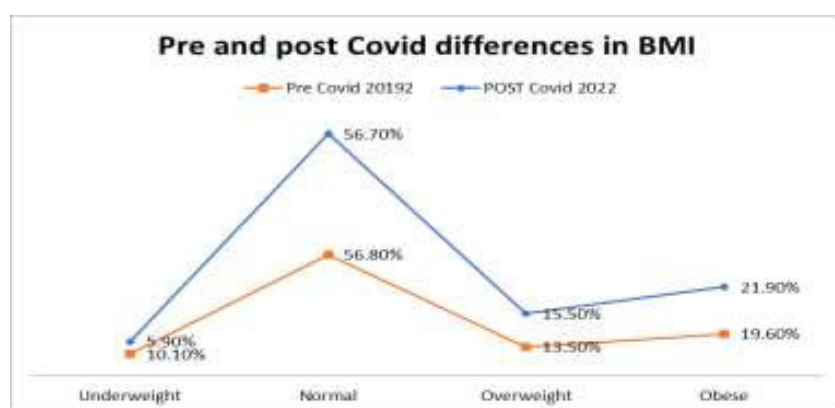


Fig.1. Pre and post Covid differences in BMI



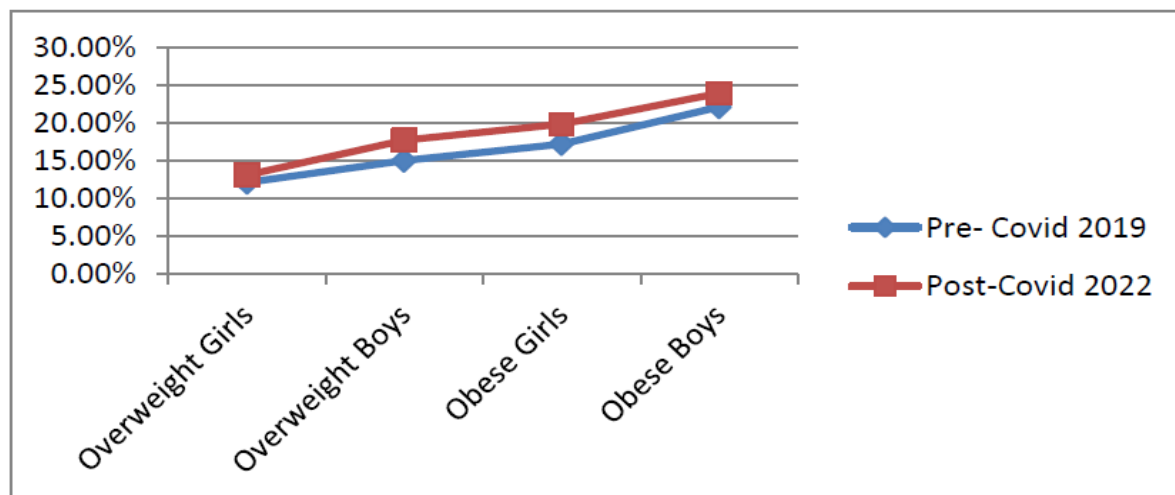


Fig. 2. Gender differences in BMI pre and post-Covid 2019/2022

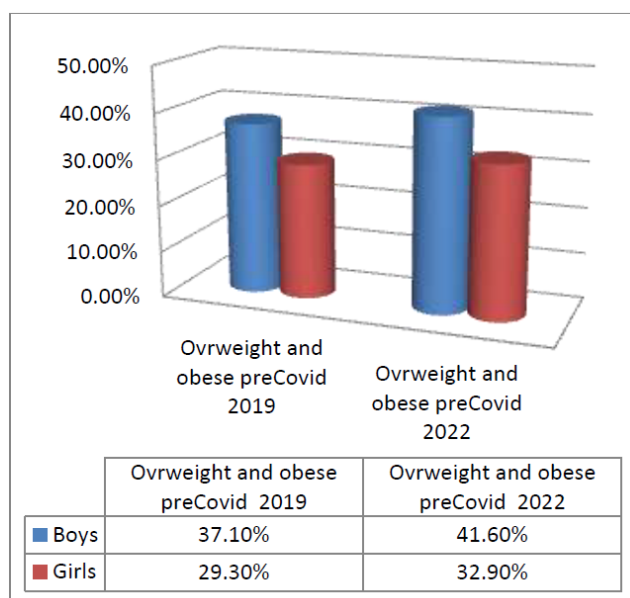


Fig 3. Gender differences in overweight and obesity pre Covid2019/ post Covid 2022

pared to girls who saw an increase from 17.2% in 2019 to 19.8% in 2022. No significant association was found between the higher prevalence of overweight and obesity in both boys and girls, for the years 2019/2022 ($p=0.149$ vs. $p=0.244$, respectively).

Additionally, in both years (2019/2022), we found a significant association of boys with a higher prevalence of overweight and obesity. Boys in 2022 had a higher prevalence of overweight and obesity with 41.6% compared to girls with 32.9%. In 2019, boys had a higher prevalence of overweight and obesity with 37.1% compared to girls 29.3%. The prevalence of overweight and obesity in 2019 was 1.42 times more common in boys than in girls [OR=1.42 (1.09-1.84), 95% CI], and in 2022, it was 1.45 times more common in boys than in girls [OR=1.45 (1.12-1.88), 95% CI].

In addition, a general decrease in undernutrition was observed in 2022 compared to 2019 for each of the analyzed ages (6-13 years). For $p<0.05$, there was a significantly lower proportion of undernourished in 2022 compared to 2019 for boys aged 6+ ($p=0.008$), as well as a significantly lower proportion of undernourished overall for boys in 2022 compared to 2019 ($p=0.017$).

DISCUSSION

Lobstein predicts that 16.2% of children aged 5-9 and 11.13% of adolescents aged 10-19 will be affected by obesity by 2030, totaling 21 million children and adolescents aged 5-19 throughout the European region [2, 6].

During the COVID-19 pandemic, the institutes public health recommendations and government measures led to various restrictions in everyday life, including social distancing, isolation, and home confinement for people [7]. However, the impact of these restrictions on lifestyle, diet, physical activity, and mental health had health consequences to both children and adults [3]. One of the main ways the pandemic affected children's weight was by changing their eating habits. With the closing of schools and the transition to distance learning, many children spent more time at home and had greater access to food. Another factor that contributed to the increase in the children's weight during the pandemic was the reduction of physical activity. The closing of schools led to a reduced physical activity and increased sedentary behavior due to online classes, from 5 to 8 hours. With the closure of the community centers, children had fewer opportunities to participate in organized sports and other physical activities. Additionally, many families did not allow their children to play outside or participate in any activities concerned by the virus spreading. This, combined with stress and uncertainty caused by the pandemic, anxiety, and reduced social interaction, may have led to increased emotional eating, which together contributed to an increase in the body weight [8].

During the COVID-19 pandemic, our study in North Macedonia showed an increase of children's overweight and obesity rates from 33% to 37.4%, representing a 4.4% rise. This is in agreement with similar findings from other studies conducted during this period, emphasizing a substantial surge in the prevalence of overweight and obesity among children.

According to Siegel's study in Cincinnati, the prevalence of overweight and obesity remained relatively stable with a gradual increase of 35% to 36.4% from 2011 to 2020. However, during the COVID-19 period in 2020/2021, there was an increase in overweight and obesity to 39.7%, representing an 8.3% increase [9].

Kim et al. conducted a study among adolescents in Korea and reported a similar increase in the prevalence of obesity and overweight from 2005-2008, with a prevalence of 3.2%. By 2020, the prevalence of obesity had risen to 8.9% [10].

Dubnov-Raz et al. study compared obesity prevalence in the fourth quarter of 2020 to the fourth quarter of 2018-2019 in children

from Israel and found that obesity rates increased by 37%, from 8.1% to 11.1% [11]. A recent study conducted in Israel also reported an increase [12].

Increased prevalence was also observed in European countries like Switzerland, Germany, Italy, Malta, Poland, Spain [13]. According to the latest results from the Childhood Obesity Surveillance Initiative Study (COSI) round six, where 13 European countries participated, the number of children perceived as having a normal weight dropped, and the percentage of children perceived as overweight almost doubled in every country, with the highest increase recorded in Italy and Malta [14].

Even in Sweden, which unlike many countries did not impose strict lockdowns or stay-at-home orders where kindergartens, schools, businesses, and public spaces remained open throughout the pandemic, also reported an increased obesity among children [15].

One of the largest longitudinal studies, by Lange et al., involved 432,302 children and adolescents aged 2–19 years across the United States. Based on baseline BMI, the prevalence of obesity was 16.1%, with 4.8% of severe obesity. The study showed that the monthly rate of increase in BMI almost doubled during the COVID-19 pandemic compared to the pre-pandemic period. The percentage of individuals aged 2-19 with obesity was 19.3% in August 2019, which increased to 22.45% in August 2020 [16].

Furthermore, our study presented significant gender differences, with a higher prevalence of overweight and obese boys pre-COVID (17.7% vs. 23.9%) compared to the prevalence among girls (13.1% vs. 19.8%), which extended post-COVID (2022) where boys had a higher prevalence of overweight and obesity with 41.6% compared to girls with 32.9%.

According to the study by Shah et al., there was a notable disparity in the prevalence of obesity by gender among all children's groups. Based on the data summarized and analyzed by Shah et al., out of 188 countries, 123 countries, constituting 65% of the countries included in the Atlas study, reported a higher prevalence of obesity in boys than in girls. According to the study, a similar trend was observed in 112 countries. This trend was further analyzed and found to persist predominantly in countries with high and high-average incomes, while it was not observed

in countries with lower averages and lower incomes [17].

Despite the evidence of gender disparity in overweight and obesity, relatively few studies exist that have investigated the potential causes of the aforementioned variation. Some studies support the notion that obesity prevention in children should focus on gender [18].

As a branch of the World Obesity Federation, the Global Atlas of Childhood Obesity provides data on the risk assessment of obesity prevalence in children aged 5-19 years. WOF published the first childhood obesity atlas in 2019, showing the specific prevalence of obesity in countries by age group and sex, and calculating risk scores for future obesity [19]. According to the latest publication, the second Atlas in 2022, the rate of increase in obesity in the adult population in North Macedonia has an average risk of 1.4% from 2010 to 2030. However, the risk rate in the pediatric population is significantly higher, 4.5%. The results for N. Macedonia show a difference in the risk of further obesity and the prevalence of obesity between adults and children. Specifically, according to the Atlas in N. Macedonia, the prevalence of children with obesity aged 5-9 years is 20.17%, while for those aged 10-19 years, it is 14.77%. Moreover, N. Macedonia has a risk index of 7/11. It is expected that there will be an increase in the rate of obesity to 52.5% among children aged 5-19 years by 2030 [2].

The results obtained in our study are alarming and they should raise the awareness of the Government and responsible authorities in North Macedonia to create national policies aimed at combating childhood obesity. Unlike some high-income countries where public awareness campaigns and multifaceted strategies have contributed to a plateau or even a decrease in childhood obesity rates, North Macedonia lacks such initiatives.

The lack of specific policies is worrying, especially considering that the prevalence of overweight and obesity among children and adolescents are on the rise. Without dedicated efforts to address this issue, there is a risk of a future health crisis, as childhood obesity often leads to lifelong health problems.

CONCLUSION

Our study and the literature studies have shown the concerning trend of increasing overweight and obesity during the COVID-19 pandemic, emphasizing the importance of addressing these health issues and promoting healthy lifestyles, especially during challenging times. North Macedonia must urgently adopt and implement strategies to combat the alarming rise in childhood obesity, as evidenced by the data obtained. Ensuring the ongoing surveillance of children's nutritional status and their risk of obesity is imperative. This ongoing monitoring is essential to develop and sustain a comprehensive, long-term strategy aimed at preventing obesity and curbing the prevalence of overweight children in our country.

REFERENCES

1. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *Lancet*. 2017; 390(10113): 2627–2642. doi:10.1016/S0140-6736(17)32129-3
2. T. Lobstein et al., “World Obesity Atlas 2022,” *World Obes. Fed.* 2022, no. March, p. 289, 2022, Available: <https://www.worldobesityday.org/resources/entry/world-obesity-atlas-2022>
3. Ammar A, Brach M, Trabelsi K, et al. Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey. *Nutrients*. 2020; 12(6): 1583. doi:10.3390/nu12061583
4. Growth Charts – Data Table of BMI-for-age Charts. https://www.cdc.gov/growthcharts/html_charts/bmiagerev.htm (accessed Feb. 04, 2022).
5. Raufi A, Konstantinova MK. Prevalence of Overweight and Obesity in Children: Variation in Different Ethnicities, Age, and Sex in North Macedonia. *Pril. (Makedonska Akad. na Nauk. i Umet. Oddelenie za Med. Nauk)*. 2022; 43(2): 23–31. doi:10.2478/prilozi-2022-0015

6. Lobstein T, Jackson-Leach R, Moodie ML, et al. Child and adolescent obesity: part of a bigger picture. *Lancet*. 2015; 385(9986): 2510–2520. doi:10.1016/S0140-6736(14)61746-3
7. Public Health and Social Measures. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/phsm> (accessed Aug. 27, 2023).
8. J Devoe D, Han A, Anderson A, et al. The impact of the COVID-19 pandemic on eating disorders: A systematic review. *Int J Eat Disord*. 2023; 56(1): 5–25. doi:10.1002/eat.23704
9. Siegel R, Khoury P, Spooner SA, et al. Body Mass Index Increased at a Large Midwestern Children's Hospital During the COVID-19 Pandemic. *Child Obes*. 2023; 19(6): 364–372. doi:10.1089/chi.2022.0037
10. Kim MJ, Lee KH, Lee JS, et al. Trends in body mass index changes among Korean adolescents between 2005–2020, including the COVID-19 pandemic period: a national representative survey of one million adolescents. *Eur Rev Med Pharmacol Sci*. 2022; 26(11): 4082–4091. doi:10.26355/eurrev_202206_28978
11. Dubnov-Raz G, Maor S, Ziv-Baran T. Pediatric obesity and body weight following the COVID-19 pandemic. *Child Care Health Dev*. 2022; 48(6): 881–885. doi:10.1111/cch.12939
12. Rose A, Mor EE, Krieger M, et al. Pediatric overweight and obesity increased in Israel during the COVID-19 period. *PLoS One*. 2023; 18(9): e0290961. Published 2023 Sep 5. doi:10.1371/journal.pone.0290961
13. Maggio ABR, Gal-Dudding C, Martin X, Chaimay-Weber C. Evaluation of the impact of the COVID-19 lockdown on BMI in children and adolescents with or without obesity. *BMC Pediatr*. 2022; 22(1): 509. Published 2022 Aug 25. doi:10.1186/s12887-022-03565-y
14. E. R. C. round 6 WHO, Nutrition, physical activity, well-being and Covid-19, Organ. Mund. Saúde, 2023. Available: <https://www.who.int/europe/publications/m/item/nutrition-physical-activity-well-being-and-covid-19-childhood-obesity-surveillance-initiative-study>
15. Fäldt A, Nejat S, Edvinsson Sollander S, Durbeej N, Holmgren A. Increased incidence of overweight and obesity among preschool Swedish children during the COVID-19 pandemic. *Eur J Public Health*. 2023; 33(1): 127–131. doi:10.1093/eurpub/ckac181
16. Lange SJ, Kompaniyets L, Freedman DS, et al. Longitudinal Trends in Body Mass Index Before and During the COVID-19 Pandemic Among Persons Aged 2-19 Years - United States, 2018-2020 [published correction appears in *MMWR Morb Mortal Wkly Rep*. 2021 Sep 24;70(38):1355]. *MMWR Morb Mortal Wkly Rep*. 2021; 70(37): 1278–1283. Published 2021 Sep 17. doi:10.15585/mmwr.mm7037a3
17. Shah B, Tombeau Cost K, Fuller A, Birken CS, Anderson LN. Sex and gender differences in childhood obesity: contributing to the research agenda. *BMJ Nutr Prev Health*. 2020; 3(2): 387–390. Published 2020 Sep 9. doi:10.1136/bmjnp-2020-000074
18. Zhang J, Zhai Y, Feng XQ, et al. Gender Differences in the Prevalence of Overweight and Obesity, Associated Behaviors, and Weight-related Perceptions in a National Survey of Primary School Children in China. *Biomed Environ Sci*. 2018;31(1):1-11. doi:10.3967/bes2018.001
19. T. Lobstein and H. Brinsden, "Compiled by," *Atlas Child. Obesity*, 2019, Accessed: Jan. 27, 2022. Available: www.worldobesity.org

Резиме

ВЛИЈАНИЕТО НА ПАНДЕМИЈАТА НА КОВИД-19 ВРЗ ДЕТСКАТА ДЕБЕЛИНА ВО СЕВЕРНА МАКЕДОНИЈА: КОМПАРАТИВНА СТУДИЈА

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Детската дебелина претставува растечки глобален здравствен предизвик. Северна Македонија се рангира меѓу десетте европски земји со највисока преваленција на прекумерна тежина и дебелина кај децата. Нашата студија имаше цел да го процени влијанието на пандемијата на КОВИД-19 врз индексот на телесна маса (ВМИ) кај децата, преку компаративна анализа на податоци од пред и по пандемскиот период.

Спроведовме проспективна пресечна студија (февруари–април 2022), која опфати 1 004 деца на возраст од 6 до 13 години од северозападниот регион на земјата. Резултатите ги споредивме со податоци од 2019 година, кои вклучуваа 1 034 деца од истата возрастна група и регион.

Резултатите откриваат дека рестриктивните мерки поврзани со пандемијата придонесоа за зголемување на преваленцијата на прекумерна тежина од 13,5 % (2019) на 15,9 % (2022), додека дебелината порасна од 19,6 % на 21,9 %. Комбинираната преваленција на двете состојби се зголеми од 33 % на 37,4 %. Статистичката анализа потврди значајна корелација меѓу пандемијата и порастот на детската дебелина (хи-квадрат тест на Пирсон: $X^2 = 13,813$, $df = 3$, $p < 0,003$).

Забележавме и значајни родови разлики во податоците. Во 2019 година прекумерната тежина и дебелината биле 1,42 пати почести кај момчињата отколку кај девојчињата (OR = 1,42; 95 % CI: 1,09–1,84). Во 2022 година овој диспаритет дополнително се зголемил на 1,45 (OR = 1,45; 95 % CI: 1,12–1,88). Паралелно, забележано е општо намалување на неухранетоста во 2022 година споредено со 2019 година, со особено значителен пад кај момчињата на шестгодишна возраст ($p = 0,008$) и кај машката популација генерално ($p = 0,017$).

Според Светската федерација за дебелина Северна Македонија до 2030 година може да доживее зголемување на преваленцијата на прекумерната тежина и дебелина од 52,4 % деца, што значи дека 1 од 2 деца ќе биде погодено, ако не се спроведуваат ефективни стратегии за спречување и за управување со детската дебелина.

Клучни зборови: детска дебелина, преваленција, пандемија на Covid 19, РС Македонија