PUBLIC HEALTH

FAMILY SOCIOECONOMIC DIFFERENCES AMONG CHILDREN LIVING WITH OVERWEIGHT AND OBESITY IN NORTH MACEDONIA

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Citation: Stamenova A, Wallace LS, Mihajlova K, Dimitrievska L, Spiroski I. Family socioeconomic differences among children living with overweight and obesity in North Macedonia. Arch Pub Health 2024; 16 (2). doi.org/10.3889/aph.2024.6121

Online First

Key words: childhood obesity, socioeconomic status, health inequalities, WHO-COSI

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Received: 5-Jun-2024; **Revised:** 20-Aug-2024; **Accepted:** 30-Aug-2024; **Published:** 17-Sep-2024

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Competing Interests: The author have declared that no competing interests

Abstract

Globally, the prevalence of overweight and obesity is increasing among children and adolescents. Halting the rise in obesity is a significant challenge because of the complex interplay of factors and influences. We aimed to explore the role of family socioeconomic status (SES) indicators in relation to overweight and obesity prevalence rates among primary school children in North Macedonia. Materials and methods: Data were collected on a nationally representative sample of children and their parent(s)/caregiver(s) participating in the 6th round of World Health Organization (WHO)-European Childhood Obesity Surveillance Initiative (COSI) in North Macedonia. Every child had their height and weight objectively measured and their family sociodemographic and SES data were obtained through a self-reported record form by their parent(s)/caregiver(s). According to COSI reporting, responses on three SES indicators (parental educational attainment, parental employment status and family-perceived wealth) were categorized in levels for data analysis. Overweight and obesity rates were estimated based on 2007 WHO growth references. Pearson's $\chi 2$-tests, corrected with the Rao-Scott method, were used to test differences in overweight and obesity across various subgroups. Results: The sample consisted of primarily native-born children (97.3%) and parents (mothers - 96.2%; fathers - 97.6%), living in urban areas (66.9%), in two-parent families (84.9%) and spoke Macedonian at home (59.8%). The majority of children lived in families with low to medium SES level. Prevalence of overweight was 30.5% [95% CI: 28.5-32.7], whilst of obesity 14.1% [95% CI: 12.3-16.0]. There were no significant differences observed across family SES indicators in overweight or obesity rates. Conclusion: Our findings contribute towards reporting on family SES among children living with overweight and obesity to better understand and address potential obesity risk factors. Future research should focus on exploring family SES within the long-term context of children's health-related behaviours.

ЈАВНО ЗДРАВЈЕ

СОЦИОЕКОНОМСКИТЕ РАЗЛИКИ ПОМЕЃУ СЕМЕЈСТВАТА НА ДЕЦА СО ЗГОЛЕМЕНА ТЕЛЕСНА ТЕЖИНА И ДЕБЕЛИНА ВО СЕВЕРНА МАКЕДОНИЈА

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Цитирање: Стаменова А, Силвер Волис Л, Михајлова К, Димитриевска Љ, Спироски И. Социоекономските разлики помеѓу семејствата на деца со зголемена телесна тежина и дебелина во Северна Македонија. Арх Ј Здравје 2024;16 (2) doi.org/10.3889/aph.2022.6121

Online First

Клучни зборови: детска дебелина, социоекономски статус, здравствени нееднаквости, СЗО-COSI

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Примено: 5-јун-2024; **Ревидирано:**20-авг-2024; **Прифатено:** 30-авг-2024; **Објавено:** 17-сеп-2024

Печатарски права: ©2024. Александра Стаменова, Лорејн Силвер Волис, Катерина Михајлова, Љубица Димитриевска, Игор Спироски. Оваа статија е со отворен пристап дистрибуирана под условите на нелокализирана лиценца, која овозможува неограничена употреба, дистрибуција и репродукција на било кој медиум, доколку се цитираа торигиналниот(ите) автор(и) и изворот.

Конкурентски интереси: Авторот изјавува дека нема конкурентски интереси.

Извадок

На глобално ниво, стапката на преваленција од зголемена телесна тежина и дебелина кај деца и адолесценти се зголемува. Запирањето на порастот на дебелината е значаен предизвик поради комплексната интеракција на многу фактори и влијанија. Цел на студијата беше да се истражи улогата на социоекономскиот статус (СЕС) на семејството во однос на преваленцијата на зголемена телесна тежина и дебелина кај децата, ученици во основните училишта во Северна Македонија. Материјали и методи: Податоците беа собрани на национално репрезентативен примерок на деца и нивните родител(и)/старател(и), учесници во 6-от круг на СЗО - Европската иницијатива за следење на дебелината (COSI) во Северна Македонија. Телесната висина и тежина на секое дете беше објективно измерена, а социодемографските и СЕС податоци беа добиени од прашалникот за семејство пополнет од страна на нивните родител(и)/старател(и). Според претходни COSI публикации, одговорите за трите СЕС индикатори (степен на образование, работен статус и перцепции за економската благосостојба) беа категоризирани во нивоа за анализа на податоците. Стапките на зголемена телесна тежина и дебелина беа пресметани врз основа на СЗО референците за раст од 2007 година. Pearson-ов $\chi 2$-тест, коригиран со Rao-Scott методот, беа употребени за тестирање на разликите во стапките на зголемена телесна тежина и дебелина помеѓу различните подгрупи. Резултати: Примерокот за анализа се состоеше примарно од деца (97,3%) и родители мајка - 96,2%; татко - 97,6%) кои се родени во Македонија, живеат во урбани средини (66,9%), како дворoдителски семејства (84,9%), и зборуваат дома на македонски јазик (59,8%). Поголемиот број деца живееја во семејства со низок до среден социоекономски статус. Преваленцијата на зголемена телесна тежина беше 30,5% [95% CI: 28.5-32.7], додека на дебелина 14,1% [95% CI: 12.3-16.0]. Не беа забележани значајни разлики помеѓу индикаторите на семејниот СЕС и превалентноста на зголемена телесна тежина и дебелина. Заклучок: Нашите резултати придонесуваат кон евидентирање на социоекономскиот статус на семејството кај децата кои живеат со зголемена телесна тежина и дебелина со подобро разбирање и адресирање на потенцијалните ризик-фактори на дебелина. Идните истражувања треба да се фокусираат кон анализирање на семејниот СЕС во долгорочен контекст на поврзаноста со однесувањата поврзани со здравјето кај децата.

Introduction

Obesity is a significant public health challenge, which is often underestimated as priority by governments despite alarming evidence of adverse health outcomes and economic impact contributing to this complex disease[1]. Of particular concern are the growing overweight and obesity rates among youth; global estimates show that 390 million children and adolescents were living with overweight and obesity in 2022, while overweight (including obesity) prevalence doubled[2]. Data from the European Childhood Obesity Surveillance Initiative (COSI) highlights substantial differences in prevalence, especially as related to country income and paradoxically highest among children living in Mediterranean countries, as well as in North Macedonia.[3] Hence, the conditions in which children are born and grow as well as social determinants of health contribute to a complex interplay in childhood obesity risk.[4]

This is also supported by an overwhelming body of research which supports that despite strong genetic factors for obesity, environmental factors are crucial for expression of predisposition as well.[5,6] In essence, the perspective in understanding and prevention of obesity changed from individual towards socio-ecological approach and model (i.e., health-related behaviour is a result of personal factors, and interpersonal interactions at home, schools, community, as well as cultural and socioeconomic factors).[7]

The socioeconomic status (SES) is term in social epidemiology accessed through measuring the social position of the individual and associations between SES and health outcomes or mortality have been documented for centuries.[8] Previous studies and reviews have reported an inverse relationship between childhood obesity and high SES (i.e., parents education, employment, family income) in high-income countries, whilst a positive relationship has been observed in low-income and middle-income countries.[9-12] Children living in families with low SES have a greater risk of obesity regardless of the country's income.[13] Heterogeneous and inconsistent evidence are also observed, most likely as a result of the different methodology and indicators applied to measure and summarize SES in one value, which influences not only the results but conclusions on causality, and consequently policies.[14] Hence, understanding the local socioeconomic context of childhood obesity is essential for ensuring evidence-based public health action in halting obesity rates among children.

The aim of this study was to explore the role of family SES indicators in relation to overweight and/or obesity prevalence among a nationally representative sample of primary school children living in North Macedonia.

Materials and methods

Study Design and Data Collection Procedures

This study used data from the 6th round of World Health Organization (WHO) European Childhood Obesity Surveillance Initiative (COSI), conducted between October and December 2022 in North Macedonia. The Macedonian study protocol and data

collection procedures were in accordance with WHO-COSI methodology and standardized procedures.[15],[16] This system is implemented on the principles of 2002 International Ethical Guidelines for Biomedical Research involving human subjects.[17] Additionally, the national protocol was approved by the Ss. Cyril and Methodius University, Faculty of Medicine's Ethics Committee (approval: 03-2140/1 from 06.05.2022). This cross-sectional survey used a two-stage stratified cluster sampling approach in the recruitment of primary schools (second grade) and participants (children and parents/caregivers). In all previous WHO COSI rounds, primary schools in North Macedonia were stratified by location to ensure national representation, including socioeconomic diversity.

To address the purpose of this study, questions from the mandatory child and voluntary family forms were used. As part of the mandatory child form, each child's height and weight were measured according to WHO-COSI standardized procedures. Prior to data collection, parents were informed of study procedures and provided written informed consent for their child to participate. Data collection teams of trained physicians and nurses from regional and local Public Health Centres measured each child's body weight and height according to WHO-COSI standardized procedures after each child provided informed consent. Furthermore, each child's anthropometric measurements were performed in a private office and adhered to principles of confidentiality.

The voluntary family form includes a comprehensive battery of questions addressing both child and household characteristics. For the purposes of this study, questions addressing family sociodemographic (place of residence [urban or rural], child's place of birth, parent(s)/caregiver(s) place of birth, language spoken at home, and family living situation [one-parent, two-parents, extended family]) and socioeconomic characteristics were explored.

Classification of Children's Weight Status

Children's weight status was classified according to their BMI-for-age (BMI/A) Z-scores which were computed based on WHO growth references.[18,19] Overweight was defined as BMI/A ≥1 Z-score, while obesity was considered when BMI/A value ≥2 Z-score. Children with biologically implausible values were excluded from the analysis (i.e., BMI/A values below –5 or above +5 Z-scores) relative to 2007 WHO growth reference median.

Classification of Family Socioeconomic Status (SES)

The voluntary family record form included three questions addressing SES markers, including: (a) parental educational attainment, (b) parental employment, and (c) family-perceived wealth. Individual WHO-COSI questions for each SES marker and response options are presented in Table 1. For data analysis purposes, SES category levels were consistent with previous WHO COSI studies.[20]

Statistical Analysis

Multiple steps were employed to establish data quality assurance. Firstly, the national Macedonian COSI team reviewed and verified child and family forms for completeness. Next, data files were sent to the Regional European WHO Office for review and insertion of post-stratification weights to adjust for the complex sampling design, oversampling, and non-response error.

Descriptive analyses were calculated to depict children's sociodemographic characteristics, anthropometric measurements (BMI/A Z-scores and categories), and self-reported familial socioeconomic status. Prevalence estimates with 95% confidence intervals (CI) of overweight (including obesity) and obesity were calculated for the overall sample and by various subgroups (e.g., sex and family SES). Pearson's $\chi 2$-tests, corrected with the Rao-Scott method, were used to test differences in overweight and obesity across various subgroups. Statistical significance was set at $p<0.05$ *a priori*.

Table 1. World Health Organization (WHO) Childhood Obesity Surveillance Initiative (COSI) Predefined Family Socioeconomic Status (SES) Questions and Response Options

WHO COSI Family SES Questions and Response Options		Level of SES Categories for Data Analyses
Questions	**Response Options**	
Parental educational attainment		
What is the highest level of education you and your partner have completed? Please select one answer only for each of you	• Primary education or less (ISCED 0-1) • Lower secondary education (ISCED 2) • Upper secondary and post-secondary non-tertiary education (ISCED 3 and 4) • Short-cycle tertiary education or Bachelor's or equivalent level (ISCED 5 and 6) • Master's or Doctoral or equivalent level (ISCED 7 and 8)	(a) Low (both parents/caregivers reported education asISCED 0-1, 2, 3 or 4). (b) Medium (one parent with lower education and one parent with higher education) (c) High (both parents/ caregivers reported their education as ISCED 5, 6, 7, or 8).
Parental employment		
Which of the following best describes yours and/or your partner's main work over the last 6 months? Please select one answer only for each of you	• Full-time domestic housework/homemaker • Work full-time • Work part-time • Unemployed • Full-time education (i.e. student) • Sick/disabled • Something else	(a) Low (one or more parent(s) unemployed or economically inactive (i.e., comprises "full-time domestic housework/homemaker," "full-time education," "sick/disabled" and "retired" (b) High (both parents employed)
Family-perceived wealth		
Which of the following best describes your financial situation at home? Please select one answer only	• We barely make ends each month with our earnings • We have trouble making ends meet each month with our earnings • We get through the month without serious problems with our earnings • We easily get through the month with our earnings	(a) Low (those who barely or had trouble meeting the end of the month) (b) Medium (parents who met the end of the month with their earnings without serious problems) (c) High (those who easily met the end of the month with their earnings).

Results

The total sample included students (n=2783) present at school on the day of data collection who had completed information on age, sex, and anthropometric measures. Among those students, 96.4% (n=2683) returned at least a partially completed family form, with most (n=2667) returning a family form with completed SES indicators as well.

Family sociodemographic and socioeconomic characteristics are presented in Table 2. Overall, children and their parents/caregivers were born in North Macedonia. Most children lived in urban areas (66.9%), mainly in two-parent families (84.9%) and spoke Macedonian at home (59.8%). Approximately half of the families reported low educational level (49.4%), medium level of perceived wealth (52.8%), and current employment of both parents/caregivers (61.2%).

Table 2. Sociodemographic and socioeconomic characteristics of study sample

Sociodemographic characteristics		%
Residential urbanization	*Urban*	66.9
	Rural	33.1
Child's country of birth		
	Native-born child	97.3
	Foreign-born child	2.7
Parent(s)/Caregiver(s) country of birth		
	Native-born mother	96.2
	Foreign-born mother	3.8
	Native-born father	97.6
	Foreign-born father	2.4
Language spoken at home		
	Macedonian language	59.8
	Other languages	40.2
Family living situation		
	T*wo-parent family*	84.9
	One-parent family	11.3
	Other or extended family	3.8
Socioeconomic characteristics		%
Parents/Caregivers educational attainment		
	Low	49.4
	Medium	21.6
	High	29.1
Parents/Caregivers employment status		
	Low	38.8
	High	61.2
Family-perceived wealth		
	Low	20.2
	Medium	52.8
	High	27.0

As shown in Table 3, overall prevalence of overweight (including obesity) was 30.5% [95% CI: 28.5-32.7], whilst obesity prevalence was 14.1% [95% CI: 12.3-16.0]. As compared to girls, significantly more boys were overweight/obese (34.2% *versus* 26.9%, *p*=.0010) and obese (16.4% *versus* 11.6%, *p*=.0016).

Table 3. Prevalence of overweight (including obesity) and obesity, according to WHO standard definitions

		Overweight (including obesity)		Obesity	
Child's sex	Number of available observations	Prevalence (%) 95 % CI [lb-ub]	p value	Prevalence (%) 95 % CI [lb-ub]	p value
Boys	1339	34.2 [31.9-36.6]	*.0010*	16.4 [14.4-18.7]	*.0016*
Girls	1328	26.9 [23.6-30.4]		11.6 [9.5-14.2]	
Total	2667	30.5 [28.5-32.7]		14.1 [12.3-16.0]	

Notes: Overweight (BMI/A ≥1 Z-score), Obesity (BMI/A value ≥2 Z-score), estimated based on the 2007 WHO cut offs. Prevalence of overweight includes obesity according to WHO definition

Overall, overweight and obesity rates in relation to family SES indicators are presented in Tables 4 and 5. For both overweight and obesity, there were no significant differences observed across family SES indicators.

Table 4. Prevalence of overweight (including obesity) according to WHO definition among school children in relation to family SES indicators

Overweight			
	Number of available observations	Prevalence (%) 95 % CI [lb-ub]	p value
Parents' educational attainment			
Low	1185	31.4 [28.2-34.7]	.4357
Medium	596	32.9 [28.8-37.3]	
High	693	28.8 [24.1-34.1]	
Parents' employment status			
Low	693	29.4 [24.6-34.8]	.1731
High	1428	33.4 [30.6-36.3]	
Family-perceived wealth			
Low	485	30.6 [26.0-35.6]	.8584
Medium	1312	31.4 [28.0-35.0]	
High	710	30.0 [26.1-34.2]	
Type of family			
Two-parent family	2205	30.1 [27.8-32.4]	.1126
One-parent family	238	33.9 [27.4-41.0]	
Other or extended family	83	41.2 [29.8-33.1]	

Table 5. Prevalence and 95% CIs of obesity according to WHO definition among school children in relation to family SES indicators

Overweight			
	Number of available observations	**Prevalence (%) 95 % CI [lb-ub]**	**p value**
Parents' educational attainment			
Low	1185	15.5 [12.7-18.7]	.1765
Medium	596	15.2 [12.3-18.5]	
High	693	11.8 [9.2-15.1]	
Parents' employment status			
Low	693	15.2 [11.7-19.6]	.6063
High	1428	14.2 [12.4-16.1]	
Family-perceived wealth			
Low	485	16.4 [12.0-22.0]	.4419
Medium	1312	13.4 [11.1-16.1]	
High	710	14.3 [11.8-17.2]	
Type of family			
Two-parent family	2205	13.9 [11.9-16.1]	.4577
One-parent family	238	16.0 [11.0-22.7]	
Other or extended family	83	19.3 [10.4-33.1]	

Discussion

The findings obtained in this study were drawn from a nationally representative sample. Each child's height and weight were objectively measured using standardized procedures and equipment. Additionally, family SES was assessed using previously validated questions applied in all COSI countries, warranting comparability.

Our findings showed high prevalence rates of both overweight and obesity among primary school children in North Macedonia. Consistent with previous COSI rounds, overweight and obesity were more prevalent among boys in North Macedonia.[21] No significant differences emerged between overweight and/or obesity and family SES in our study, which did not reflect findings from previous studies from the first and fourth COSI round exploring SES[20,22] in WHO/Europe region, where strong associations were reported for parental education level among European countries, except for Central Asian countries, as well as association between family-perceived wealth and overweight and/or obesity. For the other SES indicator: parental employment status, no associations were demonstrated in the majority of high-income countries, except in few Balkan countries, Georgia and Turkey.

We could not dismiss the family SES context of overweight and/or obesity among children living in North Macedonia merely on these findings. Obesity is manifested by re-

sponses not only to present family circumstances but to all stages of the life-course, especially influencing child development.[23] Therefore, it is of concern that the majority of children lived in families with low and medium SES levels, especially that 20% of the families had low level of perceived-wealth, meaning they could not get through the month with their own earnings. As shown in previous research, this leads to a psychological distress, and financial scarcity that impairs health-related behaviours, especially dietary habits, resulting in maladaptive behaviours to financial stress and long-term responses and could eventually lead to obesity.[24, 25] Furthermore, this is supported in cohort studies, which also report on significant associations between low-income families and increased risk for obesity in preschool children.[26]

Important aspects and limitations should be considered in the interpretation of the results. Firstly, family SES was based on self-reported data from parents or caregivers, and the formation of the questions with predefined answers may have introduced a reporting bias. Secondly, participants with incomplete family forms on SES information were excluded from data analysis, which may have resulted in selection bias. Thirdly, survey response options on SES indicators were categorized for data analyses; therefore, results may have varied if a different statistical strategy was employed. Finally, the small number of available observations in subgroups and large variations might have influenced these results as well.

Conclusion

To the best of our knowledge, this is the first study in North Macedonia reporting on family socioeconomic aspects in childhood overweight and obesity after the COVID-19 pandemic. Halting childhood obesity rates is a significant challenge as obesity is a complex disease with an interplay of numerous factors and influences. Our study contributes towards the importance of reporting on family SES among children living with overweight and obesity for better understanding and addressing obesity in the national context. Future research should focus on exploring the family SES and children's health-related behaviours, not only overweight and obesity prevalence rates. Moreover, data generated from past COSI rounds should be pooled to explore family SES and overweight and obesity trends over time.

Acknowledgments

We express our sincere gratitude to all children, their parents and/or caregivers, school teachers and administrative staff participating in the 6th COSI round in North Macedonia. Furthermore, we are thankful to all teams for data collection from the Departments of hygiene and environmental health in the 10th Regional Centres for Public Health (CPH) across North Macedonia (CPH Skopje, CPH Kumanovo, CPH Kochani, CPH Shtip, CPH Strumica, CPH Veles, CPH Prilep, CPH Bitola, CPH Ohrid, and CPH Tetovo). Moreover, the authors express their grateful acknowledgement to Dr. Marta Buoncristiano (WHO Europe

COSI study consultant), for her advice and computation of statistical analyses.

Funding: This research was funded by the National Annual Public Health Programme in North Macedonia.

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