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EATING HABITS OF CHILDREN IN NORTH MACEDONIA: RESULTS FROM THE FIFTH ROUND OF THE CHILDHOOD OBESITY SURVEILLANCE INITIATIVE (COSI)

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Abstract

Introduction. In Europe, 29% of boys and 27% of girls aged seven to nine were overweight and 12% of boys and 9% of girls obese. Eating habits are important for understanding the obesity problem. The aim of this paper was to describe the eating behaviors of second grade children in North Macedonia (MKD).

Material and methods. A total of 3246 children were selected for data collection. Measurements of height and weight, as well as data for the eating habits was collected. Frequency of consumption of fruits, vegetables, soft drinks, savory snacks, and sweet snacks as well as breakfast consumption was used to create eating habits score.

Results. There were significantly more obese boys while more girls were overweight. Obesity was more prevalent in urban areas of the country. Majority of children practiced neither "healthy" nor "less healthy" nutrition behavior. Children whose parents has tertiary education had significantly lower score comparing to those whose parents have secondary or lower education. Dietary habits had not a significant impact on BMI. 75% of girls and 78% of boys had breakfast every day. 40% of children daily consumed fruit and 37% consumed vegetables. Consumption of soft drinks was significantly higher in boys.

Conclusion. Eating habits of children may shed light on root causes for obesity in MKD. There is much room for improvement in the intake of fruit and vegetables. Consumption of snacks and particularly soft drinks should be reduced. National obesity surveillance program that collects data and present evidence to policy makers is crucial and should be supported.

Keywords: eating habits, children, obesity, surveillance, health, noncommunicable diseases

Introduction

Noncommunicable diseases (NCDs) are the largest contributor to mortality worldwide. Over 70% of deaths are attributed to NCDs, killing 41 million people every year[1]. Risk factors for NCDs including nutrition and nutrition-related conditions like obesity are one of the major focus in public health efforts to decrease the high burden that NCDs put on individual health and health systems. The World Health Organization's (WHO) Global NCDs monitoring framework set up the list of indicators and voluntary targets for the countries to track progress in reaching the established targets until the year 2025. According to the foreseen scenarios, not a single country in the European region of the WHO is on track to meet one of the targets which aims to "halt the rise in diabetes and obesity"[2]. Overweight and

obesity is rising among children and adolescents with estimation of 124 million individuals of that age category (5-19 years) suffering from obesity and 213 million from overweight[3]. In Europe, data from the WHO's Childhood Obesity Surveillance Initiative (COSI) shows that 29% of boys and 27% of girls aged seven to nine years had overweight and there was a prevalence of obesity of 12% in boys and 9% in girls[4]. Situation in North Macedonia (MKD) is even worse with rising trends of overweight and obesity in 7-year old children from 2010 to 2019 and with prevalence from 2019 COSI round showing that 20.8% of boys and 16.1% of girls were obese[5].

Eating foods that assure health benefits is crucial to minimize diet-related risks for developing NCDs. Diet rich in fruit and vegetables, with appropriate intake of legumes, nuts and whole grains, and with limited intake of free sugars, salt and saturated fatty acids will enable the body to synthetize all needed compounds without endangering its functioning by increasing health risks[6,7]. Trans fatty acids should be eliminated from the diet. For that purpose, European Union (EU) member states started to regulate presence of trans fats since April 2021[8]. Sugar-sweetened beverages should also be limited because of their role in promoting obesity in children[9]. Dietary guidelines for the population in North Macedonia also stress these recommendations as particularly important for preventing premature occurrence of diet-related diseases[10].

The COSI provides data on anthropometric characteristics of the nutritional status as well as the eating behaviors of children across the European Region of the WHO. Established in 2007, COSI represents a unique monitoring system for collecting high-quality data for research and policy purposes[11]. Macedonia joined COSI in the second round in 2010/2011 school year and since then it has participated in all data collection rounds. COSI in North Macedonia has built up onto the already existing system of measuring height and weight among the school-aged children. Every school year, representative samples of children attending kindergartens, second and fifth graders and children attending 1st year of the secondary school are subject to height and weight measurements, in a coordinated action of the Institute of Public Health and the Centers of Public Health in the country. The measurements are provisioned in the National Annual Program of Public Health and are funded by the Government of the country[12]. Adjustment to COSI system additionally required fine tuning of the process of population's sample preparation and more frequent communication with the Ministry of Education and Science (MoES) due to the national and regional changes of the number of children enrolled in schools between two rounds of data collection.

Using the most recent data from the 2019 COSI round, the aim of this paper was to describe the eating behaviors of 7-year-old children in North Macedonia.

Material and methods

The data collection took place in the school premises in the period April-May 2019. National study protocol which was aligned to the COSI study protocol[13] was approved by the Ethics Committee of the Faculty of Medicine, Ss. Cyril and Methodius University in Skopje (approval no. 03-242/10 from 24.01.2019). Stratified two stage cluster sampling was performed: primary sampling units (PSU) were schools and secondary sampling units (SSU) were the second-grade classes. The stratification was done according to the territory covered by the ten Centers of Public Health (CPH) in North Macedonia with each center representing one stratum. Those 10 centers are distributed over the total territory of the country covering all statistical regions. The size of the schools was determined according to the number of second grade classes. Using the probability proportional to size sampling for each stratum and considering the distribution of urban and rural schools (according to the urban and rural distribution of population in the region covered by CPH), we performed the circular

systematic sampling for PSUs which resulted in 112 sampled schools in North Macedonia. To select SSUs, we implemented simple random sampling of a total of 437 second grade classes in 112 sampled schools, resulting in 185 classes with 3246 children selected for data collection.

Anthropometric measurements of body height and body weight, as well as the collection of data for the eating habits of children were performed according to the COSI data collection procedures[14,15]. Active consent (informed written consent from parents/guardians) had to be obtained before the measurement. Parents/guardians were contacted by the teachers who sent them the consent forms together with the *family form*, one of the three forms used in COSI. After receiving the signed consent form and filled in family form, the children were measured, and data was registered into the *child form*. The third form about the school nutrition environment or the *school form* was filled in by the responsible person in school (teacher, principal etc.). Body weight was measured to the nearest 0.1 kg with portable digital scales (SECA 881U), and body height was measured with stadiometers (SECA 217) to the nearest 0.1 cm. WHO child growth references were used to determine the weight classification of children[16]. Team from the Institute of Public Health verified the completeness of forms and quality of data before data processing. For the data on eating habits, parents were asked about having breakfast and the frequency of consumption of number of food items over the 7 days prior to data collection. For this paper, we report on the frequency of consumption of fruits, vegetables, soft drinks, savory snacks, and sweet snacks. The frequencies offered for choice were "never", "less than once a week", "some days (1–3 days)", "most days (4–6 days)", or "every day". Following the methodology explained elsewhere[17], to summarize the dietary behaviors of each child, we developed an "eating habits score" for each child. To calculate this score, each dietary measure was converted to a "healthy" or "less healthy" behavior. The "less healthy behaviors" included: not eating breakfast every day, not eating fresh fruit every day, not eating vegetables every day, eating savory snacks or sweets more than three days a week and consuming soft drinks more than three days a week. Each of the "less healthy" behaviors were given a score of one point, and for each child, the sum of scores was calculated. Scores ranged from zero (indicating a very healthy diet, where none of the "less healthy behaviors were observed), to six (indicating a less healthy diet, in which all of the 'less healthy behaviors' described above were observed). Chi-square test was used to compare the proportion of children in different Body Mass Index (BMI) categories and eating habits score among genders, parental education levels, physical activity level, and urbanization classes. Spearman's correlation was used to analyze the association between the eating habits score and BMI categories.

Results

A questionnaire was distributed among 3246 children, out of which 3180 provided complete anthropometric data available for the analysis. Comparing BMI categories between boys and girls we found significantly more boys in the obese category while among overweight children there were more girls as presented in Table 1 (p < 0.0001). In total, 38.5% of children in the second grade in North Macedonia were overweight or obese.

Table 1. Distribution of BMI categories by gender, N (%)

BMI category	Girls	Boys	Total
Underweight (SD < -2)	23 (1.4)	29 (1.9)	52 (1.6)
Normal (-2 < SD < 1)	989 (61.1)	915 (58.6)	1904 (59.9)
Overweight (1 < SD < 2)	348 (21.5)	259 (16.6)	607 (19.1)
Obese (SD > 2)	259 (16.0)	358 (22.9)	617 (19.4)

Besides gender, BMI categories were also analyzed with respect to parental education, physical activity, and urbanization. Among them, only urbanization was found as a significant factor with an impact on BMI. As presented in Table 2, number of obese and overweight children from the urban areas was significantly higher compared to the number of children who live in rural parts of North Macedonia ($p < 0.05$).

Table 2. Distribution of BMI categories by urbanization, N (%)

BMI category	Urban	Rural
Underweight (SD < -2)	37 (1.55)	15 (1.91)
Normal (-2 < SD < 1)	1404 (58.65)	500 (63.61)
Overweight (1 < SD < 2)	468 (19.55)	139 (17.68)
Obese (SD > 2)	485 (20.26)	132 (16.79)

Distribution of the total score by gender is presented in Figure 1 (0 indicating a very healthy diet, where none of the "less healthy behaviors" were observed, 6 indicating a less healthy diet, in which all of the "less healthy behaviors" described above were observed). Majority of children practiced average (meaning neither "healthy" nor "less healthy", index 3) nutrition behavior. When comparing "healthy and "less healthy" behavior, more children were distributed in the "healthy" nutrition behavior (45% for indexes 0-2) than in "less healthy" (28,7% for indexes 4-6). Among different socio-economic factors examined in relation to the total score, only parental education was found as associated. Children whose at least one parent has tertiary education had lower score comparing to those whose both parents have secondary or lower education level ($p<0.001$).
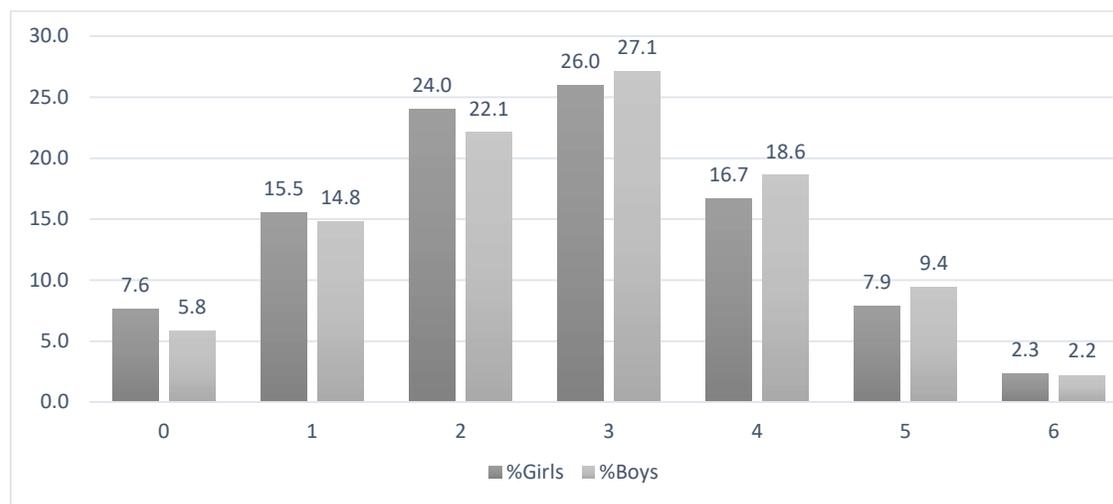

Fig. 1. Distribution of total score by gender

Table 3. Dietary habits by gender and BMI categories (%)

	Girls (%)				Boys (%)			
	Normal weight	Overweight	Obese	Total	Normal weight	Overweight	Obese	Total
Frequency of having breakfast								
Never	1.9	3.6	2.1	2.3	2.6	1.1	3.2	2.5
Some days (1-3 days)	12.7	8.8	15.4	12.3	10.5	14.0	10.2	11.1
Most days (4-6 days)	9.9	8.4	12.8	10.0	8.5	9.0	8.7	8.6
Every day	75.6	79.2	69.7	75.4	78.5	75.8	78.0	77.9
Frequency of fruit consumption								
Never or less than once per week	3.4	2.0	8.0	3.9	4.8	5.1	7.5	5.5
Some days (1-3 days)	25.5	27.2	29.8	26.6	28.2	27.5	26.8	27.8
Most days (4-6 days)	32.8	28.0	21.3	29.8	26.3	30.3	25.2	26.7
Every day	38.3	42.8	41.0	39.8	40.7	37.1	40.6	40.0
Frequency of vegetable consumption								
Never or less than once per week	6.3	5.6	9.0	6.6	7.5	7.3	9.1	7.8
Some days (1-3 days)	27.5	24.8	27.1	26.9	25.7	25.8	30.7	26.9
Most days (4-6 days)	28.3	30.8	26.1	28.5	31.4	31.5	24.0	29.7
Every day	37.9	38.8	37.8	38.1	35.4	35.4	36.2	35.6
Frequency of soft drinks consumption*								
Never or less than once per week	27.1	31.2	32.5	28.9	23.9	26.4	19.3	23.2
Some days (1-3 days)	32.8	34.0	36.2	33.7	33.7	25.8	33.1	32.2
Most days (4-6 days)	16.4	14.0	15.4	15.7	15.6	13.5	18.5	16.0
Every day	23.7	20.8	16.0	21.8	26.8	34.3	29.1	28.6
Frequency of savoury snacks consumption								
Never or less than once per week	22.4	25.2	20.7	22.7	24.7	21.4	21.3	23.3
Some days (1-3 days)	40.5	42.4	35.6	40.1	37.3	33.7	35.4	36.3
Most days (4-6 days)	19.4	18.4	23.9	20.0	18.8	21.9	24.4	20.7
Every day	17.7	14.0	19.7	17.2	19.1	23.0	18.9	19.7
Frequency of sweet snacks consumption								
Never or less than once per week	22.8	21.6	26.1	23.1	22.8	23.0	22.1	22.7
Some days (1-3 days)	35.5	43.2	31.9	36.6	34.8	29.8	34.3	33.8
Most days (4-6 days)	23.6	19.6	21.3	22.3	23.6	28.7	24.0	24.6
Every day	18.1	15.6	20.7	18.0	18.8	18.5	19.7	19.0

* Statistically significant difference of proportions between boys and girls – Chi-square test (p <0.001)

Table 3 presents distribution of children for each of the analyzed dietary habits by gender and BMI category. None of the analyzed dietary habits had a significant impact on BMI categories. However, it is notable that most of the children reported that they had breakfast every day (75% of girls and 78% of boys). Only 40% of children reported that they consumed fruit every day. Similarly, 38% of girls and 36% of boys reported consumption of vegetables on daily basis.

Consumption of soft drinks for more than three days per week was reported by a significantly higher proportion of boys (45%) compared to the proportion of examined girls (37%). A high proportion of children reported consumption of the savory snacks for more than three days per week (37% of girls and 40% of boys). Predominant unhealthy dietary habit is consumption of sweet snacks. It is worth to note that proportion of boys was again higher (44%) compared to examined girls (40%).

Discussion

Our study aimed to fill the gap on data about eating habits of children in the first grades of primary education in MKD. National available data mostly focuses on adolescents and their eating habits[18,19]. More in-depth data on food consumption and food frequency of children is expected when the data from the study conducted according to the European Food Safety Authority's (EFSA) EU Menu protocol will be published[20]. As reported elsewhere, childhood overweight and obesity is a growing public health problem with an increasing prevalence in MKD[5]. Overweight and obesity among urban children is more prevalent than among rural ones, as reported in other research[21,22]. However, some of the countries in Europe report higher prevalence of obesity among rural children, or not much difference among children from urban and rural areas[23,24]. Obesity in children usually persists to and throughout the adulthood. The global research finds that in Europe urban adults are more overweight and obese, but in some other parts of the world rural obesity is growing and driving the obesity epidemic[25]. Our findings suggest that even if only one parent has higher (tertiary) education, that significantly affects the quality of child's diet. That finding is in accordance with the findings of the European IDEFICS study where in the low and medium parental education level groups had lower odds of more frequently eating low-sugar and low-fat foods (vegetables, fruits, pasta/noodles/rice and whole meal bread) and higher odds of more frequently eating high-sugar and high-fat foods[26].

Frequency of consumption of breakfast and other foods may be compared with recently published data about dietary habits of children in most of the European countries[27]. Frequency of daily breakfast consumption among children in MKD is just around the European average (79%), with similar frequency of daily consumption as in Turkey, Czech Republic, Bulgaria, and Croatia. Having in mind the availability and favorable price of fruit and vegetables, the average daily fruit consumption should be improved. Fruit consumption around the European average (42%) but much lower than in some countries like Italy (73%) or Portugal (63%). Frequency of daily vegetable consumption is better since it is above the European average (22.6%) and comparably higher than in many countries. Daily consumption of both sweet and savory snacks is above the European average.

We have analyzed children's dietary habits in relation to gender and the BMI category. We did not find a significant impact of the analyzed dietary habits on BMI categories. However, the difference in frequency of soft drink consumption between boys and girls was highly significant indicating that a significantly higher proportion of boys consumed soft drinks more than three times a week. Additionally, daily soft drinks consumption of children in MKD was among highest when compared to other countries in the WHO European region. This correlates with the previous research that have examined and confirmed the higher prevalence of overweight and obesity among boys in MKD. However,

the same research showed worrying trends of obesity among girls as they are gradually closing the gap and approach the prevalence present among boys[5]. Consumption of sugar sweetened beverages is related to several health issues, particularly overweight and obesity[28-30].

Conclusion

Our research presents data from the large-scale comparable survey like COSI, which in one segment was focused on eating habits of primary school children. Although data was gathered with the food frequency retrospective method, it presents a current snapshot of nutrition landscape in this population of children. Childhood obesity grows into a concerning public health issue in MKD and eating habits of children may shed light on it for detection of root causes for this situation. Daily breakfast consumption of children is around the European average, but there is much room for improvement in the intake of fruit and vegetables. Reduction of intake of sweet and savory snacks should also be practiced and observed in future research. Soft drinks consumption seems to be one nutrition behavior that should be pinpointed since its daily consumption frequency is very high, and also shows a significant difference between boys and girls in MKD. Although there is a higher portion of children that practice "healthy" than "less healthy" nutrition behavior, most of the children practice average (meaning neither "healthy" nor "less healthy") one. Additional research that will use a combination of recall or diary methodology and frequency questionnaire in exploring the food consumption of children will give more in-depth analysis of the causes for such situation. The obtained data reaffirms the importance of existence of functional national obesity surveillance program like COSI in order to collect data and present evidence to policy makers for implementation of corrective measures.

Conflicts of interest declared by authors: None

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