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ORIGINAL PAPERS

THE INFLUENCE OF UNHEALTHY SNACKS ON CHILDREN'S BODY WEIGHT

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ABSTRACT

Background: Snacks play a crucial role in achieving a well-balanced daily nutrient intake. Children should have three meals a day and 2-3 snacks. The type and frequency of snacks can significantly affect their nutritional status.
Aim: Examining how children's body weight correlates with unhealthy snacking habits.
Methods: This article presents findings from a descriptive cross-sectional investigation. Data regarding dietary behaviors and physical metrics were obtained from the medical records of patients seen at five dental clinics associated with the School of Medicine, University of Mostar, Bosnia and Herzegovina. Employing age and gender-specific growth charts, the body mass index (BMI) was computed to categorize children's nutritional status. Subsequently, the correlation between children's dietary habits and their BMI category was analyzed.
Results: In this study 267 children were classified according to their frequency of consuming sweet snacks (such as biscuits, cakes, and chocolate) and salty snacks (like chips and flips). A significant relationship was found between BMI and gender, BMI and age, as well as BMI and eating habits. Boys showed a greater BMI compared to girls (p=0.026). School children displayed a notably higher incidence of overweight and obesity in contrast to preschool children (p=0.009). There were significantly more overweight and obese children in the group who consume sweet and salty snacks daily (p<0.001) compared to children who consume them weekly.
Conclusion: Daily intake of unhealthy snacks, like sweet and salty treats, heightens the risk of childhood overweight and obesity.

Keywords: Eating habits, pediatric obesity, snack food.

INTRODUCTION

Obesity is a global challenge for public health worldwide, impacting individuals across all age groups. Of particular concern is the alarming prevalence of childhood obesity, which often persists into adulthood [1]. The etiology of obesity is complex and includes genetic, environmental and economic factors. Among the environmental factors, the most important include eating habits and nutritional factors, physical activity, lifestyle and sedentary behavior. The overindulgence in foods abundant in saturated fats and refined carbohydrates is linked to the onset of obesity [2]. The early stages of childhood represent a critical time for preventing obesity [3].
Following the guidance of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), snacks are recognized as essential for maintaining adequate daily nutrient intake. Promoting fruits and vegetables as snack options is advocated, while avoiding ultra-processed snacks such as biscuits, cakes, chocolates, and chips is advised [1].
In recent years in Bosnia and Herzegovina (B&H) and around the world there has been a notable rise in the excessive consumption of salt and sugar with ultra-processed food and unhealthy snacking among children [4,5]. Previous studies in B&H have examined eating habits as a risk factor for obesity in children as well as the correlation between parents' educational levels and children's eating habits [4,6].
The aim of this study was to assess how unhealthy snacks, comprising both sweet and salty selections, affect children's body mass index (BMI). Data were sourced from the city of Mostar, Bosnia and Herzegovina, for this inquiry.

PATIENTS AND METHODS

Patients and study design

This cross-sectional observational study was carried from May to October 2022. Data pertaining to dietary patterns and anthropometric measurements were derived from the medical records of children visiting five dental clinics associated with the School of Medicine, University of Mostar, Bosnia and Herzegovina. The study's data are a component of a larger project exploring the link between nutrition and overall health, including oral health [4]. All children, accompanied by their mothers. Participation was voluntary, and informed consent was obtained from all mothers. The research protocol was approved by the competent ethics committee.

Methods

The study comprised a total of 267 children ranging in age from 2 to 18 years. Participants were selected based on their health status, excluding those with chronic diseases or any restrictions on the consumption of specific foods. The medical records were structured into three sections. The first part contained data on socioeconomic status and children's eating habits, including the frequency of consuming biscuits, cakes, chocolates, chips, and flips. The subsequent segment encompassed data regarding physical attributes (body weight and height) and oral health, whereas the subsequent section incorporated details concerning periodontal status [4]. For this research, data from the first and second parts of the medical records were utilized. Based on the responses provided by mothers, the children were divided into two groups: the initial group comprised those who consumed sweet and salty snacks daily, while the subsequent group consisted of children who indulged in such snacks 1-3 times per week.

The children were measured and weighed in light clothes, without shoes. The measuring instruments were calibrated before each measurement. BMI was computed utilizing the formula: BMI = weight in kilograms / height in meters squared. Subsequently, calculated BMI values were compared to percentiles on age- and gender-specific growth charts, as established by the collaboration between the National Center for Health Statistics and the National Center for Chronic Disease Prevention and Health Promotion. These comparisons were used to categorize children as underweight, healthy weight, overweight, or obese [7].

Statistical analysis

Data analysis utilized standard descriptive statistical methods, presenting descriptive variables as means and standard deviations (SD). The study utilized the Fisher exact probability test and Chi-squared test to identify statistically significant disparities by gender within two distinct age groups. The level of statistical significance was set at $p < 0.05$. The Rcmdr statistical software package was utilized for conducting statistical data analysis (version 2.8-0).

RESULTS

The study encompassed 267 children aged between 2 and 18 years, the mean±SD of age was 9.75±4.34 years. In the total sample, 183 (68.6%) children were of healthy weight, 15 (5.6%) were underweight, 43 (16.1%) were overweight and 26 (9.7%) children were obese. Among the participants, 136 (51%) were male, while 131 (49%) were female. There were 29 (21.3%) boys who were overweight, and 17 (12.5%) were obese. Among the overweight girls there were 14 (10.7%) and obese 9 (6.9%) (Figure 1).

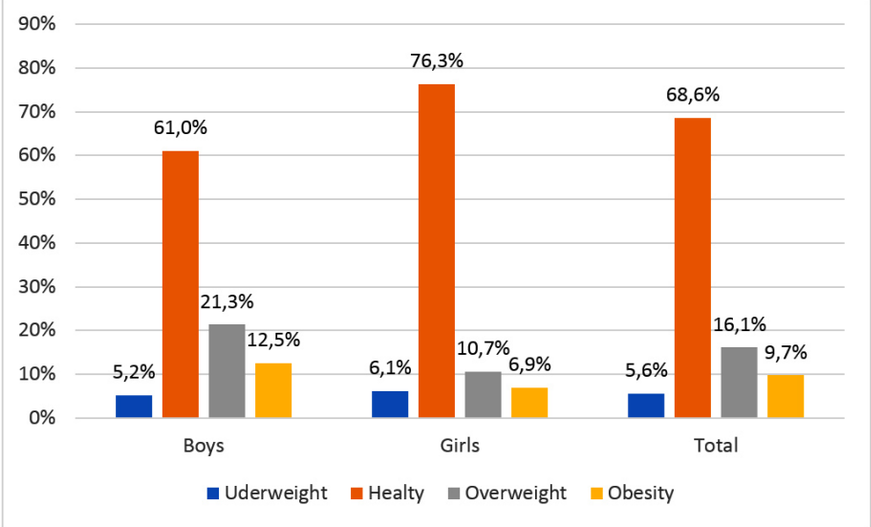

Figure 1. Categorization of children in the total sample based on BMI

Based on the frequency of sweet (biscuits, cakes, chocolate) and salty (chips, flips) snack consumption, children from the overall sample were divided into two groups. The initial group consists of children who consumed sweet and salty snacks once or more daily, while the second group comprises children who consumed these snacks 1-3 times per week.

In the initial group, there were 195 (73%) children who consumed sweet and salty snacks once or more daily. The mean±SD of age was 9.57±4.29 years. In terms of the age of the children, 61 (31.3%) were preschoolers, and 134 (68.7%) were school children. The representation of boys and girls among preschoolers was nearly equal, with 31 (50.8%) girls and 30 (49.2%) boys. In this group, the number of overweight and obese children was equal among boys and girls of preschool age. Among schoolchildren, 72 (53.7%) were boys, and 62 (46.3%) were girls who ingested sweet and salty snacks once or more per day. There were 24 (33.3%) boys who were overweight, and 10 (13.9%) boys who were obese. Among girls, 11 (17.7%) were overweight, and 3 (4.8%) were obese. In the first group, school children, especially boys, demonstrated a significantly higher prevalence of being overweight and obese compared to preschool children (p=0.018), (Table 1).

Table 1. Categorization of children from the first group

Daily consumption of sweet and salty snacks (one or more times a day)				
BMI	underweight	healthy	overweight	obesity
Preschool children n=61	6	37	6	12
male No (%)	3 (10.0)	18 (60.0)	3 (10.0)	6 (20.0)
female No (%)	3 (9.7)	19 (61.3)	3 (9.7)	6 (19.4)
School children n=134	5	81	35	13
male No (%)	3 (4.2)	35 (48.6)	24 (33.3)	10 (13.9)
female No (%)	2 (3.2)	46 (74.2)	11 (17.7)	3 (4.8)

BMI (Body mass index). *Fisher exact probability test

The subsequent group consisted of 72 (27%) children who consumed sweet and salty snacks 1-3 times per week. The mean±SD of age was 9.97±4.34 years. In terms of the age of the children, 20 (27.8%) were preschoolers and 52 (72.2%) were school children. Among preschool children, there were 11 (55%) boys and 9 (45%) girls. Notably, no girls in this group among preschoolers were overweight or obese, but 2 (18.2%) boys were overweight, and 1 (9.1%) was obese. Two girls were underweight. Among school children who consumed sweet and salty snacks 1-3 times a week, there were no instances of overweight or obesity. Two children in this group were underweight (one boy and one girl). In this group most of the school children were of healthy weight, with 22 (95.7%) boys and 28 (96.6%) girls, (Table 2).

Table 2. Categorization of children from the second group

Weekly consumption of sweet and salty snacks (1-3 times a week)				
BMI	underweight	healthy	overweight	obesity
Preschool children n=20	2	15	2	1
male No (%)	0 (0.0)	8 (72.7)	2 (18.2)	1 (9.1)
female No (%)	2 (22.2)	7 (77.8)	0 (0.0)	0 (0.0)
School children n=52	2	50	0	0
male No (%)	1 (4.3)	22 (95.7)	0 (0.0)	0 (0.0)
female No (%)	1 (3.4)	28 (96.6)	0 (0.0)	0 (0.0)

BMI (Body mass index). *Fisher exact probability test

In the total sample significant relationship was found between BMI and gender, BMI and age, as well as BMI and eating habits. Boys showed a greater BMI compared to girls (p=0.026). School children displayed a notably higher incidence of overweight and obesity in contrast to preschool children (p=0.009). Furthermore, the prevalence of overweight and obesity was significantly

higher in the group of children consuming sweet and salty snacks daily (p<0.001) compared to those consuming them weekly (Table 3).

Table 3. Categorization of children from the total sample

BMI	underweight	healthy	overweight	obesity	p
	N (%)	N (%)	N (%)	N (%)	
Gender					
male	7 (46.7%)	83 (45.4%)	29 (67.4%)	17 (65.4%)	0.026†
female	8 (53.3%)	100 (54.6%)	14 (32.6%)	9 (34.6%)	
Age of children					
preschool children	8 (53.3%)	52 (28.4%)	8 (18.6%)	13 (50%)	0.009†
school children	7 (46.7%)	131 (71.6%)	35 (81.4%)	13 (50%)	
Consumption of sweet and salty snacks					
daily consumption	11 (73.3%)	118 (64.5%)	41 (95.3%)	25 (96.2%)	<0.001*
weekly consumption	4 (26.7%)	65 (35.5%)	2 (4.7%)	1 (3.8%)	

BMI (Body mass index). †Chi-squared test. * Fisher exact probability test

DISCUSSION

This study showed that unhealthy snacks (sweet and salty snacks), especially if children consume them on a daily basis, can play a role in the onset of overweight and obesity. Snacks play a crucial role in achieving a well-balanced daily nutrient intake. Embracing Mediterranean and Nordic diets could offer a promising strategy for averting obesity [2]. Data from 2016 indicated that countries with obesity prevalence among children exceeding 10% included Italy (12.5%), Turkey (11.5%), Hungary (11.1%), Croatia (10.9%), and several others [1].

According to data from B&H in 2019, as reported by Spahić et al., among 2500 children aged 3–10 years, the prevalence rates were 14.4% for overweight and 14.8% for obesity. This study underscores the significance of educating parents on the principles of healthy eating, promoting physical activity, and encouraging positive parental feeding practices [6].

In our study, among a total of 267 children, 16.1% were overweight, and 9.7% were obese. Boys exhibited a greater prevalence of overweight and obesity in comparison to girls, particularly evident among boys of school age. Similar findings were observed in a study conducted in southern Saudi Arabia, which involved 300 children having an average age of 8.6 years. The study's data unveiled that close to one-third of the children were overweight or obese, with higher rates observed among older children who frequently indulged in unhealthy foods like sweets, chocolate, and snacks [8].

The school-based case-control study from India highlighted various risk factors statistically linked to adolescent obesity, such as elevated consumption of fast food, sweets, and insufficient intake of fruits [9]. The increased consumption of unhealthy food among school children can be attributed to factors such as packaging, branding, advertising, as well as the accessibility of these foods within the school setting [10].

A recent survey study from Poland revealed that boys demonstrated a notably higher frequency of consuming sugar-sweetened carbonated beverages compared to girls. Moreover, the study noted that older children, who had some degree of autonomy in food selection, tended to opt for more unhealthy dietary choices compared to their younger counterparts [11].

In a New Zealand study, researchers used wearable cameras and the Global Positioning System (GPS) to examine the daily environments of 158 children aged 11–13. They aimed to understand snacking habits. The study found that 68.3% of snacks were unhealthy. In public spaces, children consumed 15 times more unhealthy snacks than healthy ones, compared to 2.4 times more in schools and 1.7 times more at home [12]. This discrepancy was associated with unhealthy marketing in public spaces. The data highlights the necessity of environmental modifications to encourage healthy choices among children [13].

Recently, there has been a noticeable increase in the consumption of ultra-processed food worldwide [14]. A study from B&H, including 477 children aged 2-18 years, revealed that 31.7% of preschoolers and 68.3% of school children consumed biscuits, chocolate, and cakes daily. The rate of consuming these items multiple times a day was notably higher among children whose mothers had a high school education, in contrast to

those with university degrees [4]. Lower socioeconomic conditions and increased screen use during meals may contribute to frequent snack consumption [15]. However, parenting style and nutritional literacy are considered more crucial factors in this context [16,17].

Data from our neighboring country, Serbia indicates a total the combined prevalence of overweight and obesity was recorded at 28.9%. Findings unveiled that 12.4% of Serbian children indulge in salty snacks daily, with 20.2% consuming sweets on a daily basis [18].

In a study conducted in Croatia, encompassing 598 children aged 3-7 years, it was found that 20.8% of the children were overweight or obese. The study's primary focus was on assessing the influence of the Mediterranean diet (MeDi) on nutritional status and health. Notably, almost half (49%) of the study's participants, specifically preschool children, displayed inadequate adherence to MeDi principles, signaling a worrisome trend [19].

To ensure the success of preventive measures, addressing the obesity epidemic must become a political priority, with support from all levels of government [20].

This study could have been more impactful with a larger sample size and broader inclusion, such as involving parents in pediatric dispensaries, preschool, and school institutions. Being a cross-sectional study, it does not establish a causal relationship between BMI and the consumption of unhealthy snacks. Other relevant parameters, including physical activity, sedentary behaviors, parenting styles, and food marketing, were not considered in the research, limiting a comprehensive understanding of their influence on BMI.

Despite the mentioned limitations, the study's significance lies in highlighting the existence of unhealthy eating habits and their impact on BMI, particularly among school children. The data obtained can be valuable for developing educational workshops for both parents and children, as well as for creating guidelines to promote healthy eating habits, with a specific focus on encouraging the consumption of healthy snacks.

CONCLUSION

In conclusion, it is crucial to educate parents about the adverse effects of excessive salt and sugar consumption on children's health. While sweet and salty snacks are a common part of the diet, particularly in childhood, an outright prohibition may not be practical. Instead, focusing on educating children about healthy nutrition within the family, preschool, and school environments, coupled with restricted availability of sweets and salty snacks, and ensuring equal access to healthy nutrition for all children, can play a significant role in enhancing health and preventing overweight and obesity.

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