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PHYSICAL ACTIVITY, SEDENTARY BEHAVIOUR, AND SELECTED DIETARY HABITS OF MIDDLE SCHOOL–AGED CHILDREN IN THE UNA-SANA CANTON (BOSNIA AND HERZEGOVINA)

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Summary

The aim of this study was to analyse physical activity, sedentary behaviour, and dietary habits related to meal characteristics among younger school-age children in the Una-Sana Canton (USC), as well as parents' perceptions of their children's habits. The study was conducted on a sample of 300 children (7–11 years old) from seven schools in rural and urban areas, together with their 278 parents. Data were collected using age-appropriate questionnaires based on 24-hour dietary recall and a Food Frequency Questionnaire (FFQ), while descriptive statistics, ANOVA, and Duncan's post-hoc test were used for data analysis. The results show that 61.7% of children exercise more than twice a week for at least 1 hour per day, while 28.3% exercise less than twice a week or do not exercise at all. Regarding sedentary behaviour, 29.3% of children spend more than two hours per day in front of screens. School meals are not organised in most schools; therefore, an average of 42.9% of children consume a home-prepared meal, while the remaining children consume bakery sandwiches or pastries, snacks from the school kiosk, or commercially available sweet and salty products, all of which represent unhealthy dietary habits. The proportion of children who do not consume anything at school is 2.7%. A total of 49.7% of children eat meals with their families, while parents report that 61.9% of children have one cooked meal and 34.9% have two cooked meals per day. The findings also indicate that 12.6% of parents believe their child is overweight, whereas the actual proportion of children who are overweight or obese is 30.1%, pointing to misperceptions regarding nutritional status in 17.5% of parents. Most parents recognise the importance of healthy eating (93.2%) and are willing to change their habits for their child's health (92.4%); however, 48.9% express the need for additional education.

Keywords: younger school-age children, physical activity, sedentary behaviour, dietary habits

Introduction

The World Health Organization (WHO) published the Guidelines on Physical Activity and Sedentary Behaviour (WHO, 2020), providing a scientifically based framework for promoting physical activity and reducing sedentary lifestyles. It states that physical inactivity is one of the most significant risk factors for the development of chronic non-communicable diseases (NCDs), such as obesity, cardiovascular diseases, type 2 diabetes, and depression, while Guthold et al. (2018) also note an increased risk of certain cancers. Considering WHO data showing that NCDs account for approximately 74% of all deaths worldwide, this issue is regarded as a major public health concern (WHO, 2025), particularly affecting low- and middle-income countries, including Bosnia and Herzegovina (BiH), classified as an upper-middle-income country (WB, 2025). Sedentary behaviour is another key risk factor for NCDs. In recent years, people have been spending increasing amounts of time sitting in front of various screens, which negatively affects health even when individuals engage in physical activity (Owen et al., 2010; Tremblay et al., 2017). In addition, dietary habits are inseparable from health risks, as they can contribute to the development of physical (Craigie et al., 2011; GBD 2019 Risk Factors Collaborators, 2020) and mental disorders that affect quality of life (Opie et al., 2015). All these risks are exceptionally important during childhood and adolescence, as behavioural patterns formed during this period often persist throughout life (Janssen and LeBlanc, 2010).

These issues appear to have become more pronounced in recent years in BiH. A review of the literature reveals studies on the prevalence of obesity in different age groups (Pavlović et al., 2024), showing worrying trends. According to WHO and UNICEF BiH, obesity is present in 8.0% of children aged 5–9 years and 4.6% of adolescents and youth aged 10–19 years. Projections suggest an increase in obesity by 2030 to 29% among children aged 5–9 years and 38.7% among those aged 10–19 years, in the absence of interventions and treatment (WOF, 2018). However, attempts to identify literature addressing physical inactivity, sedentary behaviour, and

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unhealthy dietary habits among younger school-age children in BiH reveal a lack of adequate sources. Various regional or local studies were found, both older and more recent, but they are generally fragmented, methodologically heterogeneous, and notably lacking in systematic, nationally representative research. The first attempt at systematic documentation of dietary patterns was a pilot study within the B&H MENU project, which showed that 66% of adolescents in BiH spend 3 to 8 hours per day sitting, while 73% engage in moderate daily physical activity (Brenjo et al., 2018). Additional challenges relate to institutional and administrative factors in BiH, as the education system is decentralised, limiting the implementation of standardised school-based monitoring programmes. Moreover, almost no schools have a canteen providing warm meals, leaving children dependent on purchasing food from bakeries and other food outlets, which contributes to unhealthy dietary habits.

Taking all these factors into account, there is a need to define the physical activity, sedentary behaviour, and selected dietary habits of younger school-age children in the Una-Sana Canton (USC), and, based on the results, to propose guidelines to the competent Ministry of Education for educational interventions and programmes aimed at encouraging regular physical activity, reducing sedentary time, and improving dietary habits among children and their parents.

Materials and methodology

Participants

This study included 300 younger school-age children from three cities in the Una-Sana Canton (USC), attending seven schools—three in rural areas (49.6%) and four in urban areas (50.4%). The children were aged 7 to 11 years and attended grades two through five. Additionally, 278 parents participated, with 50.7% from rural and 49.3% from urban areas. Statistically significant differences ($p \leq 0.05$) in participant distribution by place of residence were observed in both groups, children and parents. Among the children, 8.7% were classified as underweight, 60.7% as normal weight, 17.0% as overweight, and 13.7% as obese. Statistically significant differences in nutritional status were observed by sex ($p \leq 0.05$), but not by place of residence. Comparisons with USDA's MyPlate recommendations (USDA, 2019) indicated that children exhibited some positive dietary habits (81.3% eat breakfast daily, 69.8% consume three main meals, 52.9% consume two or more servings of fruit, 83.7% drink water as the main beverage), but also some negative habits (52.9% consume only one serving of vegetables, 51.0% less than 250 mL of milk, 69.3% consume insufficient portions of meat, and 46.7% eat sweets and snacks daily) (Osmančević-Muminović, 2024).

Methods

The study was conducted using an age-appropriate questionnaire for children, adapted from similar studies (Lynch et al., 2014; Bilić-Kirin, 2017). The questionnaire was based on 24-hour dietary recall and the Food Frequency Questionnaire (FFQ). In addition to dietary habits, which included characteristics of daily meals, physical activity habits and the number of sedentary hours were also examined. A separate questionnaire was administered to parents to obtain their perceptions of their children's habits. The study was conducted in classrooms during the 2023/2024 school year (September and October) and was anonymous. Data analysis employed descriptive statistics, while statistically significant differences between rural and urban areas were assessed at a significance level of $p \leq 0.05$ using ANOVA to confirm or reject differences, and Duncan's post-hoc test to compare significant differences between responses and variables. Analyses were performed using Microsoft Office 2016 and the demo version of the XLSTAT-Pro 2024 statistical package for MS Office.

Results and discussion

Table 1 presents the survey results (%; ANOVA) for students (questions 1–8) and parents (questions 3–8), noting that question 6 asked parents about preparing school meals, question 7 about the number of cooked family meals, and question 8 was directed only to parents. According to WHO recommendations (2020), children and adolescents should engage in at least 1 hour of physical activity daily. In this study, the question asked how many times per week children exercise for at least 1 hour per day, and on average 61.7% reported exercising more than twice a week. Considering that a similar proportion of children participate in sports training, the typical number of club training sessions (3–4 per week), and the number of hours of physical education at school (2 per week), it can be concluded that approximately 61% of children achieve satisfactory physical activity levels. However, a substantial proportion exercise less than twice a week or not at all (28.3%). Comparing these results with other countries, for example Croatia, where 11- to 15-year-old children and adolescents engaging in at least 1 hour of daily physical activity

range from 13.0% to 30.9% (Pedišić et al., 2022), Montenegro, where 70.96% of children aged 6–9 years have at least 1 hour of active play per day (Masanović et al., 2024), or the COSI study (WHO/COSI, 2020), which reports data for 25 European countries showing that 61.7% to 98.3% of children aged 6–9 years engage in more than 1 hour of active play daily, our findings fall somewhere in between. Literature does not provide a clear EU average for weekly hours of sports activity for children aged 6–10 years; like most studied parameters, available data are fragmented, highlighting the need for coordinated monitoring.

Table 1. Physical activity, sedentary behaviour, and selected dietary habits of children according to children's and parents' responses

Questions	Answers	Parents (%)			Children (%)		
		Rural	Urban	Total	Rural	Urban	Total
(1) Do you practice any sport?	Yes	53.8 ^{Aa}	68.8 ^{Aa}	61.7	-	-	-
	No	46.2 ^{Ba}	31.2 ^{Ba}	38.3	-	-	-
(2) How many times per week are you physically active for at least 1 hour?	Not at all	4.2 ^{Da}	3.8 ^{Ca}	4.0	-	-	-
	Once	24.5 ^{Ba}	14.0 ^{Bb}	19.0	-	-	-
	Two times	16.8 ^{Ca}	14.0 ^{Ba}	15.3	-	-	-
	More than two times	54.5 ^{Aa}	68.2 ^{Ab}	61.7	-	-	-
(3) How many hours per day do you spend in front of various screens?	Not at all, I'm not interested	14.0 ^{Ca}	13.4 ^{Ca}	13.4	17.5 ^{Ca}	16.1 ^{Ca}	16.9
	Every day, 1–2 hours	53.1 ^{Ac}	57.3 ^{Ac}	57.3	60.3 ^{Aa}	61.5 ^{Aa}	60.8
	Every day, more than 2 hours	32.9 ^{Ba}	29.3 ^{Ba}	29.3	22.2 ^{Ba}	22.4 ^{Ba}	22.3
(4) Do you eat breakfast every day?	Yes	75.5 ^{Aa}	86.6 ^{Aa}	81.3	69.5 ^{Ca}	80.3 ^{Cb}	74.8
	No	4.9 ^{Ca}	3.2 ^{Ca}	4.0	0.7 ^{Ba}	2.9 ^{Bb}	1.8
	Sometimes	19.6 ^{Ba}	10.2 ^{Ba}	14.7	29.8 ^{Aa}	16.8 ^{Ab}	23.4
(5) Do you eat at the school canteen?	Yes	38.5 ^{Ba}	49.0 ^{Ba}	44.0	73.0 ^{Aa}	62.0 ^{Aa}	67.6
	No	61.5 ^{Aa}	51.0 ^{Aa}	56.0	27.0 ^{Ba}	38.0 ^{Bb}	32.4
(6) What do you eat at school?	Home-prepared meal	55.9 ^{Aa}	29.9 ^{Bb}	42.3	73.0 ^{Aa}	62.0 ^{Aa}	67.6
	School snack	2.8 ^{Fa}	31.8 ^{Ab}	18.0	27.0 ^{Ba}	38.0 ^{Ba}	32.4
	Sandwich/pastry from a bakery	21.7 ^{Ba}	17.8 ^{Cb}	19.7	-	-	-
	Chips, juice, cookies	4.9 ^{Da}	1.9 ^{Eb}	3.3	-	-	-
	A bit of everything	11.2 ^{Ca}	16.6 ^{Db}	14.0	-	-	-
	None of the above	3.5 ^{Ea}	2.0 ^{Eb}	2.7	-	-	-
(7) How many meals do you eat together with your family members?	Three main meals	42.7 ^{Aa}	56.1 ^{Aa}	49.7	-	-	-
	One meal	12.6 ^{Ca}	8.9 ^{Ca}	10.7	61.0 ^{Aa}	62.8 ^{Aa}	61.9
	Two meals	38.5 ^{Ba}	26.1 ^{Ba}	32.0	36.9 ^{Ba}	32.8 ^{Bb}	34.9
	I don't have time for any	4.2 ^{Da}	5.7 ^{Da}	5.0	2.1 ^{Ca}	4.4 ^{Cb}	3.2
(8) When is your last meal of the day?	Before 6 p.m.	-	-	-	33.3 ^{Ba}	28.5 ^{Bb}	30.9
	Before 8 p.m.	-	-	-	58.9 ^{Aa}	54.0 ^{Aa}	56.5
	Before 10.m.	-	-	-	7.8 ^{Cc}	17.5 ^{Cc}	12.6

Legend: $^{a, b, c, d}$ Different letters within rows and columns indicate significant differences ($p \leq 0.05$) based on Duncan's test.

A similar situation is observed with sedentary behaviour. Although WHO recommendations (2020) do not specify a strict maximum number of hours spent in front of screens, they advise limiting time spent in sedentary activities. Literature shows that screen time varies across countries and age groups. For example, in Croatia, 52% of primary school children spend more than two hours per day in front of screens (Pedišić et al., 2022). The IDEFICS study conducted in eight EU countries reported that children aged 2 to 10 years spend more than 2 hours per day on screens, with 20% on weekdays and 52% on weekends (Santaliestra-Pasías et al., 2014). In contrast, in Montenegro, 72.1% of children aged 6 to 9 years do not exceed two hours of screen time per day (Masanović et al., 2024). Additionally, the COSI study (WHO/COSI, 2020) showed that, on average, 62.0% of children spend less than 2 hours per day in front of screens. According to our research, 29.3% of children spend more than 2 hours per day in front of screens, which again places our results between those of other countries. It should be noted that for question 2, statistically significant differences were observed between rural and urban areas for all response categories.

Table 1 also presents questions and responses (from question 4 onwards) related to dietary habits,

including meals at home and at school. Breakfast is particularly important, as skipping breakfast is among the dietary habits associated with excess weight in children (Wang et al., 2023). For example, Hasanović et al., (2025) investigated the association between breakfast consumption and weight status in children aged 7 to 10 years, concluding that eating breakfast has a protective effect against obesity. In the present study, breakfast skipping was reported by 24.5% of children in rural areas and 13.4% in urban areas, based on children's responses, with no statistically significant differences between areas. According to parents' responses, 30.5% of children in rural areas and 19.7% in urban areas skip breakfast, and these differences were statistically significant. Comparative studies show that 13.1% of children in Germany skip breakfast (Kesztyüs et al., 2017), while in Slovenia 44% and in Spain 8% of children skip breakfast on weekdays, 21% in Greece and 7% in Norway on weekends (Manios et al., 2015). These comparisons suggest that a higher proportion of children in the USC skip breakfast than indicated by these international figures.

School meals are an important part of students' diets in general, including younger school-age children. They can provide up to 60% of daily energy intake and improve overall diet quality, provided they are varied and nutritionally adequate (WHO, 2006). However, research using various food diversity indices shows that the quality of school meals is often insufficient (Ilić et al., 2022; Dello Russo et al., 2023). Unfortunately, in BiH, most schools do not offer organised school meals with a hot option, so children generally rely on meals brought from home, purchases from bakeries, or snacks from small shops offering sandwiches, bakery products, and different sweet and savory food products. Accordingly, our results show that 55.9% of children in rural areas and 29.9% in urban areas consume a home-prepared meal at school. It is interesting to note parents' responses to this question: 73.0% of rural and 62.0% of urban parents reported preparing a school meal for their child, with statistically significant differences observed between areas. On average, 19.7% of children consume a sandwich or pastry from a bakery, 18.0% a snack purchased at the school kiosk, 14.0% a bit of everything, and approximately 2.7% do not consume anything at school.

The last two questions addressed children's meal habits at home, with their families. Children were asked about the number of meals they consume with their family, while parents were asked about the number of cooked meals and the timing of the last meal of the day. Family meals, regardless of meal composition or frequency, are important for the health and psychosocial outcomes of children and adolescents. A higher frequency of shared meals has been associated with protection against poor dietary quality, obesity, risky behaviours, mental health issues, and better academic performance (Snuggs and Harvey, 2023). Although some studies report contradictory findings, for example, Royo et al. (2024) linked a reduced risk of childhood overweight to consuming at least 50% of daily meals with the family. Results from this study show that a large proportion of children (49.7%) eat three main meals with their family. According to parents, 61.9% reported one cooked meal and 34.9% reported two cooked meals. These are satisfactory results, as only 5% of children reported having no family meals. The last meal should, according to recommendations, be 2 to 3 hours before bedtime (NSF, 2025).

For younger school-age children, it is extremely important that parents are well-educated about proper nutrition, as parents essentially define the child's dietary environment and shape eating behaviours that children often carry into adulthood (Savage et al., 2007). For example, the availability of food at home depends on parental food choices when shopping, effectively modelling children's diets, so parental intervention involves reducing the availability of foods that are unhealthy for the child. In addition, setting rules and educating the child is recommended as a strategy for promoting healthy eating habits (Yee et al., 2017). More frequent family meals and well-established mealtime rules (Lehto et al., 2012) have been associated with lower levels of overweight in children.

However, to successfully develop healthy eating habits, parents must be aware of their importance and well-informed about proper child nutrition. Higher parental education has been associated in numerous studies with more favourable dietary habits in children, including higher breakfast consumption, greater intake of water, fruits, vegetables, and dairy products, and lower consumption of fried potatoes, sugary drinks, processed foods, and snacks (Fernández-Alvira et al., 2013; Van Lippevelde et al., 2013; Flores-Barrantes et al., 2022).

In this study, parents were asked (Table 2) whether they think their child is overweight, and on average 12.6% answered affirmatively, which does not correspond with the proportion of children classified as overweight or obese, which together amounts to 30.1% (Osmančević-Muminović, 2024). This means that at least 17.5% of parents do not have an accurate perception of their child's weight status. Most parents (93.2%) are aware that being overweight affects health, and 75.5% believe they know what constitutes a proper diet; however, 48.9% feel they need

additional education. On average, 42.4% of parents obtain nutritional information from their pediatrician. A high proportion of parents (92.4%) reported that they would change their child's dietary habits if their child's health were at stake. Parental responses showed no statistically significant differences between urban and rural areas, except for questions 4 and 5. These results highlight the need for parental education.

Table 2. Parents' attitudes toward children's dietary habits

Questions	Answers	Parents (%)		
		Rural	Urban	Total
(1) Do you think your child is overweight?	Yes	12.0 ^{Ba}	13.2 ^{Ba}	12.6
	No	83.0 ^{Aa}	83.2 ^{Aa}	83.1
	I haven't thought about it	5.0 ^{Cc}	3.6 ^{Cc}	4.3
(2) Does being overweight affect health?	Yes	92.9 ^{Aa}	93.4 ^{Aa}	93.2
	No	7.1 ^{Ba}	6.6 ^{Ba}	6.8
(3) Do you know what constitutes a proper diet for your child?	Yes	74.5 ^{Aa}	76.6 ^{Aa}	75.5
	No	25.5 ^{Ba}	23.4 ^{Ba}	24.5
(4) Do you give your child any dietary supplements?	Yes	22.7 ^{Ba}	27.7 ^{Bb}	25.2
	No	77.3 ^{Aa}	72.3 ^{Ab}	74.8
(5) Where do you find advice or information about your child's nutrition?	Internet	37.6 ^{Ba}	47.4 ^{Ab}	42.5
	From a pediatrician	45.4 ^{Aa}	39.4 ^{Bb}	42.4
	From acquaintances	17.0 ^{Ca}	13.2 ^{Cb}	15.1
(6) Would you change your child's dietary habits for the sake of their health?	Yes	94.3 ^{Aa}	90.5 ^{Aa}	92.4
	No	0.7 ^{Ca}	2.9 ^{Ca}	1.8
	I don't know	5.0 ^{Ba}	6.6 ^{Ba}	5.8
(7) Do you feel you need more education about proper nutrition?	Yes	42.6 ^{Ba}	31.4 ^{Ba}	37.1
	No	44.0 ^{Aa}	54.0 ^{Ab}	48.9
	I don't have time for that	13.4 ^{Ca}	14.6 ^{Cb}	14.0

Legend: $^{a, b, c}$ Different letters within rows and columns indicate significant differences ($p \leq 0.05$) based on Duncan's test.

Given that the education system in BiH is decentralized, there is no unified national education system; education is organized at the entity, cantonal, and district levels, which is quite complex and results in significant territorial differences. One common factor, however, is the lack of organized school meals with hot options and the absence of unified guidelines aligned with WHO recommendations regarding physical activity, sedentary behaviour, and dietary habits. While such elements exist in curricula, they are variably detailed across regions. In the Federation of BiH, a Guide for Healthy Nutrition of School-Age Children has been published by the Federal Public Health Institute (PHI FBiH, 2023), and various documents have been issued at different administrative levels. In the USC, there are no guidelines for any of the topics investigated. Therefore, based on the results of this study, the authors propose the following key guidelines to the competent Ministry of Education, in line with WHO recommendations (2006, 2020):

Guidelines for Physical Activity

Children should be physically active for at least 60 minutes daily. The results of this study show that about 61% of children in the USC achieve this level of activity through a combination of school physical education and sports training, which is comparable to data from other European countries. However, around 28% of children are insufficiently active or do not exercise at all, requiring additional interventions. It is recommended to provide children with a minimum of 60 minutes of moderate-to-vigorous activity daily through school and extracurricular programs, increasing opportunities for spontaneous play and movement, and encouraging cooperation between schools and parents to monitor and promote regular activity, with a special focus on children who are physically active less than twice a week.

Guidelines for Sedentary Behaviour

Children's time spent in sedentary activities, especially in front of screens, should be limited, and frequent breaks and active play should be encouraged. Research in Europe shows a wide range of screen time, while in USC, 29.3% of children spend more than 2 hours daily in front of screens, placing USC in the mid-range compared to other countries. Therefore, it is recommended to limit screen time to ≤ 2 hours per day, introduce regular active breaks at school and at home, and support parents and schools in establishing screen-time rules and promoting active play.

Guidelines for Dietary Habits and Daily Meals

Children should eat breakfast regularly, as it has a protective effect on health. The study in USC shows that on average 19.0% of children skip breakfast, which is higher than in some European countries and requires interventions. Nutritiously varied and appropriate school meals should be provided, and the proportion of children bringing meals from home (42.9%) should be increased through a structured strategy until school canteens with hot meals are established, while reducing the consumption of low-quality food from shops. Schools and parents should cooperate to encourage and maintain family meals, aiming to develop healthy eating habits and prevent childhood obesity, and promote the habit of consuming the last meal 2–3 hours before bedtime to support optimal metabolism and sleep.

General Recommendation

The study results highlight that parental education is crucial for shaping healthy eating habits in younger school-age children. Parents influence their child's dietary environment through food choices, rules, and modelling behaviours. Despite high awareness of healthy nutrition and the impact of overweight (93.2%), 48.9% of parents report needing additional education. Public health and education systems should therefore collaborate through joint programs on nutrition, physical activity, and digital hygiene.

Conclusion

The results of this study confirm the need for a comprehensive and coordinated approach to improving physical activity, sedentary behaviour, and dietary habits of younger school-age children and/or more broadly within the education system. It is recommended that the Ministry of Education, Science, Culture, and Sports of the Una-Sana Canton establish standardized school programs to monitor physical activity, sedentary behaviour, and nutrition, and develop educational program interventions targeting children, parents, and teachers. This particularly applies to the need to increase opportunities for daily physical activity and active play in schools, limit sedentary time, and develop a school meal model with hot meals to provide children with nutritionally adequate meals. This study provides valuable insight into the health and dietary behaviours of primary school children in USC, highlighting key areas for action to reduce the risk of developing non-communicable diseases (NCDs) and promote healthier growth and development in children.

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