



RESEARCH ARTICLE

Eating habits of primary school pupils and the problem of obesity in children in the district of Istria country

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SUMMARY

Objective: To analyse the eating habits and physical activity of primary school pupils in the Istria County in order to assess the need to organise educational workshops for students and parents on healthy eating habits and activities for primary school students.

Subjects and methods: A cross-sectional study was conducted; anonymous questionnaire and descriptive statistical methods were used. The respondents were primary school students in Istria County. 182 respondents aged 7 to 15 participated in the research, which was conducted from May 2022 to January 2023 using a questionnaire created via a Google form.

Results: The majority of students live in rural areas (46%), in families with multiple household members (64%). Of the parents/guardians, the majority have a high school diploma (52.29%), with mothers/guardians mostly having a university or technical university degree (67%) and fathers/guardians having a high school diploma (61%). Of the 175 students, 3 are severely obese (2%), 20 are obese (11%), 29 are overweight (17%), 9 are malnourished (5%), and 1 is severely malnourished (1%). 113 students (64%) have a normal body weight for their age. Fruit (74.86%), dairy products (68.00%), meat products (57.71%) and bakery products (56.57%) are served most frequently at school meals. Water is the most frequently consumed drink for 95% of students. Energy drinks are consumed the least frequently (6%). Just over 26% of respondents consume coffee sometimes or daily, while alcohol is consumed sometimes or daily by around 10% of respondents. Most respondents are also physically active outside of school (73%) and 57% of them spend between 1 and 3 hours a day in front of a computer, mobile phone, etc., while 64% spend 1 to 3 hours a day outdoors. Mostly, 67% think that their body weight is okay and 14% think that they do not eat a healthy diet.

Conclusion: In addition to the problem of overweight and obesity, it was found that there are other lifestyle problems among primary school students (malnutrition, coffee and alcohol consumption). A serious health risk due to overweight or severe obesity and obesity exists in 19% of respondents. The results point to the need to continuously educate students, parents and school staff about the importance of a healthy diet and regular physical activity to promote health and prevent disease.

Keywords: physical activity, primary school students, eating habits, obesity, prevention.

Introduction

Childhood obesity rates are on the rise and are becoming a global epidemic and tends to correlate positively with obesity in adulthood, which is a major risk factor for cardiovascular disease (CVD) such as arterial hypertension (AH), diabetes (DM1 and DM2) and dyslipidaemia⁽¹⁾. The prevalence of childhood overweight and obesity has increased significantly in both rich and poor countries. In the last 30 years, childhood obesity has more than tripled. The majority of the world's population lives in countries where overweight and obesity kill more people than malnutrition. 39 million children under the age of 5 and more than 340 million children and adolescents between the ages of 5 and 19 were overweight in 2020^(2,3,4). PTSD in childhood not only affects physical health, but also has many psychosocial deficits such as self-esteem and has a negative impact on cognitive and social development⁽⁵⁾. In general, childhood obesity has a negative impact on quality of life and life expectancy, and childhood obesity is a major cost factor for the healthcare system⁽⁶⁾. Due to the difficulty of tackling obesity at a younger age and the long-term serious negative effects, the prevention of childhood obesity has been recognised as a public health priority. Childhood obesity is a multidisciplinary disease that includes environmental, genetic and lifestyle factors. Dietary factors play an important role. Several studies have investigated the relationship between body mass index (BMI) and dietary habits, but the results have not been satisfactory^(7,8). In many developing countries, a change has been observed that includes a significant increase in overweight and obesity not only in the adult population, but also in children and adolescents. This change is mainly related to changes in lifestyle and dietary habits. In addition to obesity, malnutrition is also a problem in children's eating habits. Environmental factors have a decisive influence on both problems⁽⁹⁾. The problem of obesity is also very pronounced in the Republic of Croatia. According to the results of the 2019 European Health Interview and Examination

Survey, the prevalence of obesity among adults in Croatia is higher than in any other country in the European Union, with the exception of Malta and Hungary⁽¹⁰⁾. Childhood obesity poses a particular public health challenge. Children with obesity will in most cases grow up to become adults with obesity, which puts them at increased risk of developing other CVD. In addition, obese children are often socially disadvantaged, have lower self-esteem and poorer academic performance^(11,12). Although they occur in all countries and in children of all socioeconomic groups, the prevalence of overweight and obesity in high-income countries is highest in children from unfavourable socioeconomic backgrounds such as poverty or low educational attainment. In middle-income countries, however, the opposite was observed: The highest incidence of overweight and obesity was observed in children living in more favourable socioeconomic circumstances⁽¹³⁾. The European Childhood Obesity Surveillance Initiative, Croatia, conducted in 2019, showed that in Croatia, one in three children, 37.0% of boys and 33.0% of girls, lived with overweight or obesity and about one in seven children, 18.0% of boys and 12.0% of girls, lived with obesity⁽¹⁴⁾. These data place Croatian eight-year-olds in fifth place in terms of the prevalence of overweight and obesity in the World Health Organisation (WHO) European Region, together with children of the same age from Mediterranean countries such as Cyprus, Greece, Italy and Spain⁽¹⁵⁾. Studies show that the prevalence of obesity in children and adolescents in the WHO European Region will continue to increase and that by 2035, 14.0% of girls and 21.0% of boys will be living with obesity⁽¹⁶⁾. According to studies by the Organisation for Economic Co-operation and Development (OECD), obesity is a problem that will lead to a 3.5-year reduction in life expectancy in the Republic of Croatia over the next 30 years⁽¹⁷⁾. This research was conducted to assess the eating habits and the problem of obesity among primary school children in Istria County and, based on the data obtained, to take measures to educate children, parents and schools about proper nutrition of children and

adolescents and thus prevent the consequences of poor nutrition and obesity^(18,19).

Subjects and Methods

In accordance with the objectives of this research, it was necessary to obtain data on anthropological measures, eating habits and physical activity of primary school students in the Istria County and to determine whether there is a need for the previously described interventions in the form of educational workshops for students and parents on healthy eating habits and activities of primary school students. A cross-sectional study was conducted among students from 1st to 8th grade of primary schools in Istria County. Another reason why Istria County was chosen is that it is one of the most economically developed regions in Croatia. The study involved 182 participants of both sexes aged 7 to 15 years. The survey was conducted in the period from May 2022 to January 2023 using a questionnaire created via a Google form. In the introduction to the questionnaire, respondents were informed about the purpose of the research method and that completing the questionnaire was completely anonymous and voluntary. The introduction also states that by completing the questionnaire, respondents consent to their data being used to conduct this research and for publication in the literature.

The questionnaire is divided into 2 parts:

- general information (gender, age in years, height in cm, body weight in kg, diseases/conditions affecting diet, primary school they come from, class, neighbourhood they come from (city, suburb, village), family environment, parents'/guardians' education level)
- Eating habits and physical activity (number of meals, snacks, type of meals, organised meals at school, physical activity)

The questions are age-appropriate and are supplemented by a visual explanation.

After analysing the survey, 7 respondents were excluded from the survey due to incomplete and/or inappropriate responses. In addition, in

cases where the questions were answered by parents/guardians, the age of the respondent who answered the questions was reported below the age and not the age of the child for whom the data was completed. After applying the above exclusion criteria, the total number of participants included in the study was N=175 (49% girls and 51% boys).

STATISTICAL DATA PROCESSING

The data obtained are described using descriptive statistics for each variable and scale. All variables (categorical and numerical) are presented in absolute and relative frequencies. The central tendencies of the categorical variables are represented by the mode, the numerical variables by the arithmetic mean and the standard deviation as an indicator of the dispersion. The normality of the distribution of the numerical data is analysed using the Shapiro-Wilk test and the homogeneity test using the Leven test. The analyses of the categorical variables are carried out using Fisher's exact test, Pearson's chi-squared test (χ^2 test) and the Wilcoxon test, while the numerical variables are analysed using the Kruskal-Wallis non-parametric test and the one-way analysis of variance. The HiSquare test is used to examine the difference in structure, and the significance level for all analyses performed is set at $\alpha=0.05$. The data collected as part of this study is processed using the computer programme Statistika 12 from Tibco, California

Results

The study involved 90 male students (51%) and 85 female students (49%) aged 7 to 15 years. The majority of students reported living in the countryside (46%), 36% lived in the city and 18% in a suburb. Most students live in families with several household members (64%). 42 students (24%) live with both parents, but without any other family members. 13 pupils (7%) live with only one parent and siblings, 5 pupils (3%) live with only one parent, siblings and grandparents and/or grandmother, and 4 pupils (2%) live with only one parent and no other family members. Of the parents/guardians, most have a high school diploma (52.29%) and the

fewest have a primary school diploma (3.14%). Most mothers/guardians have a university degree (N=93), specifically 67% compared to 33% of fathers/guardians, most of whom (N=112) have completed secondary school, i.e. 61% compared to 39% of mothers/guardians with a secondary school degree.

ANTHROPOLOGICAL DATA

Figures 1-3 show the minimum, maximum and average values of height in centimetres, body weight in kilogrammes for boys in relation to age and the average values of body height and weight for boys from the sample studied by age. Figures 4-6 show the minimum, maximum and average values obtained for height in centimetres, body

weight in kilogrammes for girls in relation to age and the average values for girls from the sample studied by age. Table 1 shows the minimum, maximum and average BMI values for the primary school students included in the study. Of the 175 students, 3 are severely obese (2%), 20 are obese (11%), 29 are overweight (17%), 9 are malnourished (5%) and 1 is severely malnourished (1%). 113 students (64%) have a normal body weight for their age (Figure 26).

Table 1. Minimum and maximum BMI values by gender and age

SPOL	DOB									ITM
	7	8	9	10	11	12	13	14	15	
M	13,2	14,7	13	14,7	10,2	17	13,7	15	19,8	MIN
	19,4	20,9	24,7	24,4	27,5	23,4	27	32,7	30,2	MAX
Ž	14,6	13,3	14,3	14,8	14	14	15,6	17,4	15	MIN
	16,8	16,6	19	22,2	30,2	37,3	25,5	31,8	22,3	MAX
PROSJEK	16	16,375	17,75	19,025	20,475	22,925	20,45	24,225	21,825	

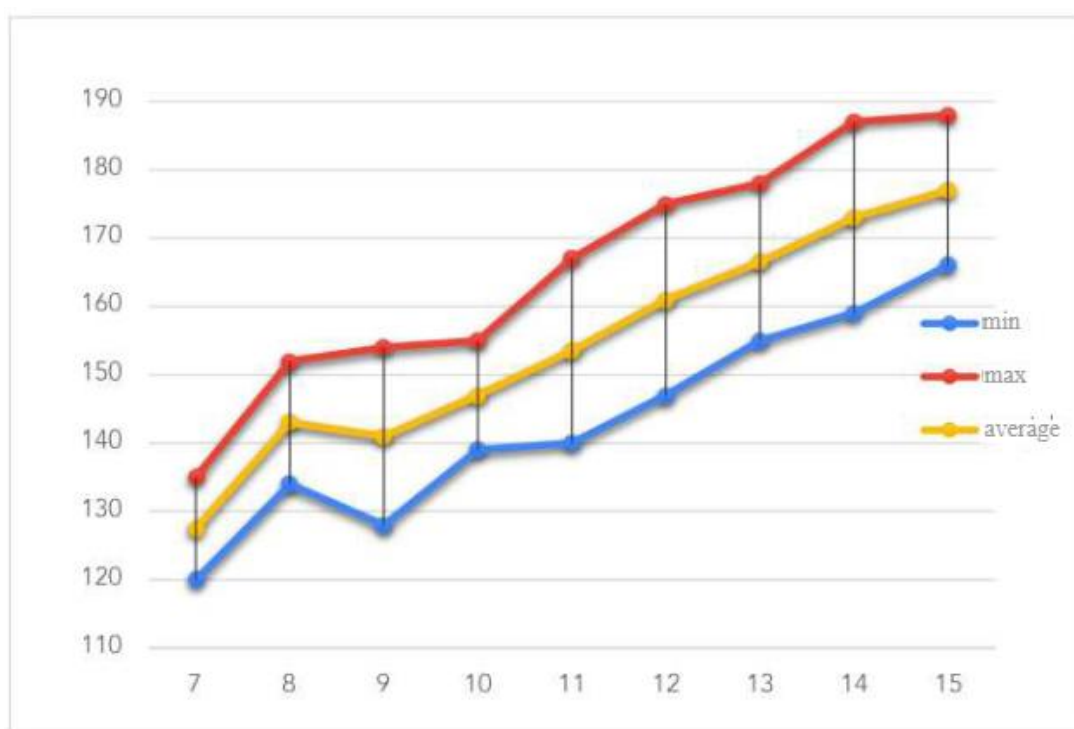


Figure 1. Display of the minimum, maximum and average height in centimeters of boys aged 7-15 years

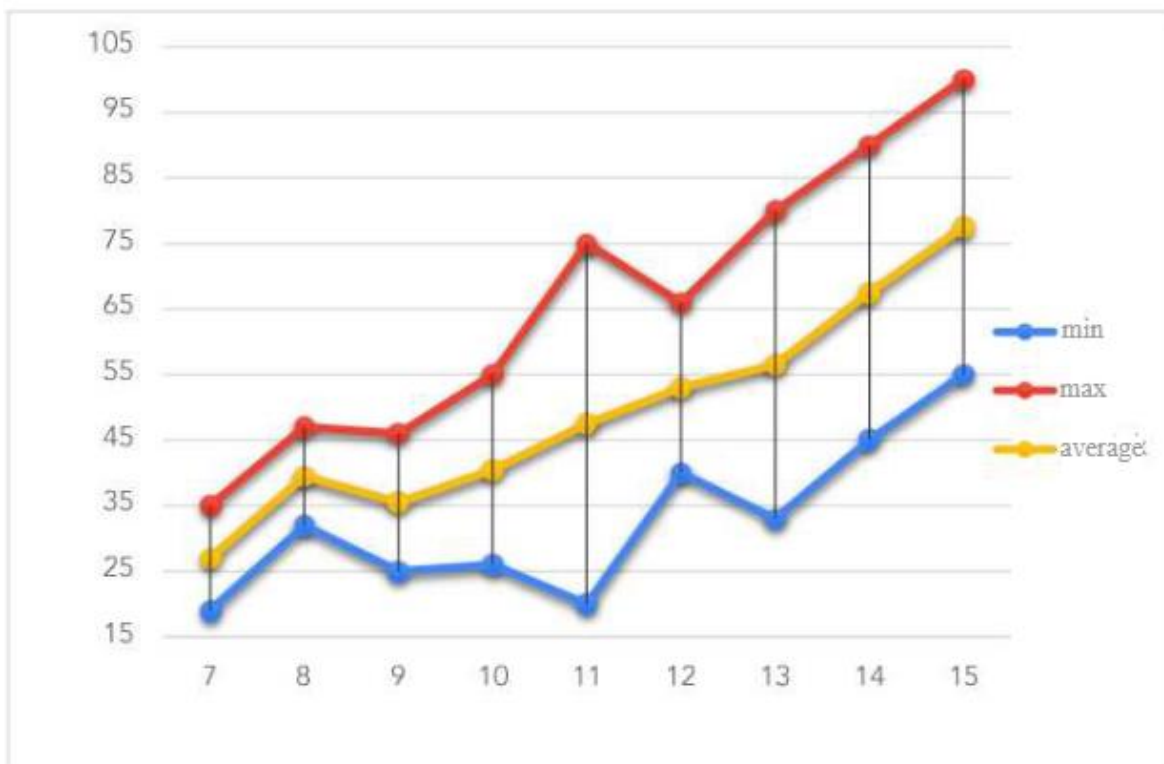


Figure 2. Display of the minimum, maximum and average body weight of boys in kilograms aged 7-15 years

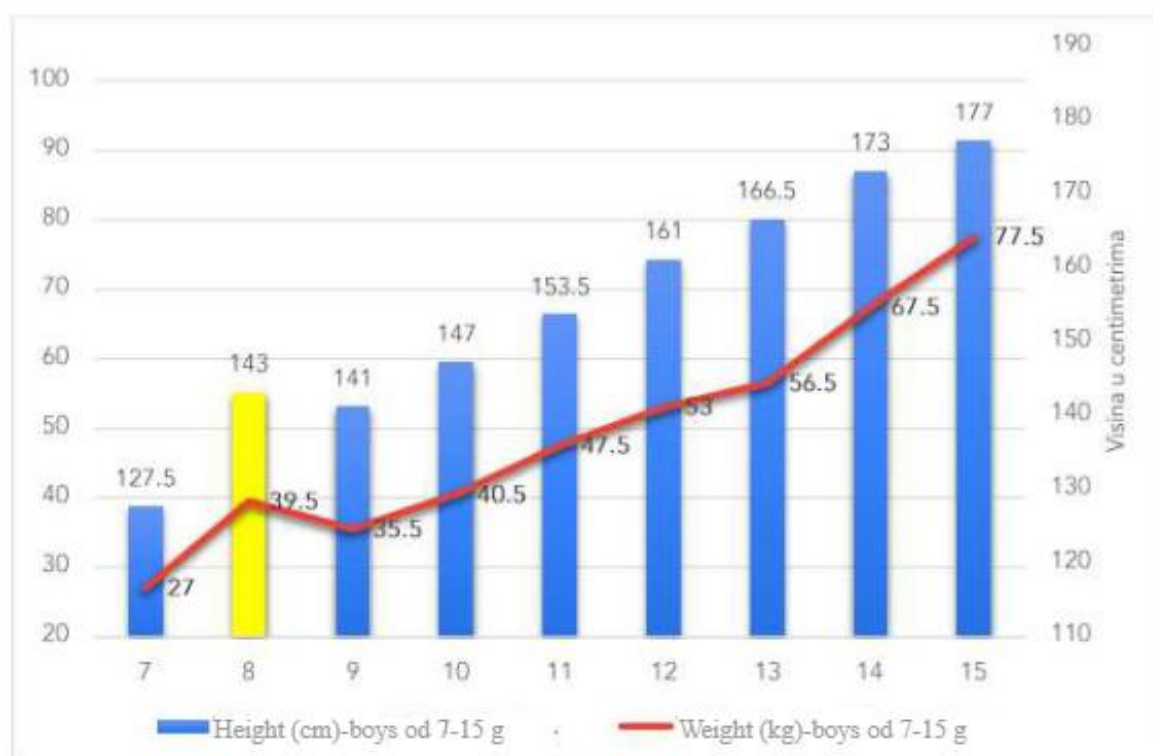


Figure 3. Display of the average value of TV in cm and TM in kg for boys aged 7-15 years

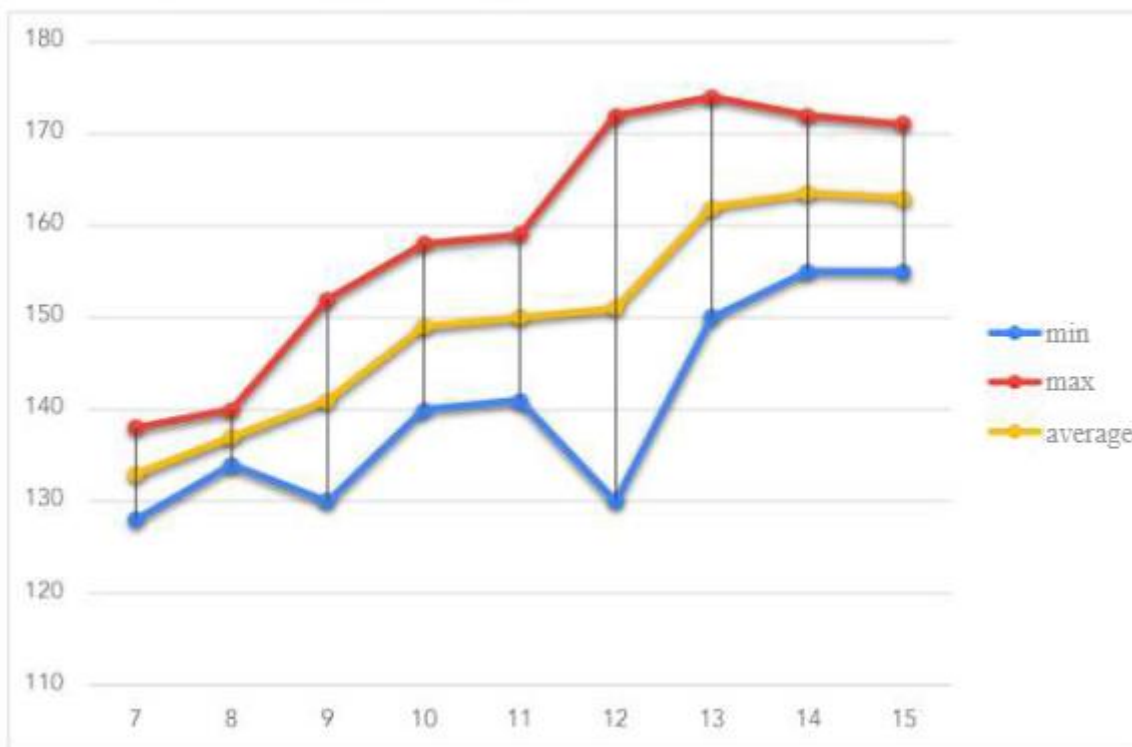


Figure 4. Display of the minimum, maximum and average height in centimeters of girls aged 7-15 years

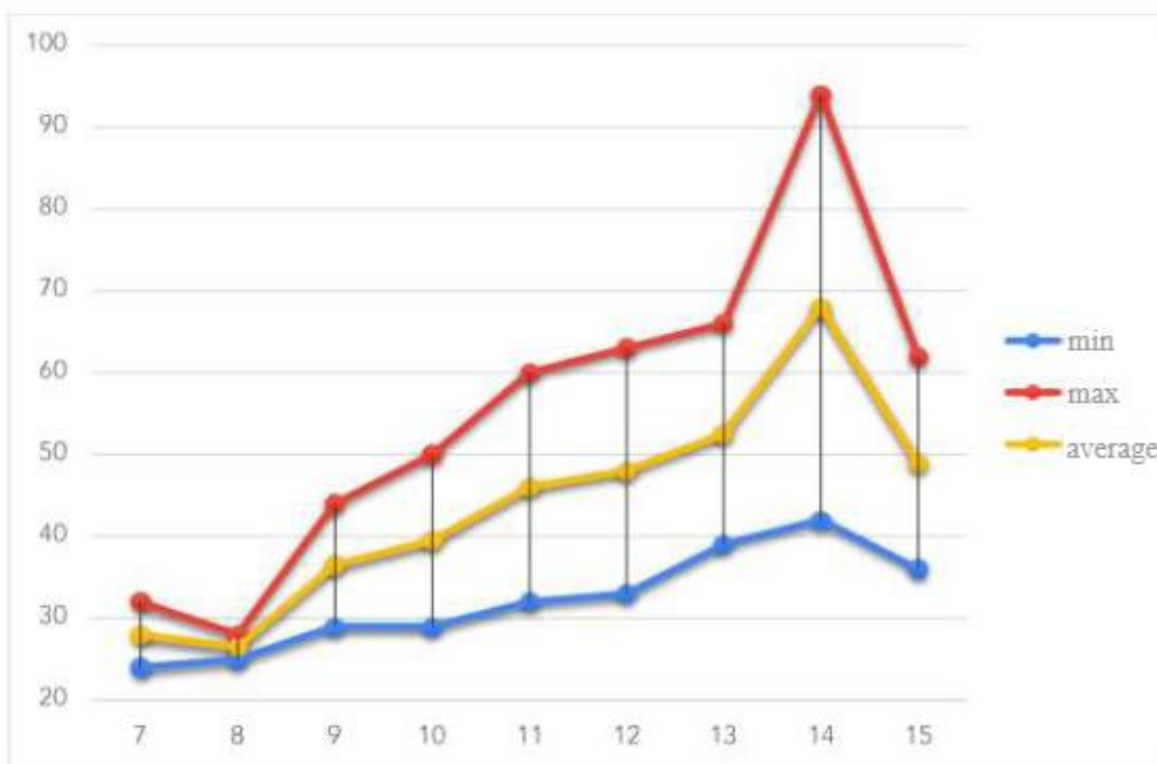


Figure 5. Presentation of the minimum, maximum and average body weight of girls in kilograms aged 7-15 years

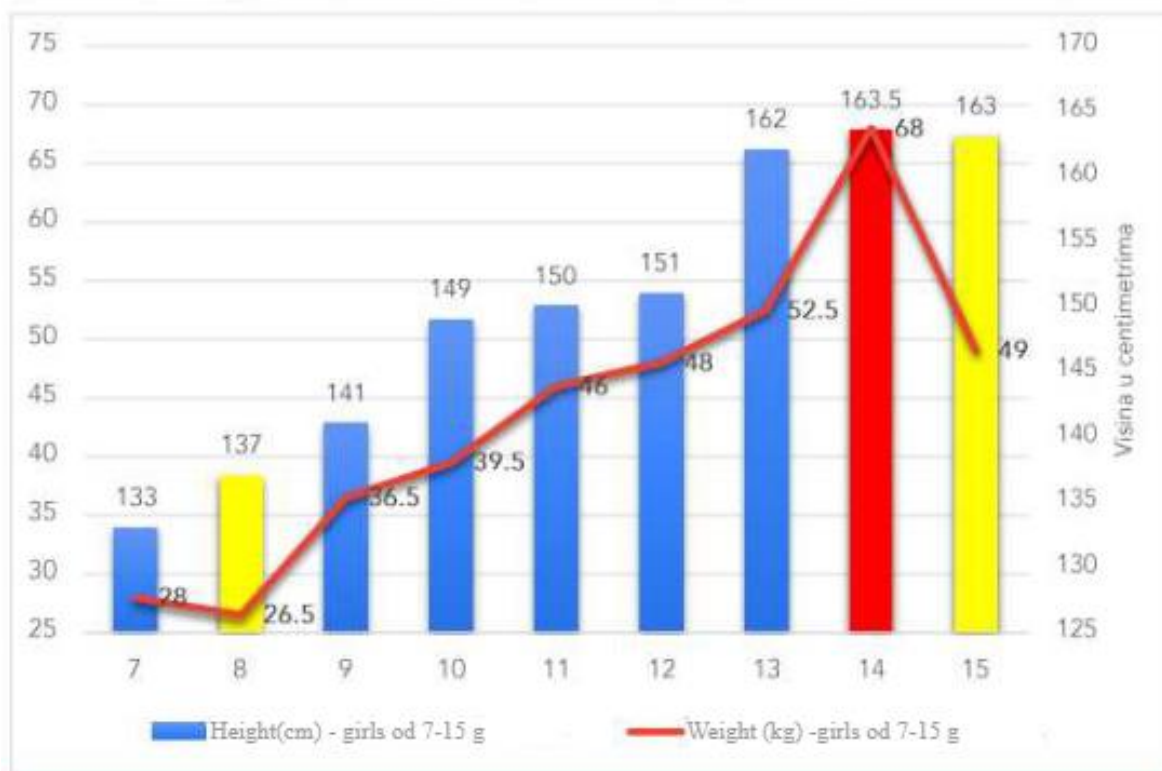


Figure 6. Display of the average value of height in cm and weight in kg for girls aged 7-15 years

EATING HABITS AND PHYSICAL ACTIVITY

Of the 175 respondents, 3% have diseases or medical conditions that affect their diet. 67% of respondents have allergies or intolerances to certain foods. Table 2 shows the most common foods consumed by respondents as a snack. Respondents indicated that fruit meals (74.86%), dairy products (68.00%), meat products (57.71%) and baked goods (56.57%) are most frequently served as part of the organised school brunch. Water is the most frequently consumed liquid by respondents in around 95% of cases, while energy drinks are the least frequently consumed at around 6%. Coffee is consumed sometimes or daily by just over 26% of respondents, while alcohol is consumed sometimes or daily by around 10% of respondents. The majority of respondents are physically active to some extent outside of school (73%), while 27% of respondents are not physically active outside of school. Figure 7. shows the most common activities undertaken by respondents in graphical form. Under "other" are activities that are practised by fewer than 5 respondents (e.g. fencing). Of the respondents who stated that they engage in physical activity outside of school, most do so for 1-2 hours per day (N = 74, 58%). Most of

the respondents stated that they spend 1-3 hours per day in front of the television, computer, mobile phone and the like (N = 99.57%). 22% of them (N = 39) spend less than 1 hour per day in front of the TV, computer, mobile phone and the like, and 5% spend more than 5 hours per day. Between 1 and 3 a.m., most respondents spend time outdoors, 64% of them (N=112), while 19% (N=34) spend less than 1 hour. Of the respondents, 5% stated that they are currently dieting or doing something to lose weight, 21% believe that they should lose weight, 6% believe that they need to gain weight, and 67% believe that their body weight is fine. Regardless of their attitude to dieting, 6% of respondents believe their body is a little too fat, 2% think it is too thin and 92% think it is ideal. Regardless of the results and attitudes presented above, more than half of respondents, 54%, believe that they eat a healthy diet. 14% believe that they do not eat healthily and 31% do not know. The eating habits by gender are shown in detail in tables 7-11. The tables show that boys eat more fruit and girls eat more vegetables, and also rarely eat fast food" or drink alcoholic beverages. Compared to boys, more girls believe that they eat a healthy diet. They also answered the same when asked if they would go on a diet, but

twice as many boys answered that they should go on a diet because they are overweight. 87% of

boys are also physically active outside of school, compared to 56% of girls (Figure 8).

Table 2. Display of common foods consumed by respondents for a snack

What do you usually eat for a snack?		
Type of food	N	% (from N=175)
Fruits/vegetables	118	67,43%
Snacks	58	33,14%
yogurt	57	32,57%
Candy	47	26,86%
bakery products	41	23,43%
sendvič /fast food	40	22,86%
nuts	36	20,57%
cereals	34	19,43%
Something else	4	2,29%

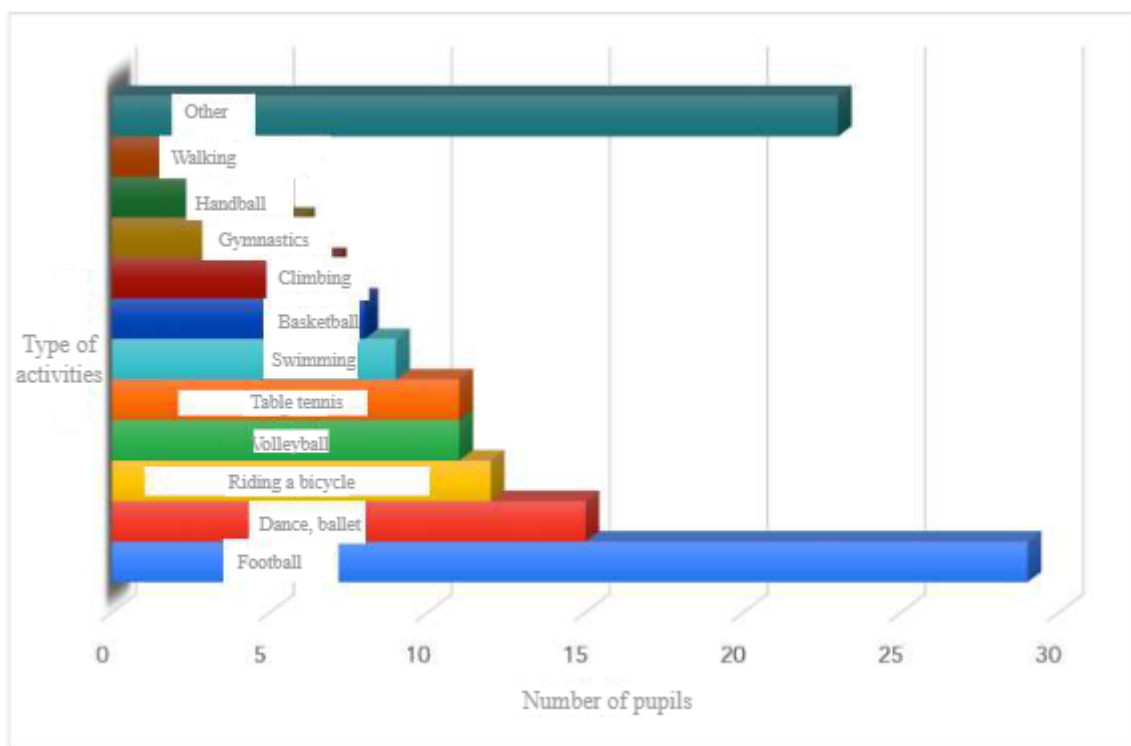


Figure 7. The most common forms of extracurricular physical activity that respondents engage in

Table 3. Presentation of the frequency of consumption of certain types of foods (fruits, vegetables, sweets, snacks) among respondents

Question:	% (N=175)				
	I don't eat	Seldom	Several times a week	Once a day	Several times a day
How often do you eat fruit?	0,57%	9,14%	22,29%	35,43%	32,57%
How often do you eat raw or cooked vegetables?	4,00%	22,29%	28,57%	36,00%	9,14%
How often do you eat sweets?	1,14%	25,71%	30,29%	32,00%	10,86%
How often do you eat salty snacks (e.g. chips)	2,86%	54,29%	36,00%	4,57%	2,29%

Table 4. Presentation of the frequency of consumption of certain types of food (soup, meat, fish, pasta) among respondents

Question:	% (N=175)				
	never	seldom	Once a week	several times a week	every day
How often do you eat soup or some other cooked meal on a spoon?	1,14%	7,43%	13,14%	59,43%	18,86%
How often do you eat fish?	8,00%	32,57%	48,57%	10,29%	0,57%
How often do you eat meat (boiled or baked)?	1,14%	2,29%	8,57%	65,71%	22,29%
How often do you eat pasta?	0,57%	6,29%	32,00%	57,71%	3,43%

Table 5. Presentation of the frequency of consumption of certain types of food (fast-food, canned food) among respondents

Question:	% (N=175)			
	never	seldom	several times a week	once a day
How often do you eat canned food?	28,57%	58,86%	10,29%	2,29%
How often do you eat fast food, fast-food (pizza, hamburgers, hot dogs...)	4,57%	81,14%	3,43%	0,57%

Table 6. Display of the types of liquids consumed by subjects

What types of liquids do you consume?		
Type of liquid	N	% (from N=175)
water	166	94,86%
milk	100	57,14%
natural/squeezed juice	70	40,00%
tea	63	36,00%
juice for dilution	60	34,29%
carbonated juices	48	27,43%
Energy drinks	10	5,71%

Table 7. Representation of fruit in the diet, comparison by gender

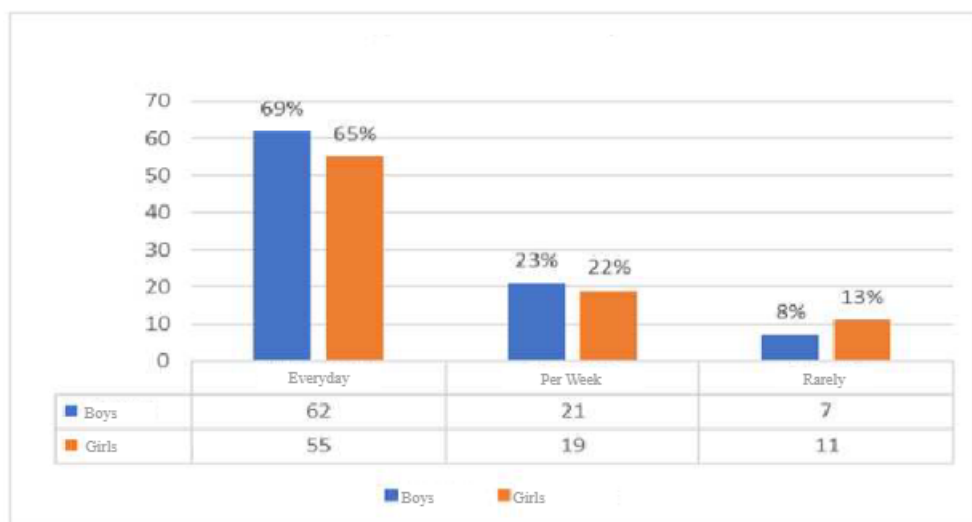


Table 8. Representation of vegetables in the diet, comparison by gender

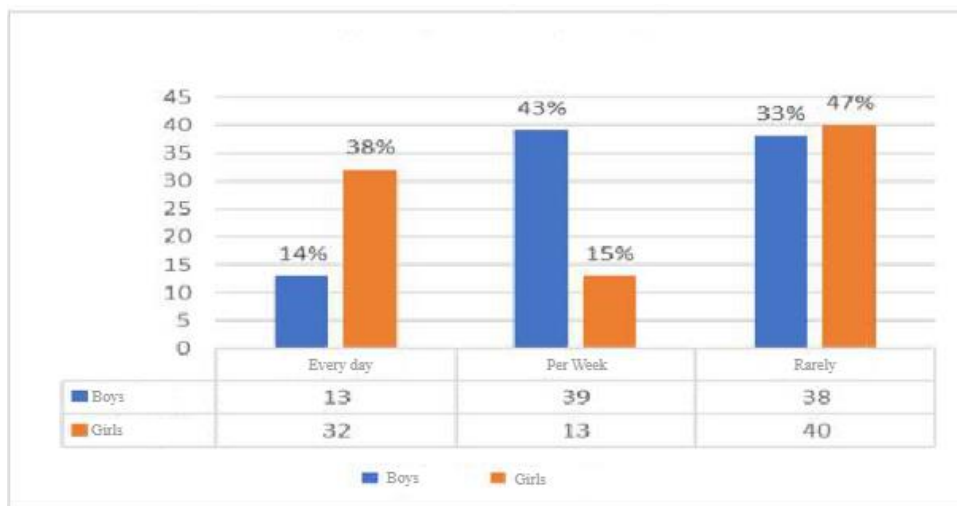


Table 9. The representation of "fast-food" food in the diet, comparison by gender

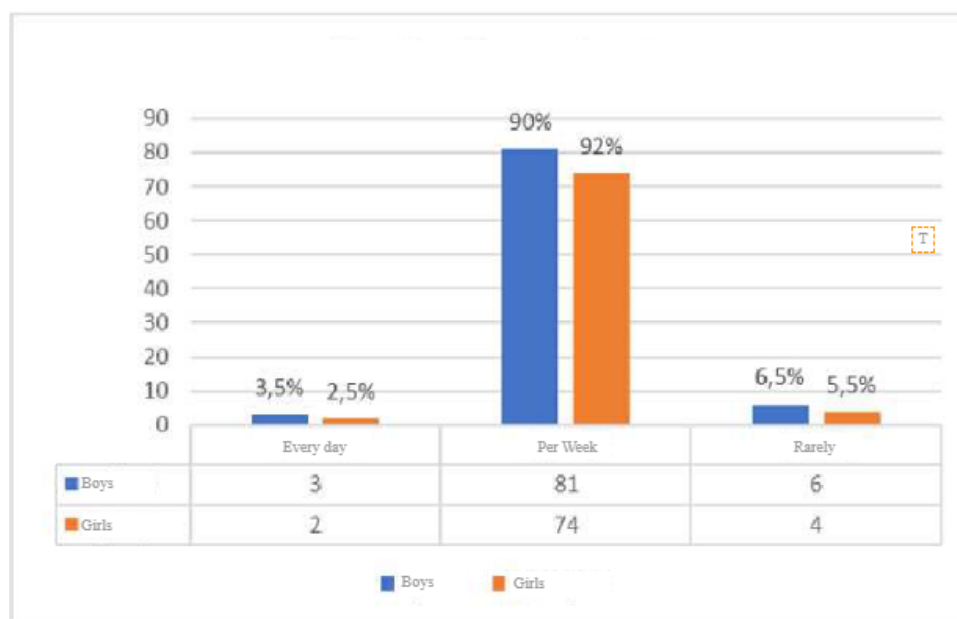


Table 10. Implementation of the diet, comparison by gender

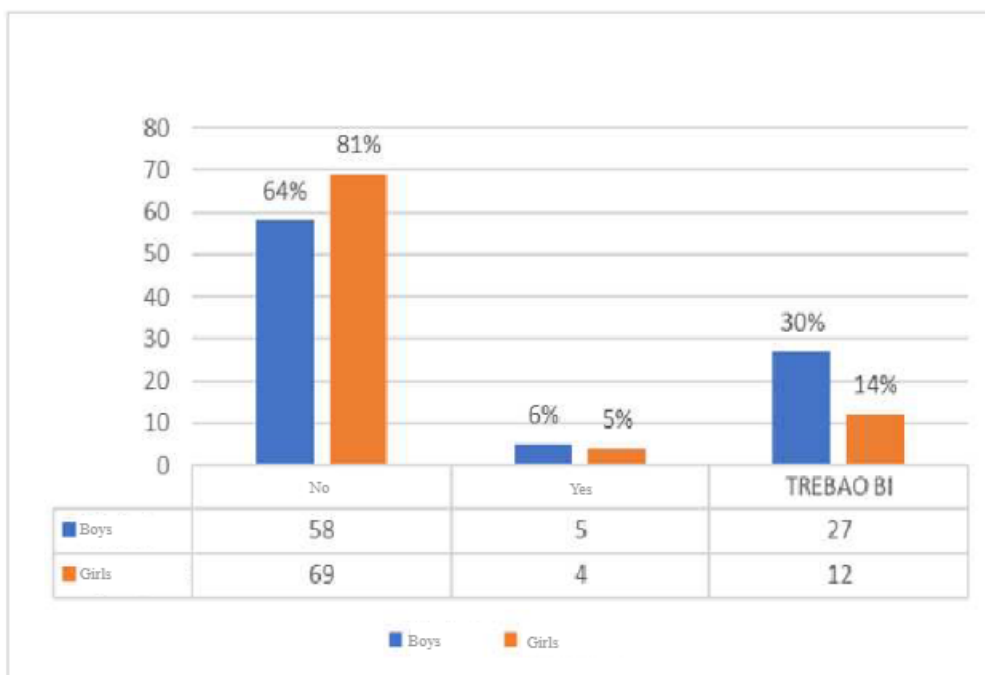


Table 11. Personal attitude to the quality of nutrition, comparison by gender

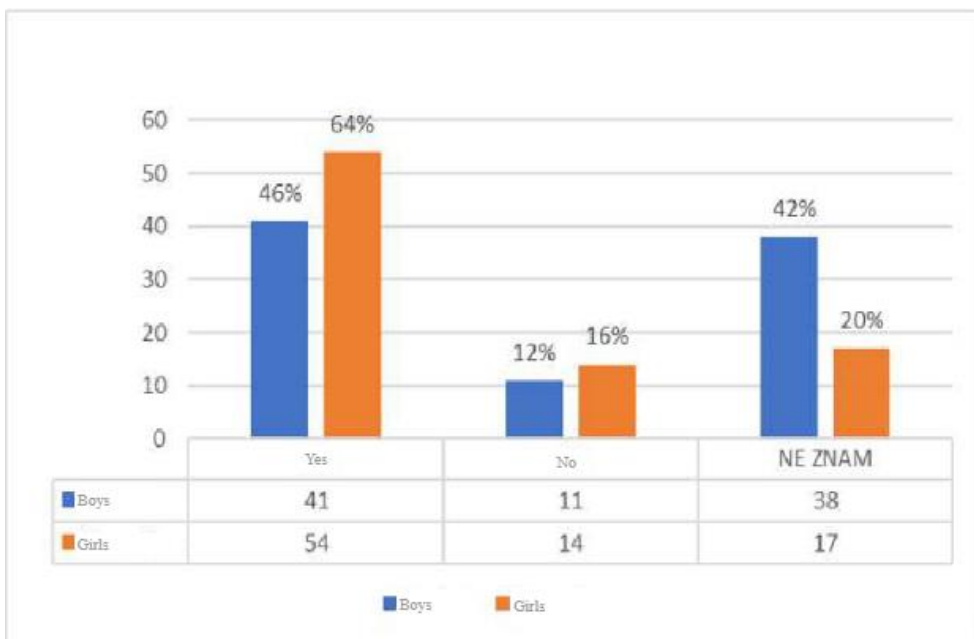
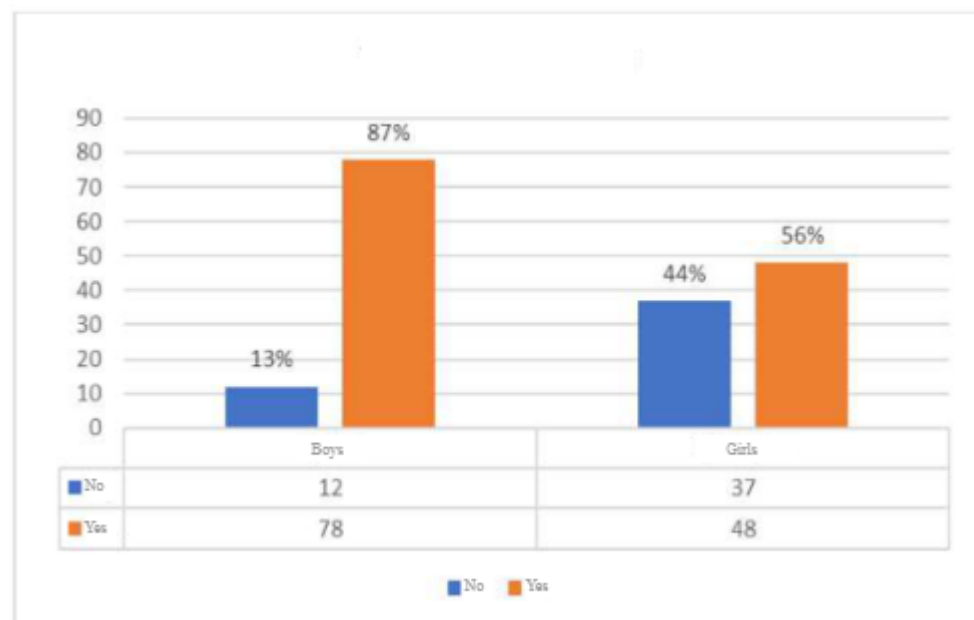
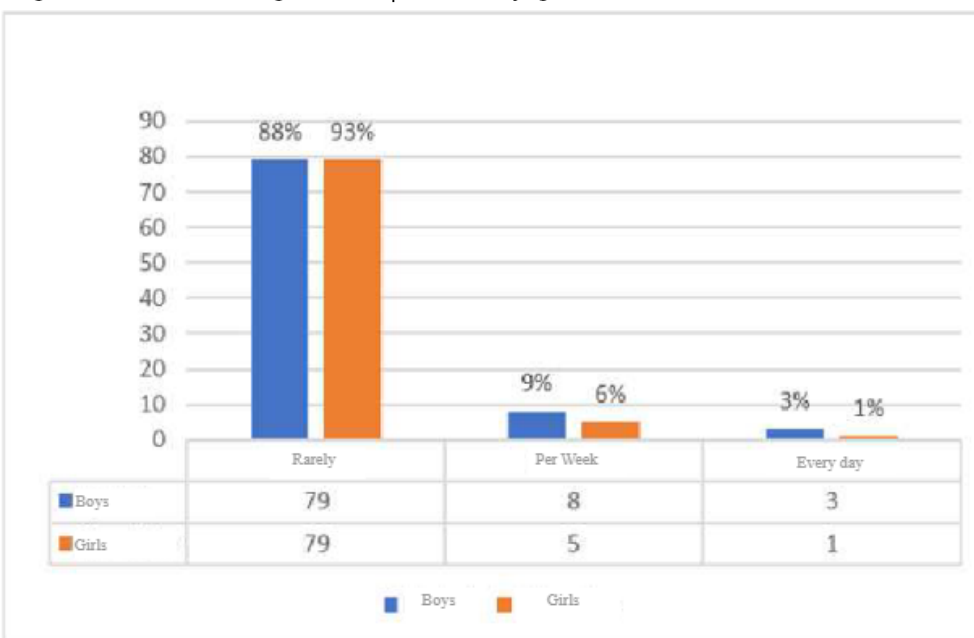


Table 12. Drinking alcoholic beverages, comparison by gender



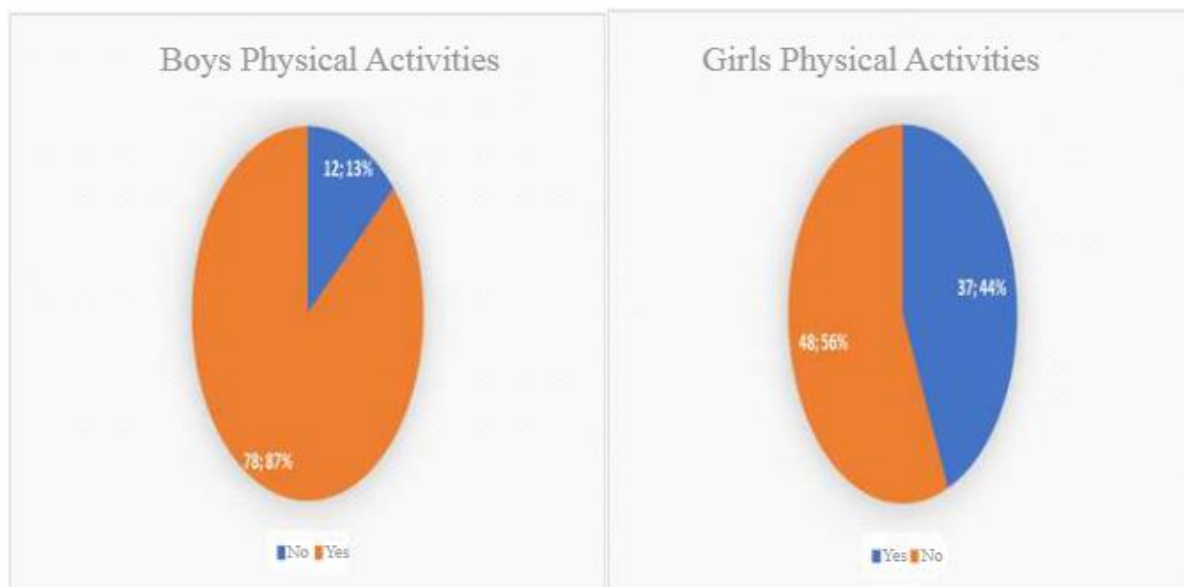


Figure 8. Extracurricular physical activity, comparison by gender

Discussion

Childhood obesity is a growing public health problem worldwide, and it is of particular concern in Croatia⁽²⁰⁾. The results of the CroCOSI 2021/2022 study show that 36.1 % of children aged 8.0 to 8.9 years in the Republic of Croatia are overweight or obese. Looking at the two previous CroCOSI survey rounds 2015/2016 and 2018/2019, when these proportions were 34.9 % and 35.0 % respectively, it is clear that the prevalence of overweight and obesity in children is continuously increasing, which, with regard to the goal of stopping the increase in childhood obesity by 2025, indicates that we are not on track to realise this global WHO goal^(21,22). In addition to the very high prevalence of overweight and obesity in children, marked gender differences were also found, i.e. overweight and obesity were more common in boys, at 38.5% compared to 33.7% in girls. However, a significantly stronger increase was found in girls compared to 2015, as the prevalence increased by 2.7 percentage points, while a slight decrease in prevalence of 0.2 percentage points was recorded in boys⁽²³⁾. Methods for the assessment and treatment of paediatric obesity are rapidly evolving. Obesity is thought to be caused by an imbalance of caloric intake and expenditure, and requires a comprehensive assessment of the patient's characteristics, family, environment, genes and culture in order for clinicians to develop successful

interventions. Current guidelines recommend a gradual increase in treatment plans, and multidisciplinary treatment teams are recommended for patients who require intensive intervention. The teams of experts involved at a multidisciplinary level must bring their speciality to the team area to develop a comprehensive treatment plan. Prevention and treatment of PTSD and obesity in children in primary care aims to change behaviours that lead to excessive energy intake and inadequate energy expenditure. Healthy lifestyle choices by individuals and families can lead to a reduction in many chronic diseases and conditions, of which obesity is the most common⁽²⁵⁻³⁰⁾.

OBESITY PREVENTION AS A PUBLIC HEALTH PRIORITY

Obesity prevention is an important public health priority alongside treatment. Paediatricians should take a longitudinal, developmentally appropriate life-course approach to identify children who are on the path to obesity early and base their prevention efforts on family dynamics and reducing risky diets and activities. They should encourage a diet free of sugary drinks, fewer foods with a high calorie density and an increased intake of fruit and vegetables. It is also important to promote a lifestyle with less sedentary behaviour and 60 minutes of moderate to vigorous physical activity per day^(31,32). The importance of all these points is confirmed in our work. The proportion of

respondents by gender is the same (M = 51%, F = 49%), but interest in participation varies, particularly in relation to age. Girls aged 13 and boys aged 14 showed the greatest interest, while girls aged 7 and 15 and boys aged 7 showed the least interest in completing the questionnaire. The influence of gender and age can be explained by the influence of puberty on the perception of self-image. Girls in puberty are particularly vulnerable to environmental influences on their perception of self-image, which can often lead to negative consequences and the development of eating disorders such as bulimia and anorexia or mental health problems such as depression, which are a common cause of PTSD and obesity⁽³³⁾. We included data on whether respondents lived in rural, suburban or urban areas in the study because we were interested in whether the environment had an impact on eating habits. According to the data obtained, children whose BMI is below the normal age average are just as prevalent in urban environments as in rural areas, more specifically in the countryside. In the suburbs, there is not a single subject with a BMI below the average for their age. However, according to the data, most children whose BMI is above the normal average for their age, i.e. who are demonstrably obese and severely obese, live in rural areas, followed by respondents who live in the city and those who live in the suburbs. Similarly, those at risk of obesity based on BMI categorised as overweight children. The importance of the family eating environment for the formation of healthy eating habits in childhood and adolescence has been well researched⁽³⁴⁻³⁶⁾. The availability of food at home and parental modelling of eating behaviour are crucial for eating behaviour in childhood. There is also evidence that children's eating experiences depend on where meals are eaten and whether they are eaten with other family members. In many families, meals were often eaten in front of the television, and this frequency was associated with lower fruit and vegetable intake and higher fat consumption in children⁽³⁷⁾. According to the results of our study, the majority of respondents (88%) live in a multi-

parent family where both parents live. The effects of single-parent families on children's food consumption and nutritional status were analysed by Tian and Wang using a sample of 1114 children of single parents in China. They came to the conclusion that single-parent families have no negative impact on children's food consumption and nutritional intake. On the contrary, single parents tend to give their children more food to compensate for the absence of one parent, and this compensatory effect neutralises the negative effect caused by the decline in family income. In particular, urban, wealthy families had a stronger compensatory effect than other low- and middle-income families. It was also found that single parents gave their children cash prizes as compensation, which the children then used to buy unhealthy food and drinks such as fast food and energy drinks, mainly to better adapt to peers from families with both parents⁽³⁸⁾.

EDUCATIONAL LEVEL OF THE PARENTS/ GUARDIANS

The educational level of the mother and/or father was also considered as one of the possible factors influencing the eating habits and physical activity of the respondents. According to the data obtained, among the subjects with a BMI above the average for their age, i.e. obesity and obesity, there are more respondents with one or both parents having completed primary or secondary education than those with higher or tertiary education) In the case of people with pathological obesity whose BMI is significantly above the average for their age (BMI = 37.3), both parents have a tertiary education. In subjects whose BMI is below the average for their age, i.e. who have been diagnosed with malnutrition, there are an equal number of respondents in whom one or both parents have a secondary school qualification and a university degree. Only one respondent who was diagnosed with severe malnutrition according to BMI (10.2) had both parents having only completed primary school. Data from the 2014 Dutch INPACT study, which involved 1318 children and parents (mothers) and aimed to determine the relationship

between the mother's level of education and the children's healthy eating behaviour, showed that children whose mothers had a high level of education consumed more pieces of fruit per day and more grammes of vegetables per day and were more likely to eat breakfast daily than children of mothers with a low level of education⁽³⁹⁾. Another study, which also examined the association between parents' education level and the eating habits and physical activity of primary school students and was conducted in China on a sample of 11270 children and parents, found that more than one parent with a high school degree or higher was positively associated with healthy eating behaviour in their children ($P < 0.05$), but their association with high-calorie eating habits was negative in urban areas and positive in rural areas ($P < 0.05$)⁽⁴⁰⁾.

SEDENTARY LIFE STYLE AND EATING HABITS

From the data obtained, the largest deviations in mean TV occurred in boys aged 9, 11, 12 and 14 years and in girls aged 12 years, while the largest deviations in mean TM occurred in boys aged 11 years and in girls aged 14 years. For boys in the sample analysed, TV and TM generally follow an upward trend with age, except at age 8, where both TV and TM deviate from the normal trend in terms of PTT. According to the WHO, TV and TM in boys at age 8 years are normally 27.7 (± 4.7) kg and 129 (± 5) cm^(3,4). For the girls in the sample, TV essentially follows the trend of age-appropriate growth. However, TM shows deviations at the ages of 8 and 15 years in relation to malnutrition and at the age of 14 years in relation to PTT. At the transition from early to mid-adolescence, there are significant gender differences in pubertal maturation. Girls are already in post-puberty, they have reached their final height and have accumulated fat tissue in certain areas. Boys, on the other hand, go through the entire scale of pubertal development from early to postpuberty, with most of them having the lowest body fat percentage due to their simultaneous rapid height growth over the course of their lives⁽⁴¹⁾. It has been speculated that puberty accelerates body dissatisfaction in girls as they accumulate more

body fat, which in turn causes them to move away from the common ideal of thinness. Body dissatisfaction has been reported to decrease or remain stable in boys as they approach adulthood. A study of adolescent patterns of eating problems during young and middle adolescence has shown that this pattern is related to earlier pubertal maturation and higher body fat, concomitant mental disorders, later eating problems, and other long-term adjustment symptoms such as depression in young adulthood. Most respondents eat 3-4 meals a day, while very few eat only 2 meals^(42,43). A study conducted on children in schools participating in the school health programme in the northern region of Brazil showed that children who eat up to 5 meals a day and also engage in some form of physical activity have a lower risk of developing PTSD⁽⁴³⁾. The frequency of cooked meals, especially at home, also has a major impact on the development of PPT and obesity in school-age children. Tani, Fujiwara, Doi and Isumi investigated the association between home cooking and childhood obesity in a large sample of primary school children in Japan⁽⁴⁴⁾. Children living in households with little cooking was done were twice as likely to be obese as children living in households with a lot of cooking was done. This association is partly mediated by children's diet (vegetable, breakfast and snack consumption), suggesting that home cooking is associated with a healthy diet, which in turn reduces the risk of obesity⁽⁴⁵⁾. Home cooking and family meals are important indicators of family functioning and can therefore be considered an important target for future obesity prevention interventions. The transfer of cooking skills from parents to children could be an important aspect of encouraging cooking at home. Most of our respondents eat snacks between main meals. Proper nutrition depends on the type of snack. When children eat fruit, vegetables, muesli, yoghurt, nuts and the like as a snack between meals, they provide their bodies with valuable nutrients that are necessary for growth and development. This type of snack can help them maintain concentration and provide

a healthy source of energy that will not lead to unnecessary weight gain. However, if the snack consists of sweets and snacks, such a source of energy leads to the development of bad eating habits. From the data obtained, we can conclude that most of our respondents consume a variety of snacks in which fruit is the most common. However, a large number of respondents were found to consume sweets and snacks (e.g. crisps) as a snack once or several times a day. When the researchers analysed the data from 31 studies, they found that sugary foods and drinks did not improve mood or reduce fatigue. They looked at different time periods after eating, including the first half hour, and found that sugar did not improve mood or alertness. Rather, it seemed to increase the drop in energy. And this fatigue increased one hour after sugar consumption (Mantantzis et al., 2019). Snacks are alternately defined in the literature as foods consumed between meals and/or "snacks", usually labelled as high in energy but low in nutrients (i.e. sweets, crisps, biscuits, sugary drinks). Snacking currently accounts for a third of children's daily energy intake in the United States (Piernas in Popkin, 2010) and a quarter of young people's daily energy intake in some European countries (Samuelson, 2000). Although data on snacking and obesity in children are limited and inconclusive, there is evidence that children who frequently snack eat more energy, have poorer diets, and have other risk factors for PTSD (Larson i Story, 2013; Evans and others, 2015). Of our respondents, most eat breakfast before school every or almost every day (N = 95, 54.28%), but there are also a large number of respondents who do not eat breakfast at all or rarely eat breakfast before school (N = 80, 45.71%). Children who eat breakfast generally eat a healthier diet and are more likely to be physically active — two ways to maintain a healthy weight. When children skip breakfast, they can feel tired, restless or irritable. In the morning, their bodies need to refuel for the day ahead. If they do not eat breakfast, their mood and energy levels can drop mid-morning. Breakfast can

help to keep children's weight under control. Breakfast stimulates the metabolism, the process by which the body converts fuel from food into energy. And when the metabolism gets going, the body starts burning calories. Some studies show that the body burns more calories in the morning than late at night. Children who skip breakfast are more likely to be overweight because they snack more often during the day, eat too much at later meals and usually make up for what they have missed late in the evening. It is important that children eat breakfast every day, but it is also important what they eat in the morning. The ideal breakfast consists of foods rich in wholemeal products, fruit or vegetables and protein and low in added sugar. Eating breakfast helps children consume more fibre, calcium and other important nutrients, perform better in school and improve their memory and attention (Gavin L, 2021). Almost all schools have organised school meals. The study, carried out by Rabe and Angus Holford from the Institute of Social and Economic Research at the University of Essex, looked at the impact of a policy to provide free meals for all primary school children. They reviewed the BMI data of children in 16,000 primary schools to examine the impact of the balanced free meals of no more than 530 calories introduced by the Coalition Government in 2014. They found a steady decline in average BMI throughout the school year, amounting to around 12% of the standard deviation, suggesting that the school environment is having a favourable effect on children's energy balance. It is noteworthy that children's BMI increased again after only one or two weeks of school holidays, suggesting that children burn more calories at home or expend less energy through play and exercise than at school (Holford and Rabe, 2022). The environment can have a significant positive or negative influence on children's eating habits and physical activity. We may not always be able to influence the environment outside of school, but within school, with good programmes, we can create an

environment that has a positive impact on the development of healthy eating habits and physical activity in children (Gubbels, 2020). Educational interventions for healthy habits implemented in children in the first years of life improve and correct unhealthy habits. Preliminary findings from available research indicate that the sociocultural environmental factors that define what is socially acceptable, desirable and appropriate to eat may be more important for healthy eating than the physical environment that defines food availability. The respondents in our study mainly consume 1-2 litres of fluid per day, most commonly water. A small proportion of respondents, around 4%, consume less than 1 litre of fluid per day, and unhealthy forms of fluid intake consist of energy drinks for around 6% of respondents, coffee for 26% of respondents and alcohol for around 10% of respondents. A study conducted among Norwegian adolescents (N=2916, median age: 14.25 [SD = 0.85], 56% girls) in the period 2017-2021 concluded that higher consumption of energy drinks among Norwegian adolescents aged 13-15 years was associated with higher concomitant alcohol consumption and a greater increase in alcohol consumption during the study period up to the age of 17-19 years⁽⁴⁶⁾. A survey conducted in May 2014 with a nationally representative sample of 1,032 adolescents aged 13 to 17 revealed that almost two thirds of adolescents stated that they had consumed energy drinks. The most common reasons for consumption (e.g. lack of sleep or sport) varied according to gender and age group. The odds of lifetime and recent consumption increased with sensation-seeking, alcohol consumption and recent consumption of caffeinated soft drinks. Research has also shown that energy drink consumption is widespread among adolescents and varies according to demographic and psychosocial characteristics, lifestyle and substance use⁽⁴⁷⁾.

Plain water is the best hydrating drink for most people, but sports and energy drinks are advertised to appeal to those who exercise or need

energy to get through the day. Although they are sometimes confused with sports drinks, energy drinks are a completely different product. They are marketed to increase alertness and energy levels as they contain significant amounts of caffeine and as much or more sugar than sodas. Many energy drinks contain around 200mg of caffeine, which is equivalent to the amount in two cups of brewed coffee. Other substances that supposedly boost energy can also be added, such as B vitamins and herbs like ginseng and guarana. Of particular concern is the lack of regulations on the safety of these drinks, as well as the aggressive marketing tactics targeting young people⁽⁴⁸⁾.

IMPORTANCE OF PHYSICAL ACTIVITIES

Regular physical activity can help children and adolescents improve their cardiorespiratory fitness, build strong bones and muscles, control their weight, reduce symptoms of anxiety and depression, and reduce the risk of developing chronic non-communicable diseases. The extensive literature shows that regular physical activity promotes growth and development and has multiple benefits for children's mental, physical, cognitive and psychosocial health⁽⁴⁹⁾. The data from our survey shows that over 70% of respondents are physically active outside of school and participate in various sports, most of them playing football and dancing, and most of them participate in multiple sports and/or activities. Respondents who reported being physically active spend between 1-2 hours on some form of physical activity outside of school in most cases. Just under 30% of respondents do not engage in any physical activity outside of school. Participation in organised sport should enable young people to be physically active outside of school. According to some studies, 50 to 60% of 6 to 12-year-olds regularly take part in organised sport, with the participation rate higher among boys (61%) than girls (52%). Children who participate in organised sports are usually active in 1 to 2 organised sports. In most European countries, extracurricular activities are not compulsory. Extracurricular activities are organised by PE teachers and in most

cases fall within the remit of the Ministry of Education or the Ministry of Sport. Only in three countries is it possible to teach extracurricular activities without a qualification. Switzerland is the country that allocates the most hours to extracurricular activities (6 hours per week), while Slovenia and the United Kingdom only allocate one hour per week. The minutes per session vary from 45 minutes in Slovenia to 100 minutes in Luxembourg⁽⁵⁰⁾. The biggest problem with extracurricular sporting activities is that the time and resources needed to participate in organised sport are usually put on the backs of the family. It can be challenging for families to schedule the time needed for their children to participate in organised sports. In addition, each sport may require specialised equipment and protective gear that needs to be purchased and changed as children grow and develop. These are the main disadvantages that can affect long-term participation in organised sport. Almost all children (with the exception of those with medical conditions) receive some form of physical health culture (PE) as part of their primary education. Ideally, physical activity should be done daily, and the Centres for Disease Control and Prevention recommends that children and adolescents engage in at least 225 minutes of physical activity per week, with 50% of that time spent in moderate to vigorous physical activity. If these standards are met, children and adolescents would accumulate at least 20 minutes of physical activity per day during school hours, which is one-third of the recommended daily level of physical activity. The opposite of physical activity is a sedentary lifestyle and time spent in front of a screen. Excessive screen time can replace time spent in structured and unstructured play, directly lowering physical activity levels, and may even indirectly decrease physical activity by hindering the development of motor skills and physical literacy, ability, confidence and desire to be physically active throughout life⁽⁵¹⁾. This problem has probably been exacerbated in recent years due to ubiquitous access to screen time. In the past, children's TV programmes were watched at a

specific time on a dedicated TV set at home. Today, children can watch programmes on a variety of fixed and mobile devices, and many programmes can be watched online at any time of day. Physical inactivity in children and adolescents is considered one of the biggest health problems of the 21st century. According to the results of our survey, more than half of the respondents spend between 1 and 3 hours in front of the television, computer, mobile phone and the like, and 5% spend more than 5 hours per day.

PERCEPTION OF ONE'S OWN BODY

Most of the respondents in our study believe that their body weight is normal and that they eat a healthy diet. About 5% of respondents are on a diet, 21% believe they should lose weight and 6% believe they should gain weight. Of respondents surveyed, 14% believe that they are not eating healthily and more than 30% of respondents do not know whether they are eating healthily or not. Perception of body weight plays a crucial role as it encompasses feelings, attitudes and thoughts about weight, size, shape and appearance. Perception of body weight is a predictor of body management and BMI-related behaviours, i.e. actual weight status⁽⁵²⁾. A dissatisfaction with body image has increased among school children, who then look for quick or easy strategies to lose weight and develop eating disorders. These disorders affect their health and prevent them from seeking help from healthcare professionals. In addition, misperception can have further consequences on a child's life, not only in terms of health status, but also through the social environment and emotional well-being, affecting lifestyle. Last year, the World Health Organisation (WHO) published the results of the fifth round of the European Childhood Obesity Surveillance Initiative (COSI). The data collection was carried out from 2018 to 2020, 33 countries in the WHO European Region participated, and in the end almost 411.000 children aged six to nine years were measured. The Republic of Croatia participated in the fourth round of the survey for the first time. The fifth round of research in the Republic of Croatia was conducted

in the 2018/2019 school year, 232 schools participated, and the final sample included 2711 children aged 8.0 to 8.9 years^(14,53). The latest COSI report shows a worrying proportion of overweight and obese children. Overall, almost one in three children in the WHO European Region (29%) is overweight and obese, with a higher proportion of boys (31%) than girls (28%). It is particularly worrying that this proportion is highest in the Mediterranean countries. It is lowest in the countries of Northern and Eastern Europe. The Republic of Croatia is in fifth place, where 35% of children aged 8.0 to 8.9 years are overweight and obese. At the level of the WHO European Region, there is also a difference in the proportion of obesity between boys and girls. The problem of obesity is more pronounced in boys (14%) than in girls (10%), and there are also marked gender differences in Croatia, where 18% of boys and 12% of girls are obese^(14,53).

In contrast to the WHO recommendations for the daily consumption of five portions of fresh fruit and vegetables, the frequency is lower in most countries in the WHO European Region. For example, in 27 countries, 43% of children eat fresh fruit daily and only 34% eat vegetables. In Croatia, one in three children (32%) eat fruit daily and only one in five children (20%) eat vegetables daily. Regarding the physical activity of children in the Republic of Croatia, 41.2% of children spend two or more hours per day on weekdays watching TV or using electronic devices, and on weekends 78.3% and 58.9% of children spend three or fewer hours per week on organised physical activity. Childhood overweight and obesity therefore remains one of the biggest public health problems in the European region, and compared to other countries, Croatia has a high proportion of overweight children and devastating results in children's eating habits. Of particular concern is the fact that parents have a misconception about their child's diet. Of the 35.0% of children diagnosed with an overweight and obesity problem, only 14.0% of parents believe that their child is overweight or obese. Accordingly, the Croatian

Institute of Public Health points out that it is necessary to intensify the implementation of targeted public health measures that help to recognise the problem of overweight and obesity in children in order to prevent it and maintain long-term health⁽¹⁴⁾.

The main drawbacks and limitations of this study are: sample size smaller than expected, incorrectly/incompletely/inappropriately completed questionnaire, questionable accuracy of data (especially anthropological measures).

For all these reasons, this research represents an important contribution to the development of a health promotion and disease prevention strategy in the area of influencing modifiable risk factors for the development of overweight and obesity, the precursors of a number of chronic non-communicable diseases.

Conclusion

The data obtained gave us a good insight into the eating habits, physical activity and the problem of obesity among primary school students in Istria County and 19% of respondents are at high risk of severe malnutrition or severe obesity and obesity (according to the calculated BMI in relation to gender and age). Comparing these data with similar surveys conducted in other parts of the Republic of Croatia on the primary school population, it can be concluded that primary school pupils in Istria do not differ significantly from primary school pupils in other counties of the Republic of Croatia. Given this information, the next step, which is also the aim of this research, is to implement measures to educate students, parents and school staff. Education should be carried out by a multidisciplinary team consisting of nutritionists (with an elaborated individual nutrition plan for each individual student, depending on their needs, preferences, possibilities, etc.), health professionals (doctors and/or bachelor/master in nursing in the field of paediatrics, school medicine, public health and internal medicine), social workers (due to the influence of the family environment),

pedagogues, psychologists, kinesiologists and other expert profiles, depending on the individual approach required. This part of the intervention refers to students who, based on the data collected, are already at risk of health problems and includes the aforementioned interventions in 3 phases. For other respondents, including 17% of children diagnosed with overweight, who are at high risk of health consequences related to overweight and obesity preventive measures should be implemented. This type of intervention does not necessarily need to be carried out by a multidisciplinary team, but by individual professionals such as a Master of Clinical Nutrition or a Bachelor/Master of Nursing. Education can take place in the context of a class community centre or a parents' meeting where both students and parents are present. Teaching methods include PPT lectures, workshops on proper nutrition with distribution of brochures, leaflets and the like. As part of the LRC, students can make educational posters and posters. It is also recommended to conduct a survey among the students at least once a school year about their satisfaction with the school brunch (e.g. which meals they like best, what they would like to include in the school menu, etc.). The physical activity of school children can be improved by increasing the number of sports clubs available to the majority at school and in the local community. This requires a free or at least symbolic membership fee, and the actual costs should be covered by the local government, district or state budget. Authorities should realise that prevention is much cheaper than treating the consequences of poor diet, bad eating habits and lack of activity, especially in school-age children when lifelong habits are formed.

The growing problem of childhood obesity can be curbed if society focuses on the causes. A combined nutrition and physical activity programme implemented in a community with a school component is more effective in preventing obesity and overweight. What school-age children learn about healthy eating, exercise and proper

nutrition will have an impact on other aspects of their lives over time. By focusing on these causes, childhood obesity can be reduced over time and lead to a healthier society as a whole.

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We have no conflict of interest to declare.

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Ethical Approval

There is no ethical issue in our research and the research conducted is of minimal risk and was conducted in accordance with the usual standards of good academic practice. All participants was informed about research goals and methods.

Authors Contributions

All authors have contribution to the conception and design of the work, TV conducted research, TV and ŽJ analyzed and interpreted data, ŽJ wrote initial and final draft of article. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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