CHILDHOOD OBESITY SURVEILLANCE INITIATIVE, CROATIA 2021/2022 (CroCOSI)

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CroCOSi

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The Authors

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COSI	Childhood Obesity Surveillance Initiative
COVID-19	Coronavirus disease 2019
CroCOSI	Childhood Obesity Surveillance Initiative, Croatia
CIPH	Croatian Institute of Public Health
BMI	Body Mass Index
NCD	Non-Communicable Disease
M	Mean
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th Revision
MH	Ministry of Health
MSE	Ministry of Science and Education
N	Number
OECD	Organization for Economic Co-operation and Development
HRV	Republic of Croatia
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SD	Standard Deviation
SES	Socioeconomic Status
WHO	World Health Organization
PE	Physical Education

Introduction

Globally, obesity represents one of the biggest public health challenges of today's society. According to the tenth revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10), obesity is classified as a disease (1). In addition to being a disease, obesity represents an important modifiable risk factor for the development of numerous chronic non-communicable diseases (NCDs), which are currently the cause of morbidity and mortality in more than 90.0% of the people in the Republic of Croatia (2). The share of deaths caused by NCDs in Croatia (HRV) is above the European Union average (3). The term NCD covers a large number of diseases that arise as a result of the combined effect of hereditary, physiological, environmental and behavioral factors, such as cardiovascular and respiratory diseases, tumors, diabetes mellitus, etc. (4).

The problem of obesity is also very pronounced in HRV. According to the results of the 2019 European Health Interview Survey (EHIS), the prevalence of obesity in Croatian adults is higher than in any other European Union country, except Malta and Hungary (5).

A particular public health challenge is childhood obesity. Children with obesity will most often grow up to be adults with obesity, which also elevates the risk for the development of other NCDs. Furthermore, children with obesity are often socially disadvantaged, have lower self-esteem and are less successful at school (6,7). Although present in all countries and children from all socioeconomic backgrounds, the prevalence of overweight and obesity in high-income countries is highest in children coming from backgrounds affected by unfavorable socioeconomic conditions, such as poverty or lower level of education. On the other hand, the opposite was observed in middle-income countries: overweight and obesity prevalence were highest in children living in more favorable socioeconomic conditions (8).

According to the Childhood Obesity Surveillance Initiative, Croatia, conducted in 2019, one in three children in Croatia – 37.0% of boys and 33.0% of girls, are affected by overweight or obesity, and approximately one in seven children, that is, 18.0% of boys and 12.0% of girls, by obesity (9). These data rank Croatian eight-year-olds in fifth place on the scale of overweight and obesity prevalence in the World Health Organization (WHO) European region, together with children of the same age from Mediterranean countries such as Cyprus, Greece, Italy and Spain (10). Studies indicate that the prevalence of obesity in children and young people 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 (11). Also, according to research conducted by the Organization for Economic Co-operation and Development (OECD), overweight is a problem that will shorten life expectancy in Croatia by 3.5 years in the next 30 years (12).

There are concerns that the COVID-19 pandemic 2020-2022, due to containment measures, further affected the trend of increasing obesity prevalence in children (10,13), as evidenced by early research from other European countries (14,15).

It is important to know that the etiology of obesity is complex and that there is more and more scientific evidence on influences during the early life period, and even before the prenatal period, such as epigenetic factors, prenatal environment, maternal obesity, etc. In addition to these early influences, other risk factors for developing childhood obesity are the absence of breastfeeding or a breastfeeding period shorter than six months, inadequate nutrition, insufficient physical activity, environmental conditions in which children live and perform daily activities, and lower socioeconomic status (SES) (16-19). In adulthood, obesity and other NCDs share a common behavioral pattern. The four main behavioral factors associated with NCD mortality are tobacco use, physical inactivity, alcohol consumption and unhealthy diets (20).

The severity of the health threat posed by overweight and obesity is also reflected in one of the goals set by the WHO by 2025, which aims to terminate the trend of obesity growth (21). Today, no country in the WHO Europe Region is on track to achieve this objective (22).

For all aforementioned reasons, it is necessary to work on the prevention and control of overweight and obesity in children through the development of public health interventions, policies and regulations directly aimed at various determinants of obesity. Effective nutrition-related public health policies most often include production, fiscal measures, labeling and advertising of foods and beverages. Physical activity policies usually include incentives to use active transport and fiscal incentives, while environmental policies refer both to the natural and man-made or artificial environment (13). An example of environmental interventions in HRV is the 'Polygon for Physical Activity of School-Aged Children', through which a multipurpose kinesiological equipment set was delivered to primary schools lacking a gym or sports hall, thus contributing to the implementation of physical education classes, but also facilitating the physical activity of pupils from schools with limited material and spatial conditions (23).

In general, public health interventions and policies aimed at preventing overweight and obesity should always be science-based, lifelong, multisectoral and population-oriented, and their design should consider the socioeconomic inequalities and cultural specificities of individual populations (13). Since 2003, the 'Healthy Living' national health promotion program has been implemented across HRV, which, by promoting healthy nutrition and physical activity, aims to contribute to the preservation and improvement of health and the prevention of overweight and obesity in all Croatian residents (23). Also, in the process of adoption is the Action Plan on Obesity Prevention 2024 – 2027, with the aim of reducing the burden of

obesity by taking measures that promote healthy lifestyles, prevent risk factors and strengthen activities aimed at identifying, monitoring and treating obesity (13). A special sensibility for this problem that has manifested in all European countries, was expressed by the spouses of European Leaders who held a Summit in Zagreb in 2023 on the Prevention of Childhood Obesity in the WHO European Region. The "Zagreb Declaration" was adopted at the Summit, calling for the establishment of a New WHO European Centre on the Prevention of Childhood Obesity, to enhance joint strategic activities and facilitate the transfer of best practices in the field of obesity prevention (24).

Since in HRV data on the weight status, physical activity and dietary habits of schoolchildren are not collected in a standardized manner, although all schoolchildren undergo regular physical examinations with anthropometric measurements, in 2015/2016 Croatia introduced the Childhood Obesity Surveillance Initiative (COSI), coordinated by the WHO Regional Office for Europe. The main goal of the COSI research is regular collection of comparable data on the weight status of schoolchildren, on their families' lifestyle habits, and characteristics of environments in the schools they attend.

In HRV, the COSI research is being conducted under the title Childhood Obesity Surveillance Initiative, Croatia (CroCOSI). To date, three rounds of CroCOSI research have been conducted in HRV. The first round was conducted in 2015/2016, the second round in 2018/2019 and the third round in 2021/2022. The age group for which the data are collected, 8.0-8.9 years, is crucial as it includes children attending second and third grades of primary schools, who are familiar with school processes and have acquired habits compatible with the school environments they attend (25).

By joining the COSI research, HRV joined the largest initiative of monitoring obesity in children, whose members continuously observe the weight status of children in a methodologically concordant manner, which allows comparison with other European countries and, at the same time, contributes to raising awareness of the growing problem of obesity and related problems in all the countries involved, including HRV. Based on the results obtained, this will give HRV the foundation for creating strategies and policies for the prevention of overweight and obesity in children, which will strengthen the targeted and focused promotion of health among schoolchildren.

This report presents the results of the third round of CroCOSI research conducted in the school year 2021/2022, with the main goal of obtaining data on the weight status and lifestyle habits of a representative sample of schoolchildren aged 8.0 to 8.9 years. The added value of this round of research is in the data collection and comparison of the children's habits before and during the COVID-19 pandemic, an overview of which forms an integral part of this publication.

Research methodology

COSI is a cross-sectional research of the WHO Regional Office for Europe monitoring childhood obesity, so far implemented in three-year intervals. Croatia joined this research for the first time in the school year 2015/2016 when a total of 36 countries of the WHO Regional Office for Europe participated in the research. At that time, 35.0% of children with overweight and obesity – 33.1% of girls and 37.0% of boys (26), were recorded in HRV. Comparatively, the highest share (43.0%) of children with overweight and obesity was reported in Cyprus, while the lowest (6.0%) was reported in Tajikistan (10).

The research in HRV was conducted by the Croatian Institute of Public Health (CIPH), with the support of the Ministry of Health (MH), the Ministry of Science and Education (MSE) and the WHO Office for Croatia, in accordance with the COSI Data collection procedures of the WHO Regional Office for Europe (27). The principal investigator for the Republic of Croatia is Associate Professor Sanja Musić Milanović.

Sampling and research design

The target population of the CroCOSI research consisted of children aged 8.0 to 8.9 years, i.e. 96 to 107 months of age. The research was conducted on a nationally representative random cluster sample that was regionally stratified.

For sampling purposes, HRV was stratified into four statistical regions of the second level (NUTS 2): Pannonian, Adriatic and Northern regions, and the City of Zagreb, by the National Classification of Statistical Regions (28).

The planned sample size was 2.800 children from the targeted age group, 1.400 girls and 1.400 boys. In order to include the targeted age group, children of all second and third grades of primary schools in HRV were included in the sampling. When calculating the sample size, a response rate of 75.0% was assumed. Considering the assumed response rate and the share of children from the targeted age group in a particular grade, 3.500 children from all second and 3.500 children from all third grades were planned for sampling.

The sampling unit was a class. The official list of all classes was provided by the MSE. According to the list, second and third grades comprised a total of 74.196 children in HRV at the time of sampling, of which 25.0% were from the Pannonian region, 33.0% from the Adriatic region, and 21.0% from the City of Zagreb and the Northern region, each. Considering the average number of children per class in individual regions, 88 second grade classes from the Pannonian region, 91 second grade classes from the Adriatic region, 38 second grade classes from the City of Zagreb and 56 second grade classes from the Northern region were randomly selected in the sample using the SPSS statistical software. Where possible, one third grade was adjoined to each sampled second grade from the same primary school. The overall sample included

7.516 children from 273 second and 265 third grades from 261 primary schools in HRV, of which 179 were central and 82 district primary schools. The number of schools included in the research from each region is presented in Figure 1.

In order to improve the understanding of the problem of overweight and obesity in schoolchildren, in this round of research both central and district primary schools were included in the sample, and the sample was previously stratified into four regions: Adriatic, Northern and Pannonian region, and the City of Zagreb. This way of sampling differs from the one used in the first two rounds of CroCOSI research because, in the first round, a nationally representative sample of children from primary schools was selected without prior regional stratification, while in the second round, a sample of children from central and district primary schools was stratified into three regions: Adriatic region, Continental region and the City of Zagreb.

Figure 1. Number of primary schools participating in the CroCOSI 2021/2022 research by regions

Data collection and entry

The CroCOSI research used all three data collection forms of the WHO COSI Data collection procedures (27): the child's record form, the family's record form and the school record form. Data collection forms were translated into Croatian language.

The family's record form, filled in by the child's parents or guardians, collected data on the family's socioeconomic and anthropometric characteristics, as well as the child's dietary habits and physical activity habits. This record form also included questions regarding the impact of the COVID-19 pandemic on the child's daily routine, well-being, dietary habits and behaviors related to physical activity. Family's record forms were delivered to schools together with information on the research methodology and purpose, and an informed consent form for parents. Furthermore, a PowerPoint presentation with basic information on the research was e-mailed to each school to help inform the parents. Family's record forms were distributed during parent-teacher meetings organized by the school. The completed family's record form and the signed informed consent were collected by school personnel and given to examiners during the measurement of children. On this occasion, a school record form was filled out, containing questions about the school environment, the possibility of participating in regular physical activity in schools, the organization of nutrition in schools, initiatives for promoting healthy lifestyles and the presence of food marketing within schools. School record forms were filled in by principals, school counsellors or school teachers, with the help of examiners.

The child's record form – a form containing the child's anthropometric measures, as well as data on the child's health behavior on the day of the measurement, was filled out by an examiner during the measurement of children across schools. The child's record forms also collected data on the child's place of residence. All local administrative units were subsequently classified into three categories: cities (densely populated areas), towns and suburbs (intermediate density areas) and rural areas (thinly populated areas), according to the Eurostat classification of urbanisation (29).

Data from the printed versions of all three record forms were entered into the electronic database using the LibreClinica software.

Data entry, as well as communication with the WHO Regional Office for Europe regarding incomplete documentation or data irregularities, was conducted by the CroCOSI research team.

Training for conducting field measurements and data collection

The two-day training of examiners who conducted measurements of children and collected data was organized and conducted by the CIPH research team in February 2022. The practical part of the training was conducted in the third grade of one primary school, in accordance with all ethical principles of research and the WHO Regional Office for Europe COSI Data collection procedures (27). After the training, each examiner was assigned a unique examiner code.

Fieldwork and measurement

The data collection and field measurement lasted from 28 February to 13 April 2022. The fieldwork involved 32 trained examiners who visited schools and conducted measurements of children in teams of two or three members. One of the team members was always a healthcare worker.

When announcing the school visits, examiners asked teachers to inform the children that for measurement purposes they should wear gym clothes and take off their shoes when being measured.

Eighteen sets of measuring equipment were used to measure the children's weight and height. The sets were identical, in accordance with the WHO Regional Office for Europe COSI Data collection procedures, and contained: a weighing scale (SECA 877), height board (SECA 217), adapter element for attaching the weighing scale with the height board (SECA 437), non-elastic tape for measuring waist and hip circumference (SECA 203) and carrying bag to transport the set (SECA 414).

Measurement was conducted in school facilities during school hours. Weight was measured with the accuracy of 100 grams, and body height with the accuracy of 1 millimeter. Height was measured twice, and the average value of the two measurements was used for the analysis. Waist and hip circumference were measured after measuring body height and weight, with a non-elastic measuring tape in centimeters and recorded to the last completed millimeter (0.1 centimeters).

Examiners ensured that the basic principles of confidentiality, privacy and objectivity were respected throughout the process. Since measuring body height and weight can increase the risk of stigmatization and peer violence, examiners performed all measurements in a way to minimize the possibility of any such adverse effect.

When conducting anthropometric measurements in schools, the examiners, in addition to anthropometric measures, also recorded additional information on children, such as the type of clothing that children wore during the measurement and whether the measurement was conducted before or after lunch. The majority of children, 73.3%, were measured before lunch. In the final calculation of body weight, the measured children's weight was adjusted to the documented type of clothing. Thus, 130 g was deducted from the measured weight in case the child wore gym clothes (e.g. T-shirt and shorts), 195 g was deduced if the child wore light clothing (e.g. T-shirt, cotton trousers or skirt), and 600 g was deducted if the child wore heavy clothing (e.g. sweater and jeans). Only 10.5% of the measured children followed the recommendation to wear gym clothes when being measured, while most of the children were measured in light clothing, namely 77.4%. Only 12% of children were measured in heavy clothing. All children were measured without footwear and had emptied their pockets immediately before the measurement.

Participants

Each of the 261 sampled schools agreed to participate in the research. A total of 7.516 children were selected in the sample with a response rate of 70.5%, while parents' response rate to the family's record form was 72.4%. Of the total number of children invited to participate in the research, 1.814 lacked signed informed consent from their parents, 399 were absent from school on the day of measurement, and one child actively refused the measurement. The final sample consisted of 2.374 children aged 8.0 to 8.9 years, and the final sample was supplemented with data on another 140 eight-year-olds who were not measured but had provided a filled-out family's record form. Thus, this publication presents data on a total of 2.514 children. Data on the research sample, response rate and number of participants by sex are presented in Figure 2 and Table 1.

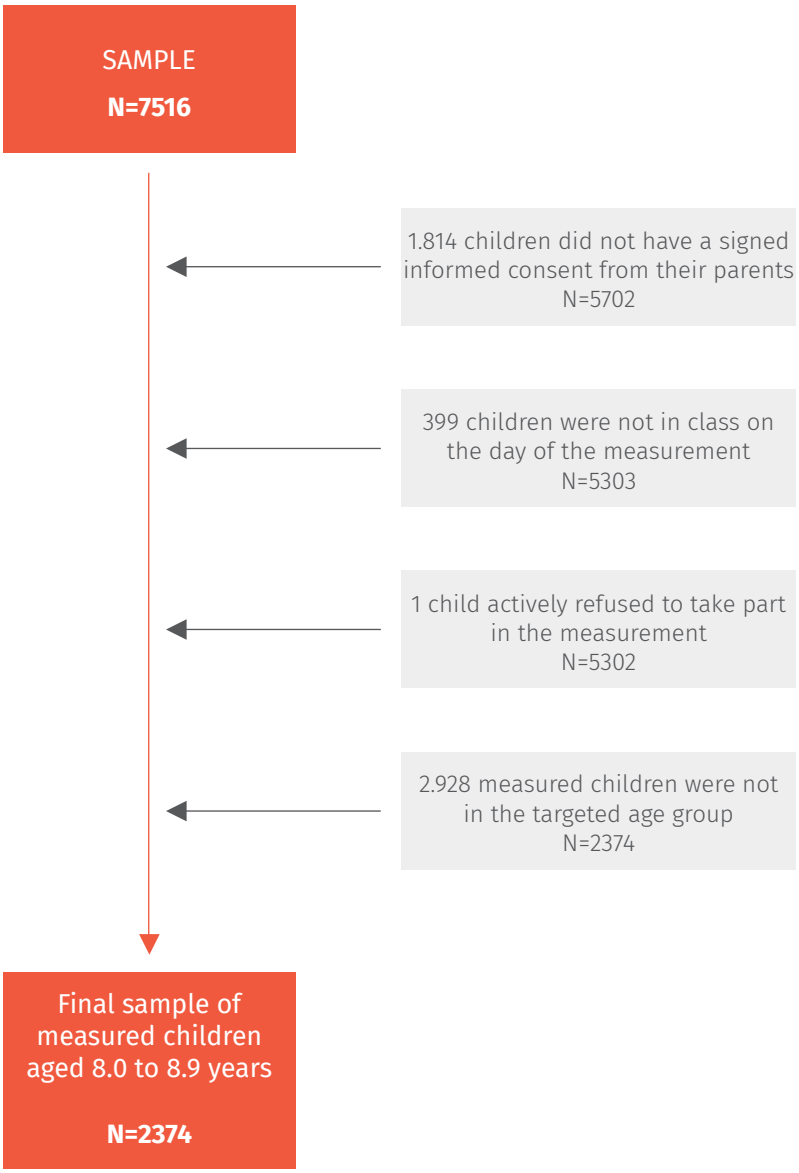


Figure 2. Flowchart demonstrating the sampling process in the CroCOSI research, 2021/2022

Table 1. Number of participants by sex, CroCOSI 2021/2022

	N
Boys	1271
Girls	1243
Total	**2514**

In order to infer results from this research sample to population, post-stratification weights estimated by the WHO Regional Office for Europe were used in all analyses conducted for the purpose of this publication, considering the sampling design, oversampling and nonresponse.

Due to a rounding error, the sum of all percentages presented in the tables may differ from 100.0%.

Classification of weight status

WHO SPSS code was used for the analysis of data on child growth, which contains criteria and WHO reference data on the growth of children aged 5 to 19 years from 2007 (30). The body mass index-for-age (BMI) indicator was used in the analysis.

Ethical considerations

CroCOSI research was approved by the CIPH Ethics Committee in December 2021 (Class: 030-02/18-07/2) and was conducted in accordance with modern ethical principles, with respect for the fundamental bioethical principles of autonomy, justice, beneficence and nonmaleficence. An informed consent signed by the child's parent or guardian was required for the collection of the child's anthropometric measures. Immediately before the measurement, all children who had presented a signed consent from a parent or guardian once again gave their active consent to participate in the measurement. The anonymity of the participants was ensured by coding the data on the child's school, class and identity, and the coding was conducted by the members of the CIPH research team, in accordance with the WHO Regional Office for Europe COSI Data collection procedures (27).

Weight status of children aged 8.0 to 8.9 years in Croatia

Children's weight status in the Republic of Croatia

On the national level, as presented in Table 2, one in three children, or 36.1% of children aged between 8.0 and 8.9 years had overweight or obesity. The prevalence of boys with overweight including obesity was 38.5%, while the prevalence of boys with just obesity was 18.7%. The prevalence data for girls is high, but slightly lower than the prevalence data for boys. They indicate that, at the time of measurement, 33.7% of girls had overweight including obesity, while 12.0% had obesity. If we look at the prevalence of underweight in children, according to the BMI-for-age, 1.4% of measured children can be classified in the category of underweight.

Regarding the region, as presented in Table 2, the lowest prevalence of overweight and obesity, 28.6%, was reported in the City of Zagreb, followed by the Northern region with 36.2% of eight-year-olds with overweight or obesity, and the Adriatic region with 38.6%, while the highest share of 38.9% was reported in the Pannonian region. Data for children with obesity, looking at the regional perspective, indicate that the lowest share of children with obesity, 9.8%, was recorded in the City of Zagreb, while in the other three regions the shares were higher, namely 15.2% in the Adriatic region, 15.7% in the Northern region, and 20.0% in the Pannonian region.

When comparing boys and girls at the regional level, as presented in Table 2, the lowest share of girls with overweight and obesity was observed in the City of Zagreb, where it was 27.6%, while the highest share was documented in the Adriatic region, 36.3%. Obesity in girls was most common in the Pannonian region, where the share of girls with obesity was 15.2%. In boys, the lowest share of overweight and obesity was also recorded in the City of Zagreb, 29.8%, while it was highest in the Pannonian region, where 43.0% of boys were affected by overweight or obesity. Obesity in boys was also the most prevalent in the Pannonian region, where it affected almost one in four boys, or 24.1%, while in the City of Zagreb the share of boys with obesity was nearly down by a half, at 12.2%. Comparison by sex within regions indicated that overweight and obesity are more common in boys than girls in all HRV regions.

Table 2. Children's weight status by sex and region, CroCOSI 2021/2022

	Underweight	Normal weight	Overweight	Obesity
	%	%	%	%
Republic of Croatia				
Boys	1.3	60.2	19.8	18.7
Girls	1.4	64.8	21.7	12.0
Total	**1.4**	**62.5**	**20.7**	**15.4**
City of Zagreb				
Boys	1.9	68.3	17.6	12.2
Girls	0.4	72.0	20.0	7.6
Total	**1.1**	**70.3**	**18.8**	**9.8**
Adriatic region				
Boys	1.5	57.8	21.6	19.2
Girls	0.7	63.0	25.1	11.2
Total	**1.1**	**60.4**	**23.4**	**15.2**
Northern region				
Boys	0.0	62.9	19.9	17.2
Girls	2.2	62.3	21.1	14.3
Total	**1.2**	**62.6**	**20.5**	**15.7**
Pannonian region				
Boys	1.7	55.3	18.9	24.1
Girls	2.8	63.0	18.9	15.2
Total	**2.2**	**58.9**	**18.9**	**20.0**

A comparison of the three rounds of CroCOSI research conducted so far (Figure 3) reveals a slight increase in the prevalence of overweight and obesity in children. In 2015/2016 the share of children with overweight and obesity was 34.9%, in 2018/2019 it was 35.0%, while in the third round, in 2021/2022, it increased to 36.1%. In this sense, HRV is another country that is still not on track to achieve one of the WHO's main goals aimed at the global prevention of NCDs, which is to stop the trend of increasing obesity by 2025 (21, 22). In fact, according to the results of previous COSI research rounds, HRV is at the very top of Europe, together with other Mediterranean countries.

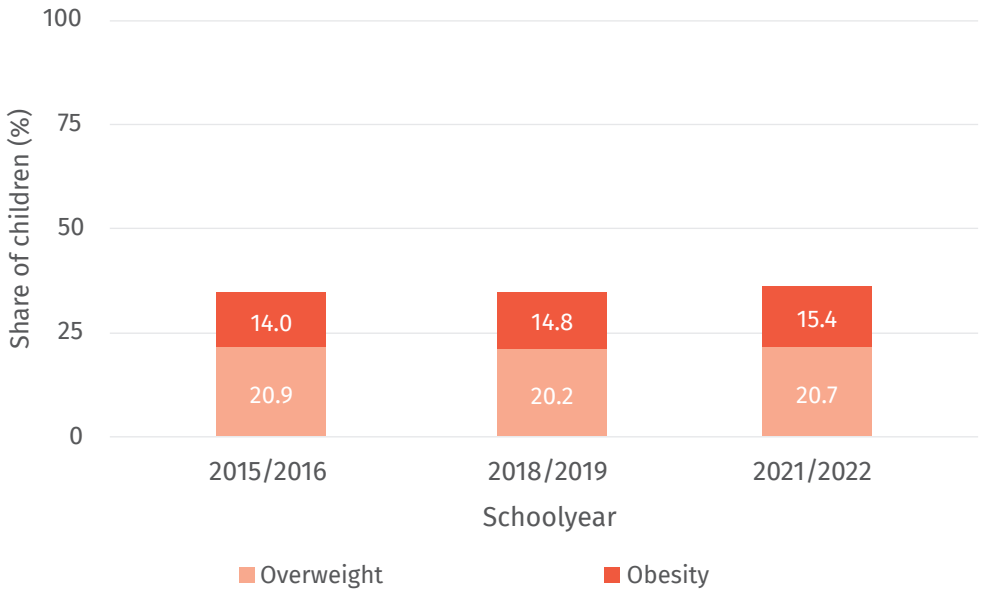


Figure 3. Comparison of prevalence of overweight and obesity in children in the first, second and third rounds of CroCOSI research, 2015/2016, 2018/2019 and 2021/2022

Children's weight status based on urbanisation

Urbanisation level shapes the lifestyle of children and families. Research suggests that in developed countries, living in rural areas carries an increased risk for obesity in children (31). The results of our research, presented in Table 3, indicate that this pattern also applies to HRV, i.e. that the share of children with obesity is lower in urban and higher in rural areas. In urban areas, 13.3% of children have obesity, while in rural areas this problem affects 20.1% of children, or one in five children.

Table 3. Children's weight status based on urbanisation, CroCOSI 2021/2022

	Underweight	Overweight (including obesity)	Obesity
	%	%	%
Urban	1.4	34.6	13.3
Rural	1.3	39.6	20.1
Total	**1.4**	**36.1**	**15.4**

The mean values of body weight and height, and waist and hip circumference are presented in Table 4. For girls, the average body height was 134.70 cm, the average weight was 31.66 kg, while the average waist and hip circumference was 60.44 cm and 72.39 cm, respectively. For boys, the average body height was 136.03 cm, the average body weight was 32.84 kg, while the average waist and hip circumference was 62.27 cm and 73.58 cm, respectively.

Table 4. Body weight in kilograms, and body height, waist and hip circumference in centimeters by sex, CroCOSI 2021/2022

	Height		Weight		Waist circumference		Hip circumference	
	Mean (cm)	SD	Mean (kg)	SD	Mean (cm)	SD	Mean (cm)	SD
Boys	136.03	6.18	32.84	7.40	62.27	8.05	73.58	7.58
Girls	134.70	6.46	31.66	7.10	60.44	7.83	72.39	7.28
Total	**135.37**	**6.36**	**32.25**	**7.27**	**61.36**	**7.99**	**72.99**	**7.45**

Children's weight status by family's socioeconomic characteristics

Figure 4, which depicts the share of overweight (including obesity) and obesity in children, regarding the socioeconomic characteristics of their family, shows that the highest share of overweight and obesity, 44.6%, was recorded in children who lived with grandparents or other guardians, in foster families or children's homes, as presented under 'Other'. This was followed by the share of 40.2% of children with overweight or obesity who lived in single-parent families and 35.6% of children in two-parent families.

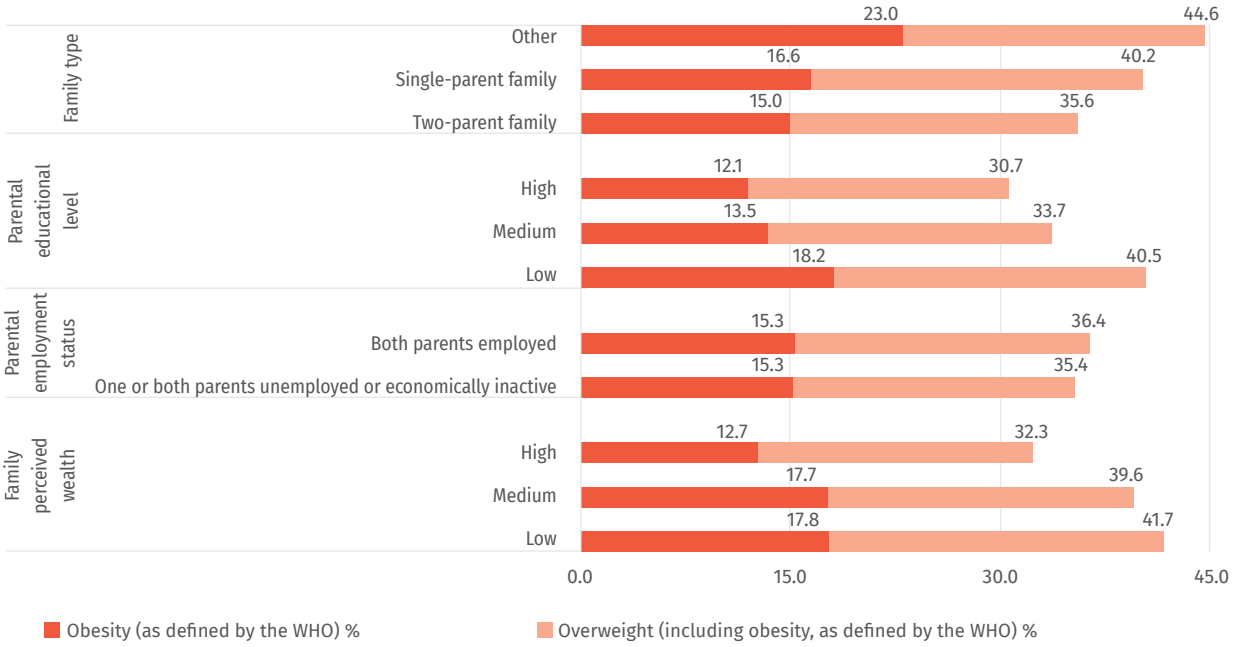


Figure 4. Share of overweight (including obesity) and obesity in children by socioeconomic characteristics of the family they live in, CroCOSI 2021/2022

Significant differences in the share of children with overweight and obesity were observed regarding the educational level of their parents. The lowest share of children with overweight or obesity, 30.7%, was recorded in families with higher parental educational level (both parents have completed a higher level of education, a Bachelor's, a short-cycle tertiary education, a master's degree or higher). In children from families in which parents had a medium education level, with one parent having a lower level of education or completed primary education, secondary education or post-secondary non-tertiary education, and the other parent having a higher level of education, the corresponding share was 33.7%. In families where both parents had lower education levels, the highest share of children with overweight or obesity was recorded, 40.5%.

A slightly higher share of children with overweight or obesity, 36.4%, was measured in families where both parents were employed, compared to 35.4% of children with overweight or obesity in families where one or both parents were unemployed or economically inactive.

As part of the family perceived wealth indicator, which is a risk factor for childhood obesity indicating the financial situation in the family, significant differences were, likewise, found. In families with low family perceived wealth, i.e. families whose income barely covers their monthly expenses or who have problems making ends meet, the highest share of children with overweight or obesity was recorded, 41.7%, followed by families with a medium family perceived of wealth, i.e. who have no major problems in covering the monthly expenses, with 39.6% of the children affected by overweight or obesity. The lowest prevalence of overweight and obesity, 32.3%, was recorded in families that have no problems covering monthly expenses.

Parents' perception of their children's weight status

The results presented in Tables 5-8 depict the perception of child weight status by parents.

Table 5 shows that only one in nine parents in HRV find their child a little or extremely overweight, which indicates that the parents' perception is not in line with the actual weight status of children measured in this research, according to which one in three children in HRV is living with overweight or obesity. Parents' perception differs regarding their child's sex, in such a way that parents more often consider girls to have normal body weight, and boys a little overweight. Parents also perceive boys as underweight more often than they do girls.

Table 5. Parents' perception of their children's weight status by sex, CroCOSI 2021/2022

	Underweight	Normal weight	A little overweight	Extremely overweight
	%	%	%	%
Boys	1.8	84.9	13.0	0.3
Girls	0.8	87.6	10.9	0.6
Total	**1.3**	**86.3**	**11.9**	**0.5**

According to data on parents' perception of child weight status, it can be established to what extent parents incorrectly perceive the weight status of their children. This piece of information is important for the development of interventions and the identification of parental groups that need special attention from the perspective of preserving their children's health. Thus, according to the data presented in Table 6, parents generally correctly perceive the normal weight status of their children, with boys of normal body weight being somewhat more often perceived as underweight compared to girls. In children with overweight or obesity, according to Table 7, only one in three parents perceives their child to be a little or extremely overweight. When looking at children with obesity, which is observed in 15.4% of them, according to the data presented in Table 8, a child's weight status is correctly perceived by very few parents, while the majority consider their children to be a little overweight or to have normal body weight.

Table 6. Parents' perception of the weight status of children with normal body weight by sex, CroCOSI 2021/2022

	Underweight	Normal weight	A little overweight	Extremely overweight
	%	%	%	%
Boys	2.4	97.2	0.4	0.0
Girls	1.1	97.9	1.0	0.0
Total	**1.7**	**97.6**	**0.7**	**0.0**

Table 7. Parents' perception of the weight status of children with overweight by sex, CroCOSI 2021/2022

	Underweight	Normal weight	A little overweight	Extremely overweight
	%	%	%	%
Boys	0.0	67.3	32.5	0.2
Girls	0.0	68.4	30.4	1.3
Total	**0.0**	**67.8**	**31.5**	**0.7**

Table 8. Parents' perception of the weight status of children with obesity by sex, CroCOSI 2021/2022

	Underweight	Normal weight	A little overweight	Extremely overweight
	%	%	%	%
Boys	0.0	42.8	56.7	0.5
Girls	0.0	45.5	51.0	3.5
Total	**0.0**	**43.9**	**54.4**	**1.7**

Family characteristics

In this third round of CroCOSI research, as presented in Table 9, the family's record form was most often, in 89.0% of children, filled out by mothers, while 10.0% of the record forms were filled out by fathers. In cases where parents were not able to fill out the family's record form, it was filled out by someone else, mainly siblings, grandmothers or other guardians, such as members of a foster family.

Table 9. Surveyed family members, CroCOSI 2021/2022

Relationship with the child	%
Mother	89.0
Father	10.0
Other	1.1

Family type

Table 10 depicts the type of family of the children surveyed. The majority of the surveyed children, 90.7% of them, lived in two-parent families, while 8.5% lived in single-parent families. The smallest share of children, 0.8% of them, lived with grandparents or other guardians, in foster families or children's homes.

Table 10. Type of family of children surveyed, CroCOSI 2021/2022

Family type	%
Two-parent family	90.7
Single-parent family	8.5
Other	0.8

Parents' weight status

Children's weight status is significantly associated with their parents' weight status. This finding can be ascribed to a combination of shared genetic, behavioral and environmental factors (32,33). Therefore, knowing the information on parents' weight status, along with information on family habits and environmental characteristics, is necessary for targeted preventive action. According to the data obtained from parents of surveyed children, as presented in Table 11, 33.2% of mothers and 76.5% of fathers were affected by overweight or obesity.

Table 11. Parents' weight status of children surveyed, CroCOSI 2021/2022

	Underweight	Normal weight	Overweight	Obesity
	%	%	%	%
Mothers	2.4	64.4	24.8	8.4
Fathers	0.1	23.4	52.7	23.8

Socioeconomic family indicators

SES, measured by education level, employment status and monthly household income, is another determinant of obesity. Previous research suggests that in countries with higher average income, to which HRV belongs, people with lower SES are more likely to have overweight or obesity (8).

According to the data on parents' education level presented in Table 12, obtained through the family's record form, in 46.8% of families both parents had a lower level of education, i.e. completed primary education, secondary education or post-secondary non-tertiary education. A medium education level was observed in 26.6% of parents, according to which one parent had a lower and the other higher level of education, i.e. Bachelor's, short-cycle tertiary education, a Master's or higher education level, while in 26.6% of the families both parents had a higher education level. Table 13 specifically indicates that both mothers and fathers most often had completed upper secondary and post-secondary non-tertiary education, followed by Master's or a higher level of education, then short-cycle tertiary education or Bachelor's, while the smallest share of both fathers and mothers had completed lower secondary education or less. Table 13 shows that a higher share of mothers had a higher level of formal education than fathers, including Bachelor's/short-cycle tertiary education or Master's and higher level of education.

Table 12. Parents' education level of children surveyed, CroCOSI 2021/2022

Parents' education level	%
Low	46.8
Medium	26.6
High	26.6

Table 13. Mother's and father's education level of children surveyed, CroCOSI 2021/2022

	Mother	Father
	%	%
Primary education or less (1st-4th grade)	0.5	0.4
Lower secondary education	3.2	4.2
Upper secondary and post-secondary non-tertiary education	49.6	62.7
Short-cycle tertiary education or Bachelor's or equivalent level	13.3	8.9
Master's or Doctoral or equivalent level	33.4	23.8

According to the data presented in Tables 14 and 15, 69.3% of surveyed children had both employed parents. In general, mothers were more likely to be unemployed or homemakers than fathers.

Table 14. Parents' employment status of children surveyed, CroCOSI 2021/2022

Parents' employment status	%
One or both parents unemployed or economically inactive	30.7
Both parents employed	69.3

Table 15. Mother's and father's employment status of children surveyed, CroCOSI 2021/2022

	Mother	Father
	%	%
Homemaker	14.8	0.6
Working full-time	69.3	89.2
Working part-time	5.0	1.4
Unemployed	4.5	3.2
Full-time education	0.1	0.0
Sick/disabled	0.0	0.2
Other	6.2	5.4

According to the data presented in Table 16, the majority of families, 92.2% of them, felt that they had no problems or no major problems in covering their monthly expenses, while 7.8% reported problems in covering their monthly expenses.

Table 16. Family perceived wealth of children surveyed, CroCOSI 2021/2022

Family perceived wealth	%
We easily pass the month with our earnings	49.2
We pass the month without serious problems with our earnings	43.0
We have trouble making ends meet in the month with our earnings	4.0
We barely making ends meet in the month with our earnings	3.8

Characteristics of early development

Some of the early childhood characteristics associated with childhood obesity are the mother's body weight during pregnancy, the child's birth weight, the increase in the child's weight during infancy, the duration of breastfeeding, etc. (34, 35, 36).

Duration of pregnancy

Some research suggests a possible connection between preterm birth, especially before the 32nd week of pregnancy, and metabolic disorders such as obesity in adulthood (37). Therefore, gestational age or duration of pregnancy is an important factor to be monitored as part of the epidemiological surveillance of childhood obesity. Data on the duration of pregnancy in mothers of surveyed children, collected through the family's record form, are presented in Table 17. The results indicate that 85.9% of the children were born on term, while 13.7% were born outside of term, i.e. before 37 weeks + 1 day of pregnancy or after due date, 41 weeks + 6 days of pregnancy, and 0.4% could not determine the duration of pregnancy.

Table 17. Duration of pregnancy in weeks by sex, CroCOSI 2021/2022

	≤32 weeks	33-36 weeks	37-41 weeks	≥42 weeks	Don't know
	%	%	%	%	%
Boys	1.5	4.6	85.0	8.5	0.4
Girls	1.2	3.8	86.8	8.0	0.3
Total	**1.3**	**4.2**	**85.9**	**8.2**	**0.4**

Birth weight

Data on surveyed children's birth weight were obtained from the family's record form. The mean birth weight of the children surveyed, according to the parents, was 3434.9 ± 559.4 grams.

Breastfeeding

According to WHO recommendations, breastfeeding should begin within the first hour after the child's birth, and the child should be exclusively breastfed until the age of six months. Exclusive breastfeeding means that the child does not consume any other food or liquid, not even water. The exceptions are oral rehydration solutions, drops or syrups with vitamins and minerals, as well as medicines. WHO recommends that mothers breastfeed on demand, i.e. when and as much as the child demands, and it is not recommended to use bottles or pacifiers. From the age of six months, it is recommended to gradually introduce adequate complementary feeding, while continuing to breastfeed until the child's second year of life or longer (38). According to the data collected through the family's record form presented in Figure 5, of all the children reported by parents to had been breastfed, 67.7% were exclusively breastfed. The share of surveyed children who were exclusively breastfed for at least 6 months, in accordance with WHO recommendations, was 27.4%.

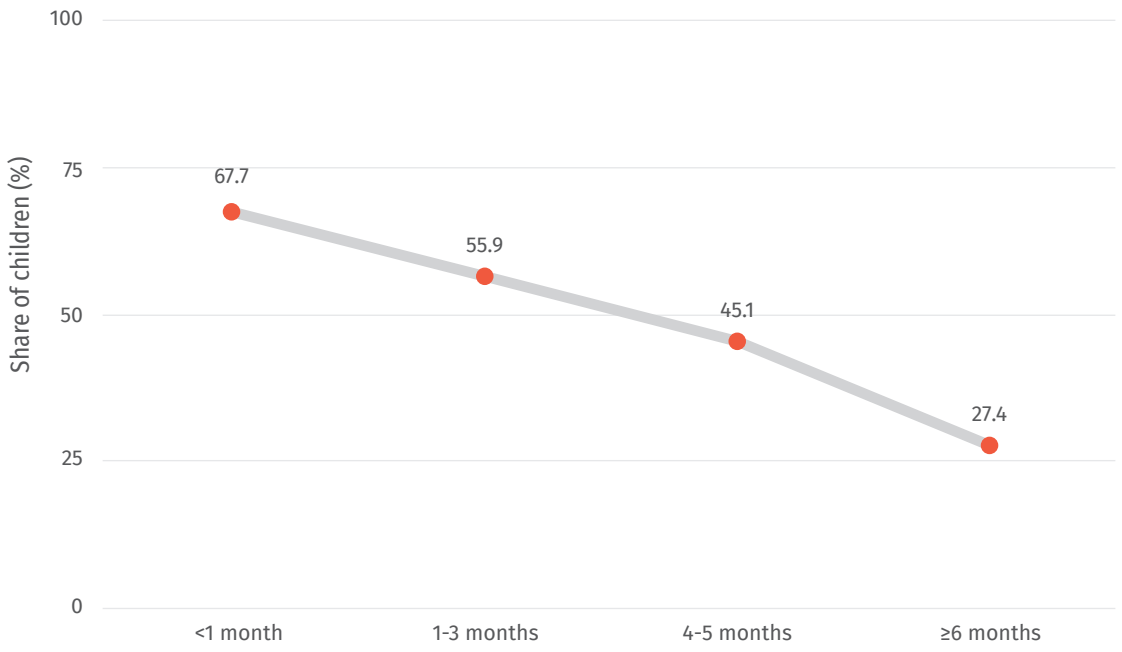


Figure 5. Duration of exclusive breastfeeding, CroCOSI 2021/2022

According to the results on the duration of breastfeeding in children whose parents reported that information, as depicted in Figure 6, the share of breastfed children declines with age. Parents report that 94.2% of children were breastfed at some point in their lives, of which 14.2% were breastfed for less than a month. Only 7.4% of children were breastfed according to WHO recommendations, i.e. for more than 24 months.

Figure 6. Average duration of breastfeeding in months, CroCOSI 2021/2022

Table 18 depicts the age of starting complementary feeding by introducing formula milk. According to the results, 15.6% of children had formula milk introduced from birth. In 47.2% of children formula milk was introduced before the age of six months, while 44.1% of surveyed children, in line with WHO recommendations, never had formula milk introduced.

Table 18. Complementary feeding by introducing formula milk, CroCOSI 2021/2022

	Never	From birth	From age of 1 month	From age of 2 months	From age of 3 months	From age of 4 months	From age of 5 months	From age of 6 months
	%	%	%	%	%	%	%	%
Boys	44.8	14.8	9.4	7.4	6.3	4.9	3.8	8.8
Girls	43.3	16.6	11.5	5.5	6.1	5.3	3.0	8.5
Total	**44.1**	**15.6**	**10.4**	**6.5**	**6.2**	**5.1**	**3.4**	**8.6**

Complementary feeding

Around the age of six months, the infant's needs for energy and nutrients start to exceed the level of energy and nutrients provided by breast milk, and it is necessary to introduce complementary foods to meet these needs. An infant of this age is also developmentally ready for other types of food. This transition is called complementary feeding and takes place gradually, from the child's age of six months or as recommended by the pediatrician. If complementary feeding is not introduced around the sixth month or if given inappropriately, that can lead to poor growth outcomes (39).

Table 19 presents the age at which the surveyed children had complementary foods introduced, according to their parents' reports. In accordance with the results, 44.7% of children had complementary foods introduced, as recommended, around the sixth month, while in other children complementary feeding was started earlier.

Table 19. Age of introducing complementary foods, CroCOSI 2021/2022

	During the first 3 months	During the 4th month	During the 5th month	During the 6th month	After 6 months
	%	%	%	%	%
Boys	6.6	24.6	24.3	21.9	22.7
Girls	7.1	25.7	22.3	24.6	20.3
Total	**6.8**	**25.1**	**23.3**	**23.2**	**21.5**

Physical activity and sedentary lifestyles

Physical activity

Physical activity is one of the important determinants of overweight and obesity. Regular physical activity is, hence, an important factor in preventing overweight and obesity, and preserving the health of children and adults. According to WHO recommendations, children and youth between the ages of 5 and 17 years should engage in physical activity of moderate-vigorous intensity for a minimum of 60 minutes every day, most of which should be aerobic. Aerobic physical activities of vigorous intensity aimed at strengthening muscles and bones should be exercised at least three days a week (40). The habit of regular physical activity at school age can be encouraged in many ways. These include active traveling to and from school, active play, participating in sports or dance activities, etc., which implies a necessary reduction of time spent in sedentary activities, such as watching television or using electronic devices (41).

The results of our research indicate that almost half of the surveyed children lived within one kilometer away from school, while just under one third of the children lived between 1 and 2 kilometers from school. The smallest percentage of children, 4.5% of them, lived at a distance of more than 6 kilometers away from school. According to the data on traveling to and from school, presented in Tables 20 and 21, a little less than half of the children walked or used active transport to get to the school, which includes cycling, scooting or skating, while the remaining children came by school bus, public transport or private motorized vehicle. Slightly more children walked or used active transport when returning from school than when going to school, equally boys and girls. In total, it can be concluded that children equally used active and passive modes of transport when traveling to and from school, while one in ten children used a combination of active and passive transport for both routes.

Table 20. Means of transport to and from school by sex, CroCOSI 2021/2022

	On foot	Bicycle, *skateboard* or non-motorized scooter	School bus or public transport	Private motorized vehicle
	%	%	%	%
To school				
Boys	45.7	1.0	11.2	42.1
Girls	45.5	0.6	11.6	42.3
Total	**45.6**	**0.8**	**11.4**	**42.2**
From school				
Boys	52.3	1.0	10.7	36.0
Girls	50.9	0.5	11.3	37.3
Total	**51.6**	**0.7**	**11.0**	**36.6**

Table 21. Means of transport to and from school by sex, combined, CroCOSI 2021/2022

	Active transport (bicycle, *skateboard* or non-motorized scooter)	Passive transport (school bus or public transport)	Combination
	%	%	%
Boys	44.5	43.5	12.0
Girls	44.5	46.1	9.4
Total	**44.5**	**44.8**	**10.7**

Children were regularly physically active through practicing sports or dancing, such as football, track and field, hockey, swimming, tennis, basketball, gymnastics, ballet, fitness activities, dance classes, etc., with an average of 2.9 ± 2.8 hours per week spent in such activities, of which boys significantly more, 3.3 ± 3.0 hours on average, compared to girls with an average of 2.4 ± 2.5 hours per week. There was a significant difference in the time spent on sports or dancing regarding family's socioeconomic characteristics. Among children whose parents have a higher education level, 79.7% were engaged in sports or dance for two or more hours a week, compared to 57.5% of children whose parents have a lower education. Furthermore, a difference was also observed regarding parents' employment status. Children of both working parents were more likely to spend two hours a week in sports or dancing, as opposed to children with at least one

parent unemployed or economically inactive, 72.5% versus 58.9%, respectively. The same type of significant difference was observed regarding family perceived wealth, that is, children of parents who did not report financial difficulties were more likely to spend two or more hours a week in sports or dancing than children of parents who reported financial difficulties, that is, 72.3% versus 58.6%, respectively.

A number of hours and minutes per week spent in physical activity doing sports or dancing is presented in Table 22. It is evident that one in four children spends no time in sports or dance activities, or does so for less than one hour a week.

Table 22. Hours and minutes per week spent doing sports or dancing by sex, CroCOSI 2021/2022

	Hours per week							
	Never or < 1:00	1:00-1:59	2:00-2:59	3:00-3:59	4:00-4:59	5:00-5:59	6:00-6:59	≥ 7:00
	%	%	%	%	%	%	%	%
Boys	23.1	5.0	12.5	19.9	14.4	8.4	7.1	9.7
Girls	29.5	6.0	23.4	18.7	11.8	3.3	3.4	3.9
Total	**26.3**	**5.5**	**17.9**	**19.3**	**13.1**	**5.8**	**5.3**	**6.8**

Play is an activity that contributes to children's physical, mental and social development (42). Through active play, children participate in physical activity of moderate to vigorous intensity, which is recommended for children and youth for at least one hour daily (40, 43). According to the results presented in Table 23, almost all children spend at least one hour a day in active moderate-to-vigorous-intensity play involving running, jumping, moving and other forms of physical activity, an average of 2.4 ± 1.0 hours on a typical day, boys slightly more than girls. Children spend fewer hours in active play of moderate to vigorous intensity during weekdays, an average of 1.9 ± 1.0 hours compared to weekends, during which they spend an average of 3.6 ± 1.7 hours in active play of moderate to vigorous intensity. It was observed that children of parents with a lower education level are significantly more likely to spend an hour or more per day in active play of moderate to vigorous intensity, compared to children of parents with a higher education level.

Table 23. Hours and minutes per day spent in active play of moderate to vigorous intensity on a typical day, on weekdays and weekends by sex, CroCOSI 2021/2022

	Hours per day				
	Never or < 1:00	1:00-1:59	2:00-2:59	3:00-3:59	≥ 4:00
	%	%	%	%	%
Average					
Boys	5.3	31.9	37.4	17.6	7.8
Girls	7.6	35.4	32.8	16.4	7.7
Total	**6.4**	**33.6**	**35.2**	**17.0**	**7.7**
Weekdays					
Boys	6.4	37.4	35.5	14.1	6.6
Girls	8.8	37.7	33.1	14.3	6.2
Total	**7.6**	**37.5**	**34.3**	**14.2**	**6.4**
Weekends					
Boys	2.2	6.3	20.2	22.7	48.5
Girls	2.7	7.6	22.4	22.0	45.3
Total	**2.5**	**6.9**	**21.3**	**22.4**	**46.9**

Sedentary behaviors

Sedentary behavior refers to the time spent in a seated, reclined (tilted backward) or lying position when the level of energy expenditure is low (44). In children and adolescents, prolonged time spent in sedentary activities is associated with adverse health outcomes: more frequent occurrence of obesity, poorer cardiac and metabolic health and reduced sleep duration. It is recommended that children and youth reduce the amount of time spent in sedentary activities as much as possible and, wherever possible, interrupt longer periods of inactivity with at least light physical activity (40).

The habit of spending time in sedentary activities in front of a screen, whether it be television, a tablet, a smartphone or any other electronic device, is widespread among children and youth. Increased availability of computers, smartphones, tablets and other electronic devices has led to increased time spent in sedentary activities, which is confirmed by research results presented in Table 24. According to the results,

on a typical day, children spend an average of 1.7 ± 0.8 hours watching TV or using electronic devices, boys slightly longer than girls. Both boys and girls spend slightly less time watching TV or using electronic devices during the weekday, 1.4 ± 0.8 hours, compared to weekends, when children spend an average of 2.4 ± 1.2 hours a day watching TV or using electronic devices, boys slightly longer than girls. There was a significant difference between children from higher and lower parental educational backgrounds and regarding family perceived wealth. Children of parents with lower education level were more likely to spend two or more hours a day watching TV or using electronic devices, 41.0%, compared to 31.9%. As for the family perceived wealth, children of parents who do not report family's financial difficulties significantly less often spend two or more hours a day watching TV, 34.5% of them, compared to 48.1% of children of parents who report financial difficulties in covering monthly expenses.

Table 24. Hours and minutes per day spent watching TV or using electronic devices on a typical day, weekdays and weekends by sex, CroCOSI 2021/2022

	Hours per day				
	Never or < 1:00	**1:00-1:59**	**2:00-2:59**	**3:00-3:59**	**≥ 4:00**
	%	**%**	**%**	**%**	**%**
Weekdays					
Boys	13.8	48.2	29.6	5.8	2.6
Girls	17.5	47.5	27.2	6.0	1.8
Total	**15.6**	**47.9**	**28.4**	**5.9**	**2.2**
Weekends					
Boys	2.8	17.9	38.8	22.6	17.9
Girls	4.3	23.0	37.0	20.2	15.5
Total	**3.5**	**20.4**	**37.9**	**21.4**	**16.7**
Average time					
Boys	12.5	48.0	30.0	6.9	2.5
Girls	16.3	48.6	27.6	5.8	1.6
Total	**14.4**	**48.3**	**28.8**	**6.4**	**2.1**

Time spent in activities that involve sitting while doing homework or reading is presented in Table 25. According to the data obtained through the family's record form, children spent an average of 1.6 ± 0.7 hours per day writing homework and reading, 1.6 ± 0.8 hours on weekdays and 1.6 ± 1.0 hours on weekends.

Table 25. Free time spent doing homework or reading, by sex, CroCOSI 2021/2022

	Hours per day				
	Never or < 1:00	**1:00-1:59**	**2:00-2:59**	**3:00-3:59**	**≥ 4:00**
	%	**%**	**%**	**%**	**%**
Weekdays					
Boys	13.3	43.7	34.8	5.8	2.4
Girls	10.4	42.3	36.2	9.4	1.8
Total	**11.8**	**43.0**	**35.5**	**7.6**	**2.1**
Weekends					
Boys	18.0	41.8	28.6	7.1	4.6
Girls	16.3	40.3	27.7	9.0	6.7
Total	**17.2**	**41.0**	**28.2**	**8.0**	**5.6**
Average time					
Boys	17.8	52.5	24.9	3.5	1.2
Girls	15.2	51.9	26.8	5.3	0.8
Total	**16.5**	**52.2**	**25.8**	**4.4**	**1.0**

In addition to physical activity and sedentary behaviors, sleep habits also affect the overall daily level of physical activity. For eight-year-old children, healthy sleep implies sleeping for nine or more hours each night (45). According to the obtained data presented in Table 26, the average sleep duration in the surveyed children per night is 9.9 ± 0.6 hours, slightly longer in girls than in boys, which indicates that the average sleep duration of children in HRV is in line with the recommended values.

Table 26. Hours and minutes spent sleeping per night by sex, CroCOSI 2021/2022

	Hours of night sleep					
	< 7:00	7:00-7:59	8:00-8:59	9:00-9:59	10:00-10:59	≥ 11:00
	%	%	%	%	%	%
Boys	0.0	0.0	3.8	45.5	45.0	5.7
Girls	0.0	0.2	3.7	44.5	45.7	5.8
Total	**0.0**	**0.1**	**3.7**	**45.0**	**45.4**	**5.8**

Dietary habits

Healthy dietary habits, as one of the key determinants in obesity prevention, are important for child growth and development, and affect dietary habits in adulthood and lifelong health.

Breakfast

Breakfast is one of the important components of a healthy lifestyle. Regular breakfast consumption is associated with a reduced possibility of developing overweight and obesity. Breakfast is especially important for children as it contributes to a balanced daily nutritional intake (46).

Data in Table 27 presents parents' responses on children's weekly frequency of breakfast consumption. Breakfast implies the intake of food, not just beverages such as milk, tea or juice. According to the data, more than three-quarters of parents, 81.1% of them, reported that their child eats breakfast daily, 17.4% of parents reported that their child eats breakfast some or most days, while 1.5% of parents said that their child never eats breakfast. Boys and girls differ in breakfast habits, that is, boys more often consume breakfast every day than girls. In daily breakfast consumption, a social gradient was observed denoting that children whose parents have high education level, both of whom were employed and could easily pass the month with their earnings, more often consumed breakfast on a daily basis, compared to children whose parents were unemployed, report lower education level or had trouble in covering monthly expenses.

Table 27. Frequency of breakfast consumption over a typical week by sex, CroCOSI 2021/2022.

	Never	Some days (1-3 days)	Most days (4-6 days)	Every day
	%	%	%	%
Boys	1.5	8.4	7.1	83.0
Girls	1.5	9.2	10.2	79.1
Total	**1.5**	**8.8**	**8.6**	**81.1**

During the measurement, in addition to the data obtained through the family's record form, field examiners asked each child whether they had had breakfast that day and if so, where. Table 28 indicates that 79.2% of children had breakfast on the day of measurement. 1.6% of them only drank a beverage such as milk, tea or juice, while 19.2% had no breakfast at all. Children's answers correspond with the data on the breakfast habits collected by the family's record form.

Table 28. Breakfast consumption on the morning of measurement, CroCOSI 2021/2022

	No	Yes	Just a beverage
	%	%	%
Boys	19.1	79.4	1.5
Girls	19.4	79.0	1.7
Total	**19.2**	**79.2**	**1.6**

Table 29 indicates that more than half of the children who had breakfast had their breakfast at home, one in four children ate it at school, and almost one in five had breakfast twice, both at home and at school.

Table 29. Breakfast location on the morning of measurement, CroCOSI 2021/2022

	Home	Store, bakery	School	Combined (e.g. at home and school)
	%	%	%	%
Boys	56.0	0.7	25.0	18.3
Girls	57.2	0.4	23.2	19.1
Total	**56.6**	**0.6**	**24.1**	**18.7**

Frequency of consumption of fresh fruits and vegetables

WHO recommends daily consumption of five portions of fruits and vegetables for optimal fiber intake and NCD prevention (47). Despite this recommendation, according to the results presented in Table 30, only 32.2% of children ate vegetables every day, 35.2% ate vegetables four to six days a week, and 32.5% ate vegetables three days a week or less. More frequent consumption of vegetables was observed in children living with parents with higher education level, and those who reported no difficulty in covering monthly expenses.

Table 30. Frequency of vegetable consumption over a typical week by sex, CroCOSI 2021/2022

	Never	Less than once a week	Some days (1-3 days)	Most days (4-6 days)	Every day, once	Every day, more than once
	%	%	%	%	%	%
Boys	1.5	2.4	28.4	36.0	22.3	9.4
Girls	0.7	3.8	28.3	34.4	23.4	9.4
Total	**1.1**	**3.1**	**28.3**	**35.2**	**22.8**	**9.4**

Somewhat more favorable results were observed for the consumption of fresh fruits, as can be seen from Table 31. Almost half of the children, 49.8% of them, ate at least one portion of fruit every day, 23.6% ate fresh fruits four to six days a week, and 26.6% ate fresh fruits three days a week or less. There was a difference in fruit consumption between boys and girls. Girls more often consumed fresh fruits than boys. It was also observed that 45.9% of children from families with a lower parental education level and 40.5% of children from families with financial difficulties consume fruits daily, which is significantly less compared to 57.1% of children living in families with higher educated parents and 56.0% of children living in families with no financial difficulties.

Table 31. Frequency of fresh fruit consumption over a typical week by sex, CroCOSI 2021/2022

	Never	Less than once a week	Some days (1-3 days)	Most days (4-6 days)	Every day, once	Every day, more than once
	%	%	%	%	%	%
Boys	1.9	4.9	22.6	23.6	27.2	19.8
Girls	1.9	2.9	18.9	23.6	31.7	21.0
Total	**1.9**	**3.9**	**20.8**	**23.6**	**29.4**	**20.4**

According to the results presented in Table 32, it is not common for children in HRV to frequently drink freshly squeezed fruit juice. Thus, 9.7% of children drank freshly squeezed 100% fruit juice daily, while 47.9% drank freshly squeezed 100% fruit juice less than once a week or never. On average, boys more often drink 100% fruit juice than girls.

Table 32. Frequency of 100% fruit juice consumption over a typical week by sex, CroCOSI 2021/2022

	Never	Less than once a week	Some days (1-3 days)	Most days (4-6 days)	Every day, once	Every day, more than once
	%	%	%	%	%	%
Boys	11.9	34.2	33.7	10.7	6.3	3.3
Girls	10.3	39.5	30.9	9.4	5.7	4.2
Total	**11.1**	**36.8**	**32.3**	**10.0**	**6.0**	**3.7**

Looking at the share of children who consumed five portions of fruits and vegetables a day as recommended by the WHO, presented in Table 33, it can be seen that 3.1% of the surveyed children followed this recommendation. A slightly higher daily intake of fruits and vegetables was recorded in girls, while children most often consumed one to two portions of fruits and vegetables a day.

Table 33. Number of portions of fresh fruits and/or vegetables eaten daily by sex, CroCOSI 2021/2022

	None	Less than one portion per day	1-2 portions per day	3-4 portions per day	5 or more portions per day
	%	%	%	%	%
Boys	1.6	16.4	63.8	15.1	3.1
Girls	0.8	13.2	67.5	15.4	3.1
Total	**1.2**	**14.8**	**65.6**	**15.3**	**3.1**

Frequency of consumption of different foods and beverages

Healthy nutrition is a protective factor against the development of NCDs including diabetes, heart disease, stroke and some cancers (47). The frequency of consumption of different foods and beverages in children, according to parents' reports, is presented in Table 34.

Consumption of sugar has a number of negative health consequences, increases the risk of developing overweight and obesity, influences blood pressure and lipids, and increases the risk of developing caries. For this reason, the WHO recommends limiting the total intake of added sugars to 10.0% of the total daily energy intake, with a suggested further reduction of sugar intake to 5.0%, for additional positive health effects (47). However, according to the results obtained, the frequency of consumption of sugar-

sweetened products in children is quite high. Namely, 43.1% of children consumed sweet snacks such as cakes, biscuits and candy desserts four or more times a week. Only 13.9% of children consumed sweet snacks less than once a week or never.

A particularly significant source of sugar for children is sugar-sweetened soft drinks. The results indicate that 26.4% of children drank soft drinks containing sugar more than three times a week, with boys drinking sugar-sweetened soft drinks more often than girls. What causes great concern is the fact that children whose parents have a lower level of education drank non-carbonated drinks with added sugar almost twice as often as children whose parents have a higher level of education, that is, 32.8% versus 17.9%, respectively. Also, children of both working parents drank soft drinks significantly less often, 24.7% of them, compared to 30.3% of children with at least one parent unemployed or economically inactive.

Furthermore, excessive salt consumption is reflected in an increased risk of developing high blood pressure and, consequently, suffering from NCDs. Reducing daily salt intake to less than 5 grams would significantly increase the share of healthy population. The most common salt sources are processed products, such as cured meat, bakery products, cheese or savoury snacks (47). Breakfast cereals can, likewise, contribute to an increased consumption of salt, as well as sugar, depending on the type.

According to parents' responses, bakery products other than bread, such as breadsticks, rolls, croissants, puff pastry, cheese or meat-filled pastry (burek), etc. were consumed by 29.1% of children most days or daily, 43.0% of children ate them once to three times a week, while 27.9% ate such foods less than once a week or never. Savoury snacks such as chips, popcorn or salted peanuts were consumed most days or daily by 19.5% of children, 48.1% of children ate them between one and three days a week, while 32.3% consumed such foods less than once a week or never. Foods rich in salt and saturated fats are especially ones known as 'fast food', such as pizza, French fries, hamburgers, kebabs or sausages. Our data indicates that 2.7% of children ate fast food most days or every day, 28.3% ate it one to three days a week, and 69.0% less than once a week or never. Breakfast cereals were consumed most days by 29.0% of children, more by boys than girls.

In addition to the presented results, some sex-based differences were observed in parental reports on the consumption of certain foods. Boys more often consumed whole-fat milk and meat. A greater number of boys never consumed cheese compared to girls, i.e. 15.0% of boys versus 10.9% of girls, respectively. However, if we look at the daily consumption of cheese, it was more frequent in boys than girls, 6.6% of boys as opposed to 4.5% of girls.

Table 34. Frequency of consumption of different foods and beverages, CroCOSI 2021/2022

	Never	Less than once a week	1-3 days a week	4-6 days a week	Every day, once	Every day, more than once
	%	%	%	%	%	%
Soft drinks containing sugar						
Boys	10.6	30.3	30.5	11.9	9.1	7.8
Girls	10.9	33.6	31.4	9.6	9.5	5.0
Total	**10.7**	**31.9**	**30.9**	**10.7**	**9.3**	**6.4**
Diet or *light* soft drinks						
Boys	80.5	13.1	4.7	0.9	0.6	0.3
Girls	81.6	13.2	3.6	0.6	0.9	0.1
Total	**81.1**	**13.1**	**4.1**	**0.8**	**0.7**	**0.2**
Legumes						
Boys	8.1	26.0	59.7	5.3	0.8	0.2
Girls	8.7	24.8	59.9	5.6	0.4	0.5
Total	**8.4**	**25.4**	**59.8**	**5.4**	**0.6**	**0.3**
Breakfast cereals						
Boys	14.5	16.1	39.5	17.0	10.4	2.5
Girls	10.8	17.8	43.4	17.2	9.3	1.5
Total	**12.7**	**17.0**	**41.4**	**17.1**	**9.9**	**2.0**
Meat						
Boys	0.3	1.4	20.6	52.4	21.3	3.9
Girls	0.2	1.4	25.4	52.3	17.9	2.8
Total	**0.3**	**1.4**	**23.0**	**52.3**	**19.6**	**3.3**

	Never	Less than once a week	1-3 days a week	4-6 days a week	Every day, once	Every day, more than once
	%	%	%	%	%	%
Fish						
Boys	8.0	40.2	50.0	1.3	0.3	0.1
Girls	8.2	41.6	48.7	1.3	0.2	0.0
Total	**8.1**	**40.9**	**49.4**	**1.3**	**0.2**	**0.0**
Egg dishes						
Boys	5.9	17.3	61.9	11.7	2.6	0.7
Girls	4.2	17.8	65.0	10.4	2.0	0.6
Total	**5.0**	**17.6**	**63.5**	**11.0**	**2.3**	**0.7**
Whole-fat milk						
Boys	22.8	11.5	18.7	15.7	19.4	12.0
Girls	23.6	15.6	19.6	15.0	17.3	8.9
Total	**23.2**	**13.6**	**19.1**	**15.4**	**18.4**	**10.4**
Low fat/semi-skimmed milk						
Boys	39.6	13.0	14.1	11.2	14.4	7.5
Girls	36.0	13.4	16.1	12.8	14.5	7.4
Total	**37.8**	**13.2**	**15.1**	**12.0**	**14.5**	**7.4**
Flavored milk						
Boys	57.6	25.4	10.4	2.6	2.8	1.1
Girls	60.2	22.2	12.2	1.5	2.6	1.3
Total	**58.9**	**23.8**	**11.3**	**2.1**	**2.7**	**1.2**
Cheese						
Boys	15.0	21.5	42.0	14.9	4.7	1.9
Girls	10.9	23.4	44.7	16.5	3.4	1.1
Total	**12.9**	**22.4**	**43.3**	**15.7**	**4.1**	**1.5**

	Never	Less than once a week	1-3 days a week	4-6 days a week	Every day, once	Every day, more than once
	%	%	%	%	%	%
Yogurt, milk pudding, cream cheese/quark or other dairy products						
Boys	3.2	8.2	37.4	29.7	16.0	5.5
Girls	2.1	7.9	39.7	30.6	14.0	5.6
Total	**2.6**	**8.1**	**38.5**	**30.2**	**15.0**	**5.6**
Savoury snacks						
Boys	2.2	30.0	47.6	12.7	6.2	1.4
Girls	2.0	30.4	48.7	12.5	5.0	1.3
Total	**2.1**	**30.2**	**48.1**	**12.6**	**5.6**	**1.3**
Sweet snacks						
Boys	1.1	13.6	42.1	23.5	16.9	2.8
Girls	0.7	12.3	43.8	23.8	16.2	3.3
Total	**0.9**	**13.0**	**42.9**	**23.6**	**16.5**	**3.0**
Bread						
Boys	0.9	5.7	16.9	18.8	29.8	28.0
Girls	0.7	6.0	19.4	22.2	29.1	22.7
Total	**0.8**	**5.8**	**18.1**	**20.5**	**29.4**	**25.3**
Other bakery products						
Boys	2.0	25.0	43.9	15.8	10.6	2.8
Girls	2.6	26.2	42.1	16.5	10.6	2.1
Total	**2.3**	**25.6**	**43.0**	**16.1**	**10.6**	**2.4**
Potatoes						
Boys	0.6	6.3	62.5	26.1	3.7	0.9
Girls	0.7	7.0	60.8	26.9	3.2	1.5
Total	**0.6**	**6.6**	**61.6**	**26.5**	**3.4**	**1.2**

	Never	Less than once a week	1-3 days a week	4-6 days a week	Every day, once	Every day, more than once
	%	%	%	%	%	%
Fast food						
Boys	3.6	64.2	29.2	2.4	0.5	0.2
Girls	3.6	66.6	27.5	1.8	0.3	0.2
Total	**3.6**	**65.4**	**28.3**	**2.1**	**0.4**	**0.2**

Ordering meals

With the development of technology came changes in food availability, and in this round of research, in addition to habits of consuming different foods and drinks, the habits of ordering meals online using either a meal delivery app or other online delivery services were also examined. According to parents, as presented in Table 35, almost half of the families or 48.6% of them never order meals, while 2.8% of them order meals once a week or more often.

Table 35. Frequency of ordering meals online using meal delivery apps or other online delivery services, CroCOSI 2021/2022

	Never	Less than once a month	Once a month	2-3 times a month	Once a week	More than once a week
	%	%	%	%	%	%
Boys	50.4	20.6	14.9	11.2	2.4	0.5
Girls	46.9	23.6	17.8	9.1	2.3	0.2
Total	**48.6**	**22.1**	**16.4**	**10.2**	**2.4**	**0.4**

Children's purchasing of snack food

Dietary habits are formed in environments where children spend most of their time, which is at home and school. However, the intake of additional calories is possible in children who independently buy savoury or sweet snack food. This way, the ability to control dietary habits is limited and children become more independent in choosing the products they buy, which increases the likelihood of buying nutrient-poor foods, thus elevating the risk of developing overweight and obesity (48). During measurements at school, examiners asked each child whether they on their own buy savoury or sweet snacks in nearby stores. According to Table 36, almost half of the children replied affirmatively to that question.

Table 36. Children's purchasing of snack food, based on self-report, CroCOSI 2021/2022

	Yes	No
	%	%
Boys	51.1	48.9
Girls	52.0	48.0
Total	**51.6**	**48.4**

Characteristics of school environments

Data on the characteristics of school environments described in this section were collected through the school record forms. According to Table 37, school record forms were mostly filled in by teachers, 58.1% of them, while the remaining 42.0% of school record forms were filled in by headmaster/headmistress/principal or other school personnel.

Table 37. School personnel who filled in the school record form, CroCOSI 2021/2022

	N	%
Teacher	151	58.1
Headmaster/Headmistress/Principal	55	21.2
Other	54	20.8
Total	**260**	**100.0**

Schools, as educational institutions, educate children on the importance of health preservation, thus encouraging the development of healthy lifestyles in children. They represent environments where children spend almost half of their day time. Besides educating children on the importance of implementing healthy lifestyles, schools should also provide conditions for regular physical activity and healthy dietary habits in children.

Physical activity in school environments

According to the Decision on Adoption of the Curriculum for Physical and Health Education (PE) for primary and grammar schools in HRV (49), PE is a compulsory subject for all grades. From the first through the third grade of primary school, PE assumes a total of three school hours, i.e. 135 minutes per week. In the 537 sampled second and third grade classes, all pupils should have 135 minutes of PE weekly, in accordance with the aforementioned Decision. However, 61 classes reported having 120 minutes of PE per week, 18 classes reported having 90 minutes of PE per week, six classes each reported having 80 and 180 minutes of PE per week, while one class reported 115, one 150 and one 200 minutes of PE class per week.

PE class in schools usually takes place in an indoor gym hall/sports hall or an outdoor playground area. Data in Table 38 indicates that 92.3% of surveyed schools had an outdoor playground area and that in extreme weather conditions 64.9% did not allow children to play or have PE outdoors. On the other hand, 35.4% of schools did not have an indoor gym hall/sports hall and could not have PE held indoors during extreme weather conditions, i.e. rain, snow, wind or high temperatures.

Furthermore, in order to meet the WHO recommendations for children's physical activity, i.e. a minimum of 60 minutes of moderate-to-vigorous-intensity physical activity daily, schools should enable and motivate children to regularly use indoor and outdoor school sports facilities in their free time. As can be seen from Table 38, 4.2% of schools reported that they allow their pupils to use the indoor gym hall/sports hall outside school hours, and 90.9% of them allow their pupils to use the outdoor playground area outside of school hours. Just over half of the schools, 146 or 58.9% of them, offered free sport/physical activity to their pupils at least once a week outside school hours. However, 61 or 24.6% of schools organized such activities only for selected grades. Also, a little over two thirds of schools, 67.7% of them, reported that the participation of pupils in these organized sport/physical activities was 50.0% or lower.

Table 38. Existence and availability of outdoor playground area(s) and indoor gym/sports hall, and participation in organized sport/physical activities outside school hours, CroCOSI 2021/2022

	N	%
Does your school have outdoor playground area(s)?		
Yes	240	92.3
No	20	7.7
Total	**260**	**100.0**
Does your school have an indoor gym hall/sports hall?		
Yes	168	64.6
No	92	35.4
Total	**260**	**100.0**
Are the children allowed to actively play in extreme weather conditions (rain, snow, windy, hot) in outdoor playing areas?		
Yes	87	35.1
No	161	64.9
Total	**248**	**100.0**
Are the children allowed to use outdoor playground areas outside school hours?		
Yes	229	90.9
No	23	9.1
Total	**252**	**100.0**

	N	%
Are the children allowed to use the indoor gym hall/sports hall outside school hours?		
Yes	9	4.2
No	206	95.8
Total	**215**	**100.0**
Does the school organize any sport/physical activities at least once a week for primary school children outside school hours?		
Yes, for all grades	85	34.3
Only for some grades	61	24.6
No	102	41.1
Total	**248**	**100.0**
Do children attend these organized sport/ physical activities?		
More than 50% of children	52	32.3
25-50% of children	76	47.2
Less than 25% of children	33	20.5
Total	**161**	**100.0**

Healthy nutrition in school environments

Data on the availability of foods and beverages in schools (excluding school lunch) are presented in Table 39. Water from the public water supply is safe for drinking in most parts of HRV, and subsequently, 97.3% of schools reported in the school record form that drinking water was free and available to pupils. In order to increase the intake of fresh fruits and vegetables, and milk and dairy products, as well as to raise awareness on the importance of healthy nutrition for schoolchildren, the Republic of Croatia has introduced the School Fruit, Vegetable and Milk Scheme, free distribution of fruit, vegetables and dairy products to schoolchildren (50). Subsequently, 64.8% of primary schools offered their pupils free fresh fruits at least once a week, while 39.1% provided their pupils with one free dairy product per week. Furthermore, tea without added sugar, along with water and milk, was the most available free beverage in 22.0% of schools, while the most often available beverages to purchase were hot drinks such as cocoa, tea or coffee with milk in 28.6% of primary schools, followed by flavoured milk, and fruit juices or other non-carbonated beverages, which were available for purchase in 27.5% and 26.5% of schools, respectively. From the perspective of healthy lifestyle habits, in terms of daily consumption of vegetables and limited intake of added sugars, in almost two out of three schools, 62.5% of them, vegetables were not available

to children, while products high in sugar or sugar-sweetened soft drinks were available for purchase in 26.5% of schools, and sweet snacks in 9.0% of schools.

Table 39. Availability of certain foods and beverages in schools, CroCOSI 2021/2022

	Availability								
	Free		Free and paid		Not available		Paid		Total
	N	%	N	%	N	%	N	%	N
Water	254	97.3	0	0.0	7	2.7	0	0.0	261
Sugar-free tea	56	22.0	5	2.0	134	52.8	59	23.2	254
100% fruit Juices	9	3.6	2	0.8	222	88.1	19	7.5	252
Fruit juices or other non-carbonated beverages	16	6.3	1	0.4	169	66.8	67	26.5	253
Carbonated (soft) drinks	0	0.0	0	0.0	249	99.2	2	0.8	251
Flavored milk, e.g. chocolate milk	19	7.5	4	1.6	162	63.5	70	27.5	255
Hot drinks (cocoa, tea, kids' white coffee)	24	9.4	3	1.2	155	60.8	73	28.6	255
Milk, yogurt, kefir	99	39.1	7	2.8	90	35.6	57	22.5	253
Energy drinks	0	0.0	0	0.0	247	100.0	0	0.0	247
Fresh fruits	166	64.8	9	3.5	56	21.9	25	9.8	256
Vegetables	27	10.7	4	1.6	158	62.5	64	25.3	253
Sweet snacks	13	5.1	2	0.8	217	85.1	23	9.0	255
Ice-cream	4	1.6	2	0.8	236	93.7	10	4.0	252
Savoury snacks	8	3.2	2	0.8	233	92.1	10	4.0	253

71.3% of schools participating in the research had a school canteen, as can be seen in Table 40. Furthermore, 4.2% of schools had vending machines with foods and beverages, and 2.3% had a shop or cafeteria. The vending machines, as well as the shops and cafeterias, most often offered food low in nutrients, mainly sweet and savoury snacks, high in refined sugars, trans-fatty acids and rich in salt, the intake of which should be limited.

Table 40. Food facilities in schools, CroCOSI 2021/2022

	N	%
School canteen	186	71.3
Shop or cafeteria	6	2.3
Food or beverage vending machines (other than water, fruits and vegetables)	11	4.2

According to the ombudsperson for children in Croatia, advertising is not appropriate in schools, and according to the Primary and Secondary School Education Act, any form of advertising and product sale which is not in line with education objectives is banned in schools (51). Table 41 indicates that, at the time of the research, 89.1% of schools were compliant with this recommendation, while 10.9% demanded no ban on such advertising, which may indicate that these schools do not recognize energy-dense and nutrition-poor foods and beverages as content that goes against educational objectives.

Table 41. Schools free from advertising and marketing of any energy-dense and nutrient-poor foods and beverages, CroCOSI 2021/2022

	N	%
Yes	228	89.1
No	28	10.9
Total	**256**	**100.0**

Promoting healthy lifestyles in school environments

According to the National Curriculum Framework, teaching schoolchildren about healthy lifestyles, including healthy nutrition, is an integral part of the cross-curricular topic 'Health', which is implemented throughout primary and secondary education in order to gain knowledge and skills, and develop a positive attitude towards health and healthy lifestyles. Contents of the cross-curricular topic 'Health' are taught across school subjects, with an emphasis on real-life examples (52). Table 42 presents the number of surveyed schools that offered nutrition education to their pupils. Of all the schools that reported offering nutrition education, as presented in Table 43, majority of them, 97.1%, informed their pupils about healthy eating, while 45.5% offered fresh fruit and vegetable tasting, and 28.9% worked on learning food preparation skills such as weighing, grating, mashing, washing, chopping, peeling, measuring, etc.

Table 42. Nutrition education in school curricula, either given as a separate lesson or integrated into other lessons, CroCOSI 2021/2022

	N	%
Yes	242	93.1
No	18	6.9
Total	**260**	**100.0**

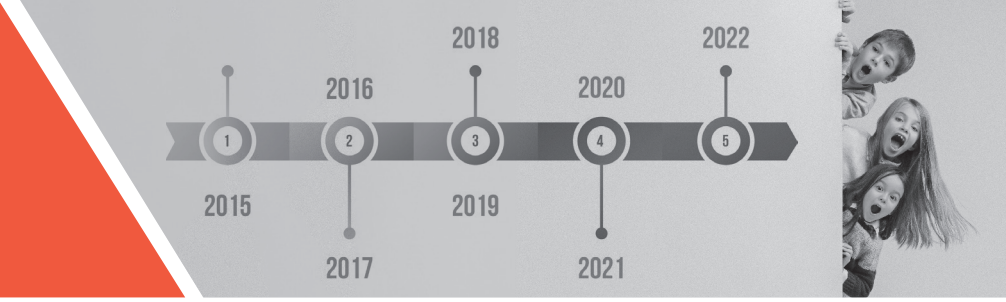
Table 43. Type of nutrition education in school, CroCOSI 2021/2022

	N	%
Healthy eating information	235	97.1
Tasting of fresh fruits and vegetables	110	45.5
Learning food preparation skills (e.g. weighing, grating, mashing, washing, chopping, peeling, measuring)	70	28.9
Other	21	8.7

To acquire knowledge and encourage healthy lifestyles, a large number of interventions for the promotion of children's health are implemented across schools. These interventions include promoting all aspects of health: physical, mental and sexual. Schools, or classes, involved in some of the projects promoting children's health further contribute to preserving and improving the lifelong health of their pupils. As presented in Table 44, 66.4% of all sampled classes implemented some form of organized initiative or project that promotes a healthy lifestyle in pupils.

Table 44. Organized initiatives/projects promoting healthy lifestyle in participating classes, in current school year, CroCOSI 2021/2022

	N	%
Yes	354	66.4
No	179	33.6
Total	**533**	**100.0**



Prevalence trends for childhood overweight and obesity

As depicted in Figure 7, the trend in prevalence of overweight and obesity in children aged 8.0 to 8.9 years between 2015 and 2022 clearly indicates a continuous increase, from 34.9% in 2015 to 36.1% in 2022, more pronounced between 2018 and 2022, when the share of children with overweight and obesity increased by 1.1 percentage points. This implies that HRV is still not on track to achieve one of the WHO's main goals aimed at the global prevention of chronic non-communicable diseases, which is to halt the rising trend in childhood obesity by 2025 (21). Considering these trends and the fact that in the fourth and fifth rounds of the COSI research HRV was seventh, and then fifth in Europe (10, 53), in the sixth round of research it may be expected to, unfortunately, take one of the leading positions in the prevalence of overweight and obesity in children.

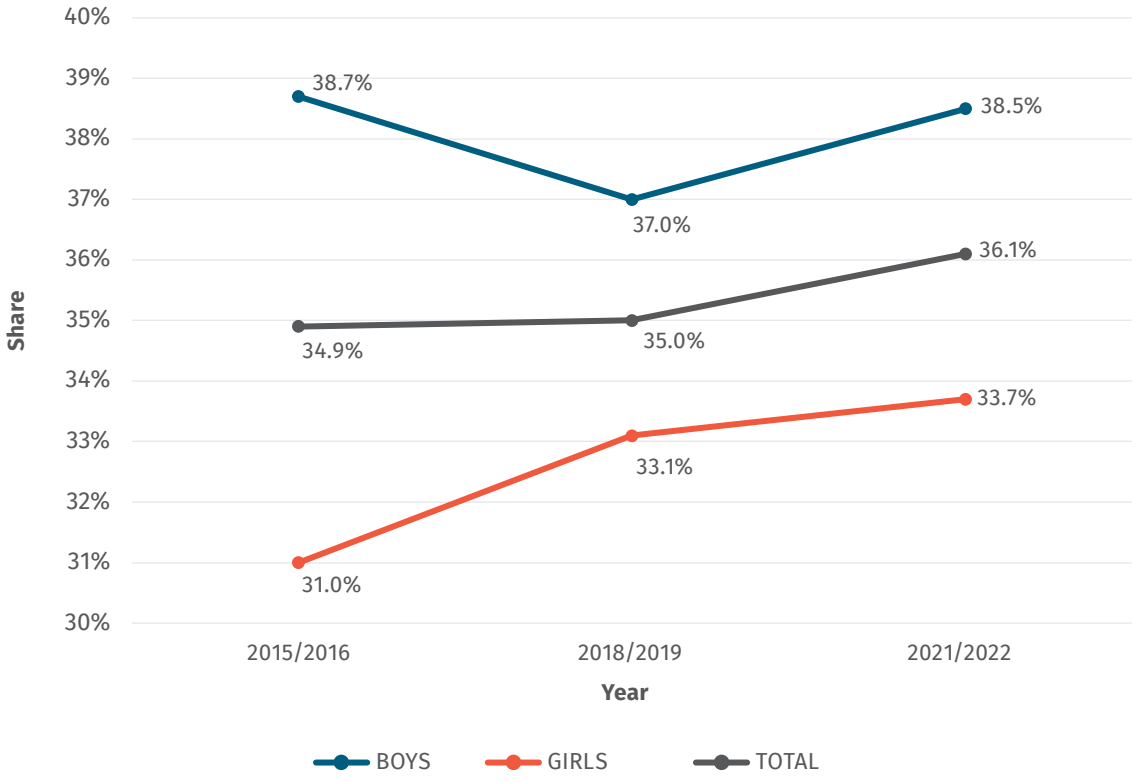


Figure 7. Prevalence of overweight and obesity in children aged 8.0 to 8.9 years between 2015 and 2022

When looking at boys and girls separately, a decrease in the prevalence of overweight and obesity was observed in boys, from 38.7% to 37.0% between 2015 and 2019, followed by an increase to 38.5% in 2022. Generally speaking, in the observed time period from 2015 to 2022, the prevalence of overweight and obesity in boys slightly decreased from 38.7% to 38.5%, but the downward trend in the period from 2015 to 2019 was stopped. On the other hand, although the prevalence of overweight and obesity in girls is still slightly generally lower than in boys, a continuous increase in the prevalence of overweight and obesity was recorded in the observed period, from 31.0% in 2015 to 33.1% in 2019 and 33.7% in 2022, which makes a total increase of as much as 2.7 percentage points.

Weight status trends for boys and girls

Figure 8 depicts the weight status of boys and girls in the period from 2015 to 2022, which indicates that the share of children with obesity during the observed period has continuously increased in both sexes. Over the entire observed period, the prevalence of obesity was higher in boys than in girls. The share of boys with obesity increased from 17.2% in 2015 to 18.7% in 2022, which constitutes an increase of 1.5 percentage points. As for girls, this share rose from 10.7% in 2015 to 12.0% in 2022, or by 1.3 percentage points.

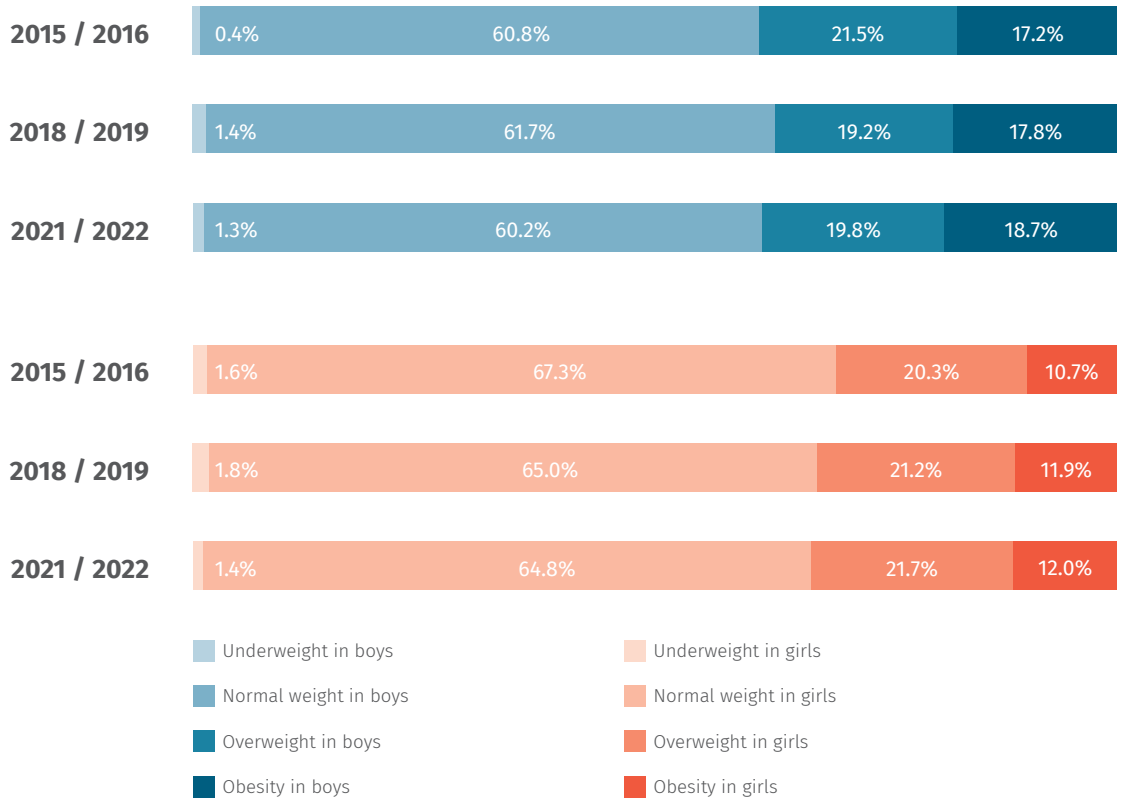


Figure 8. Overview of child weight status for 2015-2022, by sex

The prevalence of overweight in boys decreased from 21.5% in 2015 to 19.2% in 2019, but a slight increase followed, reaching 19.8% in 2022. In girls, the prevalence of overweight is continuously increasing, and has increased between 2015 and 2022 by 1.5 percentage points, or from 20.3% to 21.7%.

The share of boys and girls in the underweight category in 2022 was similar – 1.3% of boys and 1.4% of girls, respectively. However, compared to 2015, this share is greater by nearly 1 percentage point for boys, while remaining virtually unchanged for girls.

Considering all observed changes, the share of children with normal body weight also changed, i.e. continuously decreased during the observed period, from 60.8% in 2015 to 60.2% in 2022 for boys, and from 67.3% to 64.8% for girls in the same period.

Prevalence trends for overweight and obesity in boys, by region

The trend in the prevalence of overweight and obesity for boys in the three observed HRV regions (Continental region, Adriatic region and the City of Zagreb) in the period from 2015 to 2022, as depicted in Figure 9, indicates that, at all three time points, the highest prevalence of overweight and obesity in boys was observed for the Adriatic region. Although in 2022 the prevalence of overweight and obesity in boys was lower than in 2015, 40.8% versus 42.2%, it nevertheless slightly increased compared to 2019, when it was 40.2%. Although the prevalence of overweight and obesity in boys in the Adriatic region decreased by 1.4 percentage points in the observed period, it has remained higher than in any other HRV region.

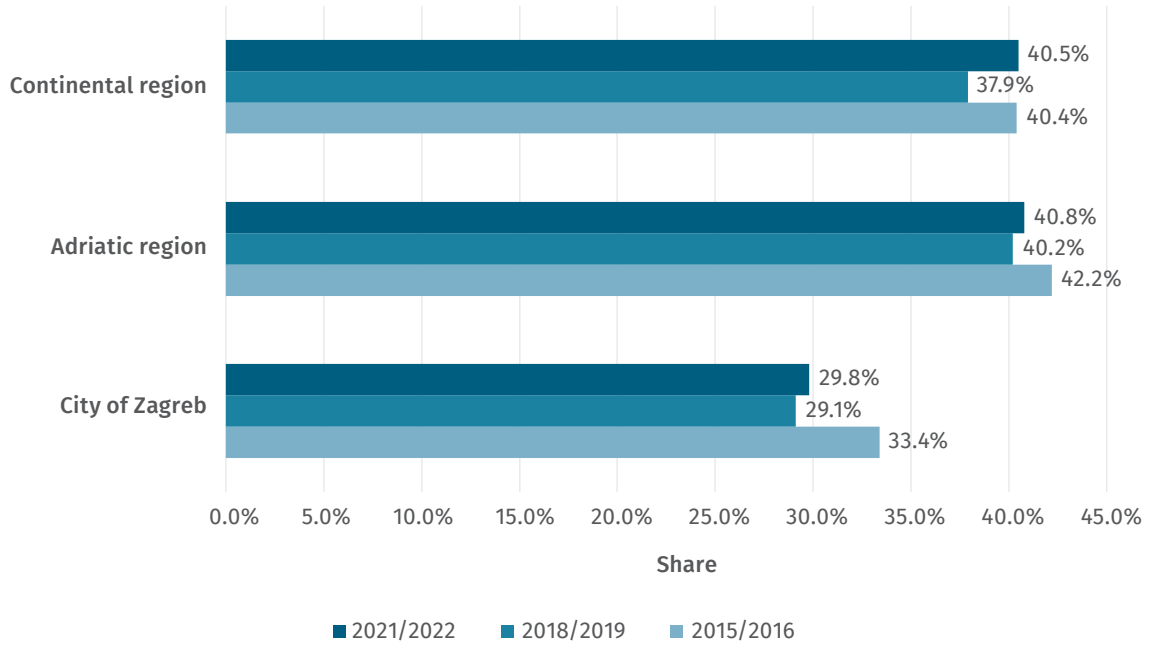


Figure 9. Prevalence of overweight and obesity in boys for 2015-2022, by region

In the Continental region (which includes the Pannonian and Northern regions), the prevalence of overweight and obesity in 2022 in boys was 40.5%. Although there is no significant change in this region compared to 2015, when the prevalence was 40.4%, prevalence increased compared to 2019, when it was 37.9%. Overall, the prevalence of overweight and obesity in boys in the Continental region increased by 0.1 percentage points over the observed period.

The City of Zagreb ranked third in 2022, with a 29.8% overweight and obesity prevalence in boys aged 8.0 to 8.9 years. The prevalence was slightly lower in 2019, 29.1%, but has decreased compared to 2015, when it was 33.4%, which represents a decrease in the prevalence of overweight and obesity in boys in the City of Zagreb, by 3.6 percentage points in the observed period.

Prevalence trends for overweight and obesity in girls, by region

As for girls, the regional trend in prevalence of overweight and obesity in the 2015 – 2022 period, as depicted in Figure 10, indicates that the highest prevalence in 2022 was recorded in the Adriatic region, where it was 36.3%. The Adriatic region also showed the largest increase in the prevalence of overweight and obesity in girls compared to earlier years, when it was 27.3% in 2015, and 33.3% in 2019, which is an increase of as much as 9 percentage points in the observed period.

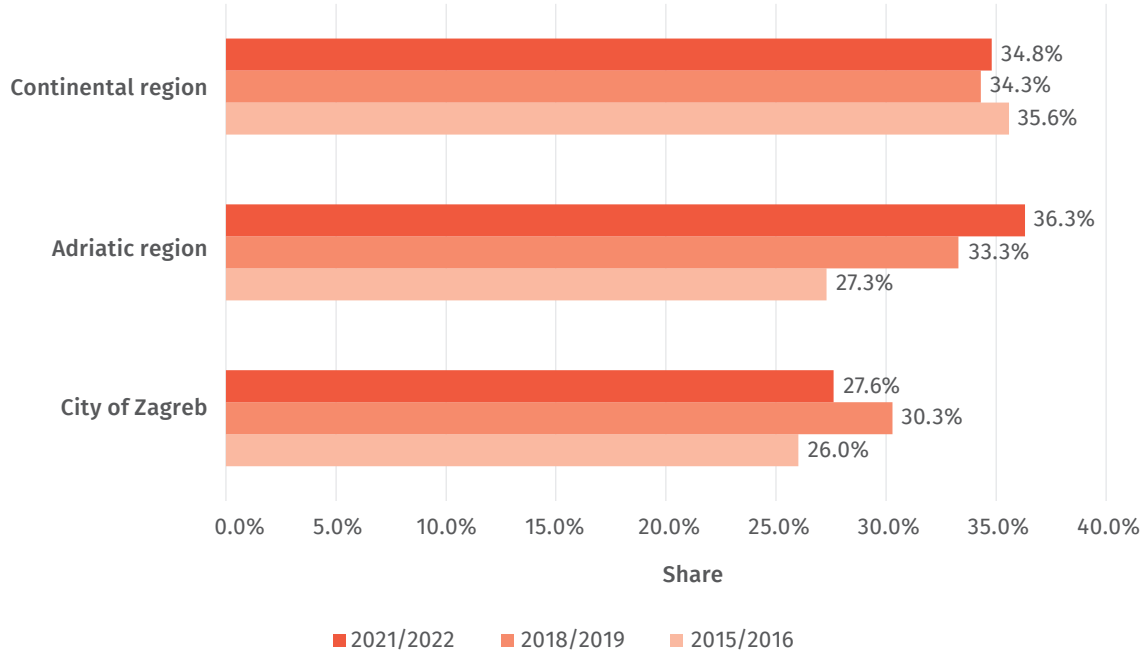


Figure 10. Prevalence of overweight and obesity in girls for 2015-2022, by region

The Continental region, where the prevalence of overweight and obesity among girls in 2022 was 34.8%, had a slight increase in the prevalence from 2019, when it was 34.3%. The prevalence of overweight and obesity among girls in the Continental region in 2015 was 35.6%, which, in the observed period from 2015 to 2022, represents a decrease of 0.8 percentage points.

In the City of Zagreb, the prevalence of overweight and obesity in girls aged 8.0 to 8.9 years in 2022 was 27.6%. The City of Zagreb is the only region with a decrease in prevalence compared to 2019, when it was 30.3%, but an increase in prevalence is still evident compared to 2015, when it was 26.0%. In total, the prevalence of overweight and obesity among girls in the City of Zagreb rose by 1.6 percentage points in the observed period.

Impact of COVID-19 pandemic

Coronavirus disease 2019 (COVID-19) is a highly infectious disease caused by the coronavirus SARS-CoV-2. In December 2019, after the first cases were recorded in Wuhan, China, this disease spread extremely quickly throughout the world (54). Consequently, on 30 January 2020, the WHO declared a Public Health Emergency of International Concern, and on 11 March 2020, a pandemic was declared (55, 56). The COVID-19 pandemic has had a drastic impact on our daily lives. In the beginning, COVID-19 was considered a disease of the adult population, but as the pandemic progressed, the child population was increasingly affected (57).

The first case of COVID-19 in Croatia was confirmed on 25 February 2020 in Zagreb, when a young man who arrived from Italy was tested positive. The National Crisis Headquarters, the Crisis Headquarters of the Ministry of Health, and the Division for Epidemiology of Communicable Diseases, Croatian Institute of Public Health, with the network of public health institutes and other healthcare and competent services then started implementing preventive measures on patient contacts to reduce the risk of infection spreading (58). All educational institutions in Croatia were closed on 16 March 2020. At that time, for the children in lower grades of elementary school (first to fourth grade) learning materials were broadcasted on the national TV station, while for the children in fifth to eighth grades of elementary school and upper secondary education, classes were delivered online (59).

Considering the negative effects of the COVID-19 pandemic on mental health, physical activity and dietary habits among children and adolescents, it is important to understand the impact of the pandemic on children's everyday routines and behaviors. In addition to the pandemic and its restrictive measures, important questions were raised concerning the potential impact on education, social relations, health and the intellectual, physical and emotional development of children and adolescents (60). Many studies have shown that the COVID-19 pandemic played a major negative role in the global fight against childhood obesity. School closures, changes in routine, loss of structure and control negatively impacted the development of childhood obesity during the COVID-19 pandemic (61).

As part of the implementation of this CroCOSI research round in the period from February to April 2022, when filling in the family's record form, parents of second and third-graders also filled in the COVID-19 questionnaire. Data analysis regarding the COVID-19 impact on children's behavior and well-being is nationally representative, and based on the collective data on a total of 2.458 eight-year-olds from 257 primary schools included in the research. Parents' response rate in this part of the research was 72.7%, and included equally boys and girls – 50.4% and 49.6%, respectively.

For the purposes of this research, the period before 1 March 2020 was defined as 'Pre-COVID-19', while the period of the COVID-19 pandemic was defined as the period during which children were restricted to their homes due to the COVID-19 pandemic, i.e. did not go to school due to restrictive measures caused by the COVID-19 pandemic. Data analysis was based solely on the information provided by the children's mothers and fathers through the record forms, and not by other family members.

Table 45 depicts the share of children and parents who had COVID-19 confirmed by a doctor and/or a positive COVID-19 test in the observed period. Data indicates that about one half of all eight-year-olds did not have COVID-19 infection by the time of completing the form, while the corresponding share of parents was slightly lower, about 40%.

Table 45. COVID-19 infection confirmed by a doctor and/or positive COVID-19 test, CroCOSI 2021/2022

	Child	Mother	Father
	%	%	%
No	52.4	40.0	41.9
Yes, at home isolation	40.6	56.3	47.7
Yes, admitted to the hospital	0.0	0.4	0.9
No answer	7.0	3.3	9.5

Socioeconomic family indicators

According to the data on family perception of household finances presented in Table 46, it is evident that in the pre-COVID-19 period, 92.4% of the parents reported that they covered their monthly expenses without any or serious problems, while during the COVID-19 pandemic this share was slightly lower, 87.4%. On an individual level, most parents did not report a change in the household financial situation, i.e. they marked the same answer for both observed periods, while 13.4% of the parents reported that the financial situation worsened during the pandemic.

Table 46. Family perceived wealth during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Pre-COVID-19 household financial situation	Household financial situation during the COVID-19 pandemic
	%	%
We easily pass the month with our earnings	52.5	44.3
We pass the month without serious problems with our earnings	39.9	43.1
We had trouble making ends meet in the month with our earnings	3.0	5.7
We barely making ends meet in the month with our earnings	2.9	4.7
Do not know or wish to answer	1.7	2.1

Change in the family perception of household finances during the pandemic compared to the pre-COVID-19 period	
	%
Worsened situation	13.4
Same situation	83.2
Improved situation	1.3
Do not know or do not wish to answer	2.2

Data on parental employment status, presented in Table 47, indicate that in the period before the COVID-19 pandemic, slightly more parents worked full-time or part-time, 73.0% of mothers and 83.8% of fathers, compared to the period during the pandemic, when 69.3% of mothers and 82.2% of fathers worked full-time or part-time. During the pandemic, the share of mothers and fathers with other employment status slightly increased, i.e. those in full-time education, sick/disabled or retired, from 4.5% to 6.1% for mothers, and from 3.9% to 4.4% for fathers.

Table 47. Parents' employment status during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Pre-COVID-19	COVID-19 pandemic
	%	%
Mother's employment status		
Homemaker	15.2	13.9
Working full-time	68.9	64.2
Working part-time	4.1	5.1
Unemployed	3.3	3.5
Other	4.5	6.1
No answer	4.0	7.2
Father's employment status		
Homemaker	0.4	0.6
Working full-time	82.5	80.1
Working part-time	1.3	2.1
Unemployed	2.3	3.2
Other	3.9	4.4
No answer	9.5	9.5

Children's dietary habits and family consumption behaviors in the period before and during the COVID-19 pandemic

Dietary habits play a key role in the physical and mental development of children and adolescents, their impact can last up to adulthood (9) and, at the same time, they represent one of the key determinants of obesity, which is why they are a significant component of the childhood overweight and obesity prevention. Table 48 presents parents' perception of changes in the children's consumption of different foods and beverages during the COVID-19 pandemic, compared to the pre-pandemic period, that is, parents were asked whether consumption decreased, remained the same or increased in comparison with the pre-COVID-19 period. Table 48 indicates that, according to parents' reports, the consumption of foods and beverages included in the research remained largely the same. The amount of fresh fruits and vegetables that children ate during the pandemic increased in 9.6% and 7.3% of families, respectively.

A similar change was observed regarding savoury and sweet snacks, where an increase in the eaten amount was recorded in 8.9% and 10.0% of children, respectively. Interestingly, there was a decrease in the consumption of soft drinks containing sugar in 6.7% of children, as opposed to 2.6% of children who increased the consumption of such beverages during the pandemic.

Table 48. Changes in children's consumption of certain foods and beverages during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Decreased	Stayed the same	Increased	Don't know
	%	%	%	%
Fresh fruits	3.0	84.8	9.6	2.6
Vegetables	2.1	88.6	7.3	2.1
Savoury snacks	5.4	83.6	8.9	2.1
Sweet snacks	5.0	83.0	10.0	2.0
Meat	2.8	92.6	2.5	2.0
Fish	5.5	88.9	3.1	2.4
Dairy products	1.6	92.1	4.4	2.0
Soft drinks containing sugar	6.7	87.6	2.6	3.2

This record form also examined changes in food-related family behaviors in weekly routines during the COVID-19 pandemic, compared to the pre-pandemic period. Table 49 indicates that these habits have, for the most part, remained unchanged, but that share varies, depending on the behavior, between 60.9% and 87.4%. Behaviors that most frequently demonstrated increase during the COVID-19 pandemic were buying food in large quantities, i.e. for periods longer than one week, which was more frequent in 27.3% of the families, followed by eating together as a family, which was more common in 22.8% of the families during the pandemic, planning purchases and meals in advance, which became more frequent in 21.3% of the families, and cooking meals together with the child, which was more common in 20.8% of the families. On the other hand, in a certain share of families, there was a decrease in the frequency of some food-related behaviors due to the pandemic. Such a decrease was reported in the consumption frequency of meals prepared outside of home (e.g. take away meals/online delivery services) in 19.5% of the families, buying food in super or hypermarkets in 19.0% of families, eating ready-to-eat meals in 18.5% of the families and buying regional/local food at nearby businesses (e.g. neighborhood grocery stores, farmer's markets) in 14.1% of families.

Table 49. Changes in family consumption behaviors in weekly routines during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Decreased	Stayed the same	Increased	Don't know
	%	%	%	%
Eating home-cooked meals	1.5	79.9	17.7	0.9
Eating ready to eat meals	18.5	73.7	2.5	5.3
Eating meals prepared outside of home	19.5	68.3	4.3	7.9
Eating together as a family	2.1	74.2	22.8	0.9
Cooking meals together with the child	2.3	75.3	20.8	1.6
Eating breakfast	1.3	87.4	10.4	0.9
Buying regional/local food at nearby businesses	14.1	70.2	13.6	2.1
Buying food in super or hypermarkets	19.0	74.5	5.1	1.5
Buying online grocery shopping	13.0	60.9	16.7	9.4
Buying food in large quantities	6.0	63.9	27.3	2.8
Reusing leftovers for another meal	2.5	83.3	11.4	2.8
Planning purchases and meals in advance	1.8	74.7	21.3	2.2

Parents were also asked how often their children consumed meals ordered via apps or other online delivery services during the pandemic compared to the pre-pandemic period. Data from Table 50 indicates that there are no major changes in the consumption of ordered meals and that only about a quarter of children consumed food ordered via meal delivery apps or other delivery services once a month or more often, both before and during the COVID-19 pandemic. On an individual level, most parents did not report a change in the children's consumption of ordered meals between the pre-pandemic and pandemic periods, i.e. they gave the same answer for both observed periods, while 7.1% of parents reported more frequent consumption of ordered meals during the pandemic.

Table 50. Frequency of ordering meals online using meal delivery app or other online delivery services during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Pre-COVID-19	COVID-19
	%	%
Never	48.3	48.2
Less than once a month	25.8	24.4
Once a month	14.7	14.0
2-3 times per month	9.2	10.5
Once a week	1.7	2.3
More than once per week	0.3	0.6
Changes in the consumption of meals ordered via meal delivery apps or other websites in children during the COVID-19 pandemic compared to the pre-pandemic period		
	%	
Less often	3.6	
Equal	89.3	
More often	7.1	

From the data collected in this research, it may be concluded that, due to the COVID-19 pandemic, the consumption of various foods and drinks by children has not changed significantly. Only a minor part of the families, 10% or less, reported an increase in the consumption of fruits and vegetables, as well as sweet and savoury snacks. On the other hand, one in five families reported more frequent consumption of meals prepared at home, cooking meals together with the child and eating together as a family, which is a positive phenomenon that can be explained by an increase in time spent at home, due to COVID-19 containment measures.

Physical activity before and during the COVID-19 pandemic

The COVID-19 pandemic has certainly affected children, fundamentally changing their daily habits, including movement, participation in physical activity, screen time and sleep patterns (62). This questionnaire examined changes in children's physical activity during the COVID-19 pandemic, compared to the pre-pandemic period. Changes in sleep time duration, time outside school hours spent in active/vigorous play, free time spent in sedentary activities in front of a screen, and time spent learning in the house were examined, and the data is presented in Table 51. For most children, sleep time duration remained the same, both on weekdays and weekends. For parents who reported a change in their child's sleep time duration, more often they reported an increase than a decrease in sleep time duration. On average, about

13% of the children experienced an increase in sleep time during the COVID-19 pandemic compared to the pre-pandemic period.

Parents were also asked if the time their children spent outside school hours in active play of moderate to vigorous intensity (e.g. running, jumping or moving outside and fitness games inside) had changed during the COVID-19 pandemic, compared to the earlier period. Approximately one in two children spent the same amount of time in these activities during the pandemic as before the pandemic, while a decrease in time spent outside school hours in active/vigorous play during weekdays was observed in 36.5% of the children, and 29.0% of the children during the weekend.

More than a third of children increased their screen time. Namely, 39.5% of the parents reported that their child spent more time in front of a screen on weekdays during the pandemic than before the pandemic, while 37.5% of parents reported the same increase on weekends. As for the change in the time children spent learning in the house, including homeschooling longer than 3 hours a day, it has increased during the pandemic for nearly one in two children, or 46.9% of children.

Table 51. Changes in behavior related to physical activity, sedentary behaviors and sleep time of children during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Weekday				Weekend			
	Decreased	Unchanged	Increased	Don't know	Decreased	Unchanged	Increased	Don't know
	%	%	%	%	%	%	%	%
Changes in sleep duration	1.9	83.9	13.2	1.0	1.3	84.3	13.4	1.1
Changes in time spent out of school hours in active/vigorous play	36.5	51.2	10.0	2.3	29.0	58.6	10.6	1.8
Changes in sedentary free time in front of a screen	3.2	55.8	39.5	1.4	2.8	58.2	37.5	1.5

	Decreased	Unchanged	Increased	Don't know
	%	%	%	%
Changes in time spent learning in the house	2.1	47.4	46.9	3.6

During the COVID-19 pandemic, some major changes occurred in children's physical activity and sedentary behaviors. As many as 36.5% of the children reduced their time spent outside school hours in active/vigorous play during weekdays, and more than a third of children, or 39.5% of them, increased their free time spent watching TV, playing video/computer games or using social media for non-educational purposes during weekdays.

Changes in parents' perception of their children's weight status

The results presented in Table 52 depict parents' perception of their children's weight status during the COVID-19 pandemic compared to the pre-pandemic period. The share of children perceived by parents as having a normal weight dropped from 91.0% before the pandemic to 85.4% during the pandemic. Although the share of children perceived by parents as overweight during the pandemic is still significantly lower than the share of children with overweight and obesity recorded by this research, it should be noted that the parents' perception of child's weight status during the pandemic increased compared to the earlier period from 7.3% of children perceived by their parents as overweight in the pre-pandemic period to 13.1% during the COVID-19 pandemic. This change in parents' perception of child's weight status may indicate an increase in awareness of this major public health problem.

Table 52. Parents' perception of children's weight status during the COVID-19 pandemic compared to the pre-pandemic period, CroCOSI 2021/2022

	Pre-COVID-19	COVID-19
	%	%
Underweight	1.6	1.5
Normal weight	91.0	85.4
A little overweight	7.1	12.5
Extremely overweight	0.2	0.6

Psychosocial well-being of children

The research also examined how the COVID-19 pandemic and the related restrictive measures affected the psychosocial well-being of children. The parents' perception was examined regarding 10 specific behaviors and feelings that children expressed before and during the pandemic, and the results are presented in Table 53. For each of the investigated behaviors or feelings, the situation more frequently worsened than improved during the pandemic, compared to the pre-pandemic period. The biggest negative change was observed regarding the question "Has your child had fun with his/her friends?", where 40.6% of parents

reported their child having fun with friends less frequently during the pandemic. The share of children who never or seldomly felt sad or lonely decreased during the pandemic from 94.0% and 94.6%, respectively, to 84.6% and 82.5%, respectively. It should also be noted that the share of children who have got on very or extremely well at school decreased during the pandemic from 83.5% to 76.3%, while the share of children who felt very or extremely fit and well before the pandemic was 71.2%, and 59.8% during the pandemic.

Table 53. Parents' perception of children's behavior and feelings during the COVID-19 pandemic compared to the pre-pandemic period, and the change between the two periods, CroCOSI 2021/2022

	Pre-pandemic period			COVID-19 pandemic			Change between the two periods	
	Never or seldom	Quite often	Very often or always	Never or seldom	Quite often	Very often or always	Improved situation	Worsened situation
	%	%	%	%	%	%	%	%
Has your child had fun with his/her friends?	11.7	27.5	60.8	36.7	31.3	32.0	3.4	40.6
Has your child been able to do things that he/she wants to do in his/her free time?	4.9	27.0	68.1	15.9	30.7	53.4	7.2	25.8
Has your child had enough time for him/herself?	2.5	24.3	73.2	3.9	28.4	67.8	7.1	13.1
Has your child felt sad?	94.0	4.2	1.8	84.6	11.8	3.6	2.9	12.3
Has your child felt lonely?	94.6	4.1	1.3	82.5	13.5	4.0	2.0	14.6
Has your child felt full of energy?	4.8	26.1	69.1	9.4	30.7	59.9	8.6	25.5
Has your child been able to pay attention?	4.3	24.9	70.8	6.5	27.6	65.9	4.3	10.4
Has your child felt that his/her parent(s) treated him/her fairly?	1.8	19.8	78.4	3.1	22.1	74.9	4.4	8.8

	Pre-pandemic period			COVID-19 pandemic			Change between the two periods	
	Never or seldom	Quite often	Very often or always	Never or seldom	Quite often	Very often or always	Improved situation	Worsened situation
	%	%	%	%	%	%	%	%
Has your child felt fit and well?	2.0	26.7	71.2	6.7	33.5	59.8	5.0	19.0
Has your child got on well at school?	1.3	15.2	83.5	2.5	21.1	76.3	1.8	9.9

In conclusion, during the COVID-19 pandemic, changes were observed in children's daily routine, well-being, dietary habits and behaviors related to physical activity. One in three children spent more free time in front of a screen during the pandemic and less time in active play than usual. Interestingly, the pandemic has led to some positive changes related to family habits and behaviors, namely one in five families reported more frequent consumption of meals prepared at home and cooking meals together with children. In addition to all the above, the results also indicate the negative impact that the COVID-19 pandemic has had on children's psychosocial well-being, which can also have a further impact on their lifestyle and behavior, and consequently on their weight status.

Conclusion

Participation of Croatia in the COSI research of the WHO Regional Office for Europe is of great public health significance. First of all, the implementation of the COSI research on a regionally representative sample is an opportunity to regularly collect data on the weight status and lifestyle habits of children and families, in a standardized manner. With these data, it is possible to get a better understanding of obesity trends in children as one of the leading NCDs and, at the same time, as one of the fastest-growing public health challenges of today's society. Also, the implementation of the COSI research provides for a regional comparison and comparison of time trends in the weight status and habits of children aged 8.0 to 8.9 years in HRV, in both the national and European contexts. Moreover, information on dietary habits, physical activity habits, characteristics of early development, and family and school environments somewhat clarify the complex picture of obesity development in children, which further facilitates the planning and implementation of targeted preventive public health interventions and points to areas where it is necessary to further strengthen the health literacy of children and their families.

The results of the CroCOSI 2021/2022 research indicate that 36.1% of children aged 8.0 to 8.9 years in HRV have overweight or obesity. Considering the previous two rounds of CroCOSI research in 2015/2016 and 2018/2019, when the corresponding shares were 34.9% and 35.0%, respectively, it is evident that the prevalence of overweight and obesity in children is continuously increasing, which, from the perspective of halting the rise of obesity in children by 2025, indicates that we are not on the right track to achieve said WHO global objective (21, 22).

In addition to the very high prevalence of overweight and obesity in children, pronounced sex differences were observed, i.e. overweight and obesity were more common in boys, in 38.5% of them, compared to 33.7% of girls. However, when compared to 2015 there was a great prevalence increase in girls by 2.7 percentage points, while boys showed a slight decrease in prevalence by 0.2 percentage points.

Comparing the results across regions, the lowest share of children with overweight and obesity was recorded in the City of Zagreb, 28.6%, while the greatest share was recorded in the Pannonian region, 38.9%, with as much as 20.0% or one in five children living with obesity. Another piece of information that should be highlighted is an increasing trend in overweight and obesity prevalence among girls in the Adriatic region, which has increased by as much as 9 percentage points compared to 2015.

Furthermore, this research has also confirmed socioeconomic differences in overweight and obesity. To start with, it was discovered that overweight and obesity are more common in children from rural areas, where the share was 39.6%, as opposed to 34.6% of children with overweight and obesity living in urban areas. Furthermore, a lower frequency of overweight and obesity was observed in children living in families with a more favorable socioeconomic status, that is, in children living in two-parent families, whose parents have higher levels of formal education and report no financial difficulties. These findings indicate the importance of reducing socioeconomic inequalities, creating interventions aimed at bridging

these gaps as well as the importance of interventions targeted at rural areas, which are remote from central healthcare and education institutions where preventive programs are most often implemented.

Overweight and obesity in children are not fully recognized by parents. Namely, only one in three children with overweight or obesity is perceived by parents as little or extremely overweight, while obesity remains virtually unrecognized. Consequently, it is necessary to continuously work on raising awareness of the problem and intensify the implementation of public health interventions aimed at strengthening the health literacy of parents, in order to empower them to help develop healthier habits in their children.

In addition to data on children's weight status, the CroCOSI research has collected a lot of information on the lifestyles of children and families, their dietary habits, physical activity and sedentary behaviors. Regular breakfast consumption, as one of the components of a healthy lifestyle, was reported by 81.1% of the parents, which means that more than three-quarters of parents reported their children eating breakfast daily. The results of this research also indicate that Croatian eight-year-olds do not consume the recommended amount of fruits and vegetables, i.e. half of the children consume fruits daily, while vegetables are consumed daily by one in three children. The recommended five portions of fruits and vegetables per day are consumed by only 3.1% of eight-year-olds in HRV. Although the COVID-19 pandemic has led to changes in the children's daily routine, well-being, dietary habits and physical activity, the consumption of various foods and beverages among children has not changed drastically, and only about 10% of the families reported increased consumption of fruits and vegetables, as well as sweet and savoury snacks. On the other hand, sugar-sweetened soft drinks, as the most common source of hidden calories for children, are consumed four or more times a week by 26.4% of the children. Their consumption has remained relatively stable during the pandemic, while only 6.7% of the children reduced their consumption of soft drinks during the pandemic.

Active play, in which children participate in physical activity of moderate to vigorous intensity, for children and young people is recommended daily for a minimum of one hour. According to the results of this research, 92.4% of children spend one hour or more in active play of moderate to vigorous intensity on weekdays, as do 97.5% of children on weekends. However, the COVID-19 pandemic has had a major impact on the children's physical activity, when as much as 36.5% of children reduced their time spent in active/vigorous play outside school hours during weekdays, and 29.0% during the weekend. On the other hand, 36.5% of children during the weekdays and 76.0% of children during the weekend spend two or more hours in front of a screen, including television, tablets, smartphones or other electronic devices. According to the parents' reports, screen time increased particularly during the COVID-19 pandemic. Namely, there was an increase in recreational screen time in 39.5% of children on weekdays and in 37.5% on weekends. Prevention of overweight and obesity should be based on adopting healthy habits, i.e. spending free time outdoors in active play in order to reduce the time spent in sedentary activities in front of a screen.

Children spend a large portion of their time in school, therefore it is also important to collect data on school environments which indicate how much individual schools invest in creating healthy habits and implementing healthy lifestyles. According to the data obtained, 93.1% of the schools educate their pupils about healthy lifestyles including healthy nutrition as part of the curriculum, in a separate lesson or

integrated into school subjects. Regular physical activity of schoolchildren is necessary to preserve their health. To further motivate them to be physically active in their free time, just over half of the schools, 58.9% of them, provide organized physical activities to their pupils outside school hours. However, only between a quarter and half of the pupils participate in these activities. Opportunities to encourage regular physical activity are limited by spatial conditions, as 35.4% of the sampled schools do not have an indoor gym or sports hall. Each primary school should also provide meals for their pupils during school time. In order to increase the intake of fresh fruits and vegetables, and milk and dairy products, Croatia implements the School Fruit, Vegetables, and Milk Scheme, i.e. distributes free fruits, vegetables and dairy products to schoolchildren, with free fresh fruits available in 64.8% and dairy products in 39.1% of the primary schools. Data on the prevalence of beverages with added sugar in a certain number of schools, along with data on their intake within the family setting, indicates the importance of taking action in both family and school environments, to reduce frequent consumption of beverages with added sugar among children.

In conclusion, considering the stated trends in children's weight status in HRV, and the fact that in the fourth and fifth rounds of the COSI research HRV was seventh, and then fifth in Europe (10, 53), HRV is in the sixth round of research, unfortunately, likely to take one of the leading positions in the prevalence of overweight and obesity in children. No one should be blamed for this situation, but all relevant stakeholders should be invited to take coordinated joint action. Aware of the fact that overweight and obesity can be prevented and that it is necessary to make an effort to preserve health from an early age, it is important to take decisive and collaborative action, at all levels. Obesity prevention is not the responsibility of an individual or any particular sector but needs to be approached through the systematic implementation of comprehensive, multisectoral interventions that require strong political will. The implementation of continuous health promotion programs, such as the national Healthy Living program ("Živjeti zdravo"), the adoption of the Action Plan on Obesity Prevention and the realization of the Zagreb Declaration objectives, such as the establishment of the New WHO European Centre on the Prevention of Childhood Obesity, will contribute to the creation of environments in which the healthier choice is a simpler and more logical one, and in which socially conditioned inequalities in health are reduced.

Furthermore, we invite all members of society, parents, grandparents, relatives, teachers and principals to become aware of their power to initiate change and set a positive example for children, in order to provide them with the foundations of a healthy lifestyle and prevent the development of overweight and obesity. This will not only raise healthy generations and relieve the burden on the healthcare system, but also prevent the shortening of life expectancy due to obesity, and ultimately contribute to the survival and development of society as a whole.

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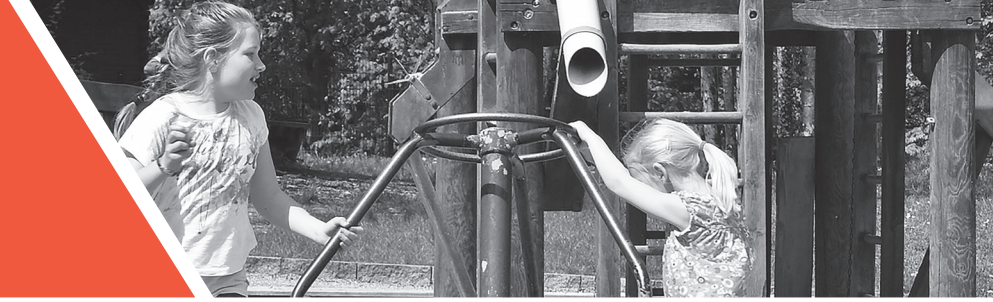
Appendix



Guidelines for Media Reporting

When reporting on the results of this research, media representatives should respect the following guidelines:

1) **Use people-first language.**
   Instead of using the phrase “obese child” or “obese people”, which label individuals by their obesity, use terms such as “child with obesity”, and “person with obesity” to indicate that they are people who, among other things, are affected by this disease.

2) **Avoid the use of pejorative and offensive expressions.**

3) **Emphasize that the findings presented in this publication are the result of scientific research, CroCOSI 2021/2022.**

4) **Report on obesity by emphasizing that it is a disease and not someone’s personal choice.**
   Obesity is a disease with complex causes – environmental, biological, genetic, economic, social and individual.

5) **Carefully select the images to accompany the report.**
   Images should be positive and should not encourage the existing prejudice on individuals with obesity. Images should present the entire body of the person with obesity, not just individual body parts without the headshot. Editors can download and use images from the following link, which have been carefully selected to avoid further stigmatization of individuals with obesity:
   www.worldobesity.org/resources/image-bank

✔ Use	✘ Avoid using
Children with obesity	Obese/overweight/fat/chubby children
High prevalence of children with obesity / Many children are affected by obesity	There are many fat children
There is a rise in childhood obesity	Children are getting heavier

CroCOSi

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REPUBLIC OF CROATIA

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