CHILDHOOD OBESITY SURVEILLANCE INITIATIVE, CROATIA 2018/2019 (CroCOSI)

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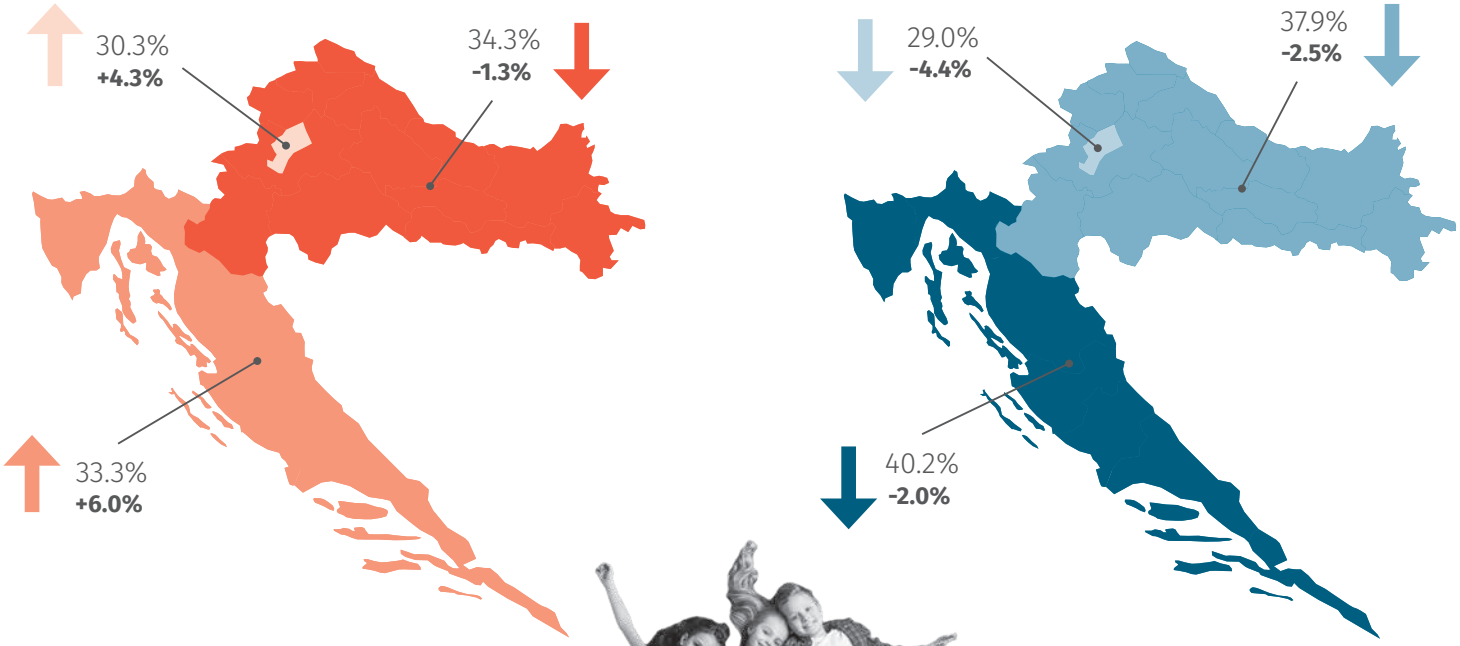
The Authors

Comparison of findings from the first and second round of research, CroCOSI

Prevalence of overweight and obesity by sex and region in 8-year-old children, 2018/2019 in comparison to 2015/2016.



Girls

The biggest rise in prevalence of overweight and obesity was observed among girls from the Adriatic region.

Boys

Among boys, prevalence of overweight and obesity fell in all regions.

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Abbreviations

BMI	Body Mass Index
CIPH	Croatian Institute of Public Health
COSI	Childhood Obesity Surveillance Initiative
CroCOSI	Childhood Obesity Surveillance Initiative, Croatia
M	Mean
MoH	Ministry of Health
MSE	Ministry of Science and Education
N	Number
NCD	Non-Communicable Diseases
OECD	Organisation for Economic Co-operation and Development
PE	Physical Education
SD	Standard Deviation
SES	Socioeconomic Status
WHO	World Health Organization

Introduction

Obesity is one of the leading public health concerns of today's society. It is globally classified as a disease according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) (1). In addition, obesity is also an important modifiable health risk for developing chronic non-communicable diseases (NCDs), which affect and cause over 90% of deaths in the Republic of Croatia (2). The European Strategy for the Prevention and Control of Chronic Non-Communicable Diseases identifies seven risk factors for developing leading NCDs (cardiovascular diseases, cancers, chronic obstructive lung diseases, mental disorders, and type 2 diabetes). Four of these seven risk factors are behavioural: inadequate nutrition, physical inactivity or insufficient physical activity, smoking, and excessive alcohol consumption; they can be regulated through a change in behaviour, while the three remaining risk factors are biomedical: hypertension, dyslipidemia, and overweight and obesity. Of all the identified risks, only overweight and obesity represent a significant risk for developing all five leading NCDs (3).

Childhood obesity is a particular public health concern. In some developed countries such as the United Kingdom, Denmark and Australia, there is a trend for a plateau in prevalence of childhood obesity, whereas in less developed or developing countries, such as some countries in Latin America, growth of prevalence of children with obesity is still exponential or linear (4). Alarming rates of children with overweight and obesity are recorded throughout Europe. Geographically speaking, north and east European countries have a lower incidence of childhood overweight and obesity, whilst the prevalence is highest in Mediterranean countries: Spain, Greece, Italy and Malta. Croatia ranks high as fifth, together with the rest of the countries of Mediterranean Europe (5). Childhood obesity poses a risk for health problems throughout life and development of many diseases such as type 2 diabetes, elevated blood pressure, cardiovascular diseases, musculoskeletal system diseases, asthma and other (6). Furthermore, children with obesity are often socially disadvantaged, with lower self-esteem, and are less successful at school (7, 8). Overweight and obesity are present in all states and affect children from all socioeconomic backgrounds. However, overweight and obesity rates are highest in children from disadvantaged communities affected by poverty, lower level of education or unemployment (9). Etiology of obesity is complex. There are increasing evidence on the effects in early life, even before the prenatal period, such as epigenetic factors, prenatal environment, obesity of mother etc. In addition to these early influences, the risk of developing childhood obesity is also affected by absence of breastfeeding or breastfeeding duration less than six months, inadequate diet, insufficient physical activity, the environment where children live and conduct their daily activities, as well as lower socioeconomic status (SES) (10-13).

Children with obesity are most likely to grow up into adults with obesity, which increases the risk for developing NCDs. In addition, according to research conducted by the Organisation for Economic Co-operation and Development (OECD), in the next 30 years overweight will shorten life expectancy in Croatia by 3.5 years (14). This is why preventive intervention from the earliest age is crucial for halting the rise in overweight and obesity. European Commission recognized the seriousness of this problem and adopted the EU Action Plan on Childhood Obesity 2014-2020, with the purpose to counteract the rise of overweight and obesity by 2025. To achieve this goal, active participation of a wide range of stakeholders is necessary across eight priority areas: supporting a healthy start in life, promoting healthier environments, especially in schools and pre-schools, making the healthy option the easier option, restricting marketing and advertising to children, informing and empowering families, encouraging physical activity, monitoring and evaluation, and increased research (15).

Although all schoolchildren in Croatia undergo regular physical exams where their anthropometric meausrements are taken, the data on their nutritional status, physical activity and dietary habits are not collected in a standardized way. Therefore, in 2015/2016 Croatia joined the Childhood Obesity Surveillance Initiative (COSI) of the WHO Regional Office for Europe, titled Childhood Obesity Surveillance Initiative, Croatia (CroCOSI). The main goal of the CroCOSI research is regular collection of comparable data on the nutrition status of schoolchildren, on their families' lifestyle habits, and characteristics of environments in the schools they attend. Data are collected for children aged 8.0-8.9 years. This age group is crucial because it includes children who attend the second and third grade of primary school, when they are already familiar with the school processes and have adopted habits in accordance with their school environments.

By joining COSI, Croatia has joined a European movement which, with joint effort, continuously monitors the nutritional status of children in a methodologically concordant manner, which enables inter-country comparison and simultaneously contributes to raising awareness on the growing rates of obesity and related problems in Croatia and all states involved. Based on the findings, Croatia will attain a foundation for creating strategies and policies for prevention of childhood overweight and obesity that will strengthen targeted and focused promotion of health among schoolchildren.

This report presents the results of the second round of CroCOSI research conducted in the school year 2018/2019, with the main goal to collect data on the nutritional status of the representative sample of schoolchildren aged 8.0-8.9 years.

Research methodology

COSI is a cross-sectional research of the WHO Regional Office for Europe which monitors the obesity epidemic in children. It is repeated in two to three-year intervals. Croatia first joined this research in the school year 2015/2016, when 36 countries from WHO European region participated in the research. The first round of research established overweight and obesity in 34.9% of children in Croatia, of which 31.0% of girls and 38.7% of boys (16). For that period, highest prevalence of children with overweight and obesity was reported in Cyprus (43%), while lowest prevalence (5%) was identified in Tajikistan (5).

Second round of research in Croatia was conducted during the school year 2018/2019. It was conducted by the Croatian Institute of Public Health, with support from the Ministry of Health (MH), Ministry of Science and Education (MSE), and the WHO Office for Croatia, in accordance with the WHO Regional Office for Europe COSI Protocol (17). The principal investigator for Croatia is Associate Professor Sanja Musić Milanović.

Sampling and research design

CroCOSI was conducted on children aged 8.0 to 8.9 years, i.e., children aged between 96 and 107 months. The research was conducted on a nationally representative random cluster sample which was regionally stratified. Sampling was performed in accordance with the WHO Regional Office for Europe COSI Protocol (17).

For sampling purposes, Croatia was stratified into three regions: Continental, Adriatic and City of Zagreb. According to the international NUTS-2 subdivision, Croatia is subdivided into two regions, Adriatic and Continental, with significant differences in cultural and traditional heritage. However, for the purposes of CroCOSI research, City of Zagreb was also included in the subdivision. Zagreb is Croatia's capital, where residents from all Croatian regions assimilate. It blends characteristics of both regions and therefore should be viewed as a separate entity.

The planned sample size was 2800 children from the targeted age group, 1400 girls and 1400 boys. In order to include all children from the targeted age group, sampling included children from all second and third grades of primary schools in Croatia. For calculating the sample size, a 75% response rate was assumed. With regard to the assumed response rate and distribution of children from the targeted age group in the included grades, 3500 children from second grades and 3500 children from third grade were planned for sampling.

The sampling unit was class. MSE provided the official list of all classes. According to this list, a total of 78 034 children were enrolled in 2nd and 3rd grade at the time of sampling, of which 48% from the Continental region, 31% from the Adriatic region, and 21% from City of Zagreb. Taking into consideration

the average number of children in classes in individual regions, using the statistical software SPSS we randomly selected 139 second grades from the Continental region, 83 from the Adriatic region and 34 from City of Zagreb. Where possible, one third grade was adjoined to each sampled second grade from the same primary school. Overall sample included 7259 children from 256 second and 249 third grades from 234 primary schools in Croatia, of which 144 main and 90 peripheral schools. Figure 1 depicts the number of schools participating in the research by regions.

For better understanding of the problem of overweight and obesity in schoolchildren, this round of research sampled both main and peripheral primary schools, and the sample was previously stratified into three regions: Adriatic, Continental and City of Zagreb. This way of sampling is different from the one used in the first round of CroCOSI, when a nationally representative sample of children from main primary schools was selected without prior stratification based on regions.

Figure 1. Number of primary schools participating in the CroCOSI 2018/2019 research by regions, CroCOSI 2018/2019.

Data collection and entry

All three data collection forms of the WHO Regional Office for Europe COSI Protocol were used in the CroCOSI research (17): child record form, family record form and school record form. Data collection forms were translated into Croatian language.

The family's record form, filled in by the child's parents or caregivers, collected data on the family's socioeconomic and anthropometric characteristics, as well as the child's dietary and physical activity habits. Family record forms were delivered to schools with information on research methodology and purpose, and informed consent form for parents. In addition, a PowerPoint presentation containing basic information on the research as an aid for informing parents was e-mailed to each school. Family record forms were distributed at parent-teacher meetings organised by schools. Completed family record forms and informed consents were collected by school personnel and given to examiners during measurements. On this occasion, the school record form containing questions on school environments, possibility of participating in regular physical activity in schools, organisation of nutrition in schools, initiatives for promoting healthy lifestyles and presence of food advertising in schools was also filled in. School record forms were filled in by principals, school counsellors or teachers, with the help from examiners.

The child record form, the form where the child's anthropometric measurements are registered, along with information on the child's health behaviour on the day of measurement, was filled in during measurement in schools. The child record form also collected information on the children's place of residence. All local administrative units were subsequently divided into three categories: cities (densely populated areas), towns and suburbs (intermediate density areas), and rural areas (thinly populated areas), in accordance with the Eurostat classification of urbanisation (18).

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

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

Training for conducting field measurements and data collection

Education of fieldworkers who conducted the measurement of children and collected data was organised and conducted by the WHO Regional Office for Europe in 2015. CIPH research team organised and conducted education for 26 new fieldworkers in 2019. Practical training was conducted in a third grade of a primary school, in accordance with all ethical principles of research and the WHO Regional Office for Europe COSI Protocol (17). After completion of training, a unique code was assigned to each fieldworker.

Fieldwork and measurement

Data collection and measurements were conducted during 8 weeks, between February 18 and April 12, 2019. Fieldwork was conducted by 42 trained examiners, in two or three member teams, who visited schools and collected measurements. One member of all teams was a healthcare worker, either a doctor or a nurse.

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

Twenty-two sets of measuring equipment were used for measuring children's body weight and height. The sets were identical, in accordance with the WHO Regional Office for Europe COSI Protocol. They included: body weight scale (SECA 877), stadiometer (SECA 217), adapter element for attaching the stadiometer to the weight scale (SECA 437), non-stretchable tape measure (SECA 203), and carrying case to transport measuring instruments (SECA 414).

Measurements were collected in school facilities during school hours, usually in indoor gyms or classrooms. Weight was measured to the nearest 100 grams and height to the nearest 1 millimetre. Height was measured twice, and the average value of the two measurements was used for analysis. Waist and hip circumference were measured over a shirt, following height and weight measurement. On average, anthropometric measurements were collected in 45 minutes per class. Measurement was conducted in silence, without commenting on the individual results.

Participants

Of 234 sampled schools, 232 agreed to participate in the research. Parents/caregivers filled in 5814 of the 7259 distributed family record forms, which was an 80.1% response rate. Of 7259 children selected for sampling, 5734 were examined, a response rate of 80.0%. In all selected classes 7113 children were registered, of which 998 did not have a signed informed consent from their parents; 373 were absent on the day of measurement, and eight children declined to be examined. The final sample consisted of 2711 children aged 8.0 to 8.9 years, 50.1% of girls and 49.9% of boys. Data on the sample and response rate of participants, with numbers and percentages of participants by sex are presented in Figure 2 and Table 1, respectively.

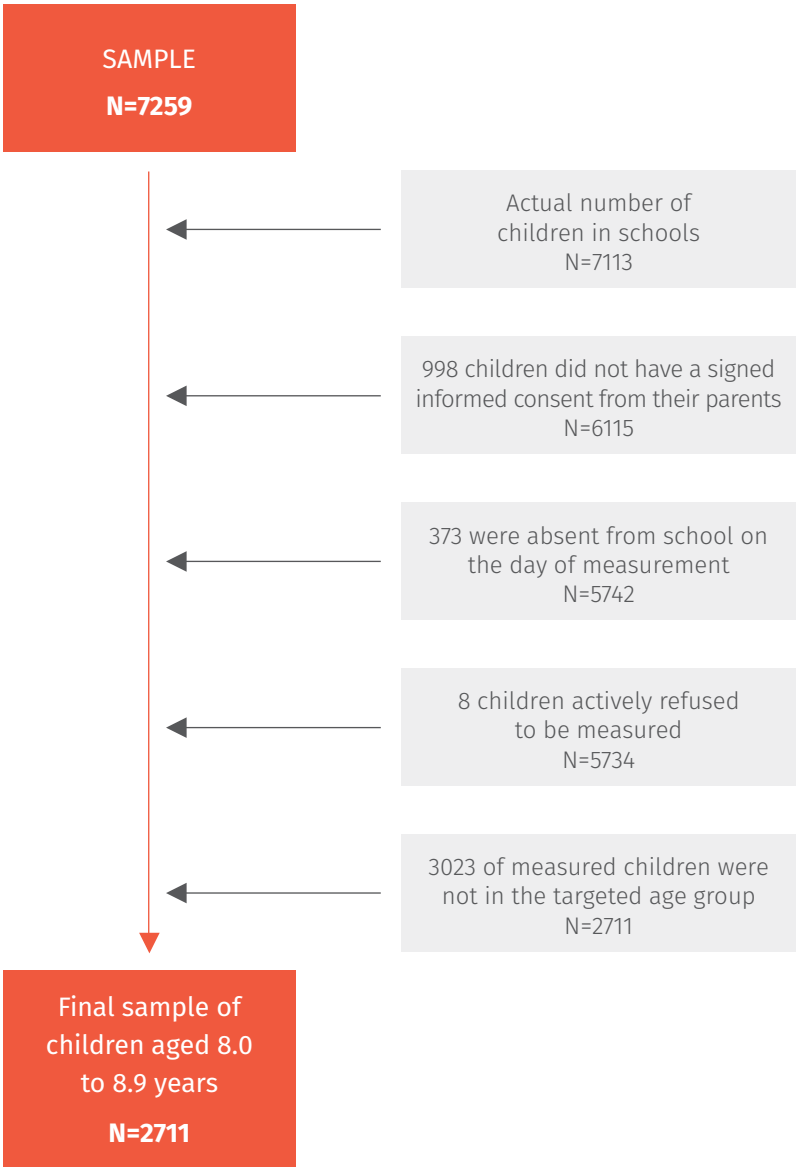

Figure 2. Flow chart demonstrating the sampling process in the CroCOSI research, 2018/2019.

Table 1. Number and percentage of participants by sex, CroCOSI 2018/2019.

	N	%
Boys	1354	49.9
Girls	1357	50.1
Total	**2711**	**100.0**

Classification of weight

WHO SPSS code was used for the analysis of data on children's growth. It contains criteria and WHO reference data on growth of children aged 5 to 19 years from 2007 (19). Body mass index-for-age (BMI) was used in the analysis. Different categories of growth-for-age according to WHO criteria are depicted in Figure 3.

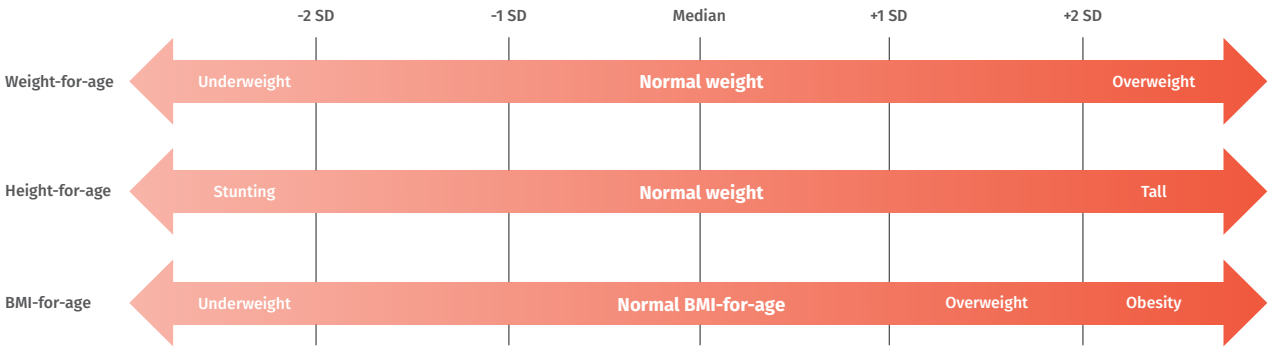

Figure 3. Z-score classification of the anthropometric measurements based on WHO criteria (20)

Ethical considerations

CroCOSI research was approved by the CIPH Ethics Committee in November 2018 (Class: 030-02/18-07/2). It was conducted in accordance with contemporary ethical principles, respecting the fundamental bioethical principles of autonomy, justice, beneficence and nonmaleficence. Signed informed consent was obtained from a parent or guardian prior to the child's anthropometric measurements. On the day of the measurements, verbal consent was obtained from each child. Anonymity was secured by coding the information on the child's school, class and identity. Coding was carried out by the CIPH research team (17).

Nutritional status of children aged 8.0-8.9 years in Croatia

Anthropometric measurements and nutritional status of children

During anthropometric measurements in schools, examiners recorded additional information on children, such as the type of clothing they were wearing during measurement and whether measurement was taken before or after lunch. The measured children's body weight was subsequently adjusted based on the documented type of clothing. Therefore, 130 g were deducted from the measured weight if the child was wearing gym clothing (e.g. t-shirt and shorts only), 195 g if the child was wearing light clothing (e.g. t-shirt, cotton trousers or skirt) and 600 g if the child was wearing heavy clothing (e.g. sweater and jeans). Most children (71.6%) were measured before lunch. Only 18.4% of measured children heeded the recommendation to wear gym clothing during measurement. Most children, 79.3% of them, were measured in light clothing, while only 2.4% of children were measured in heavy clothing. All children were measured without shoes and had emptied their pockets before measurement.

On a national level, data presented in Table 2 indicate that one in three children, 35.0%, aged 8.0 to 8.9 years had overweight or obesity. Prevalence of boys with overweight was 19.2%, while 17.8% of boys had obesity. Data are somewhat more favourable for girls, of which 21.2% had overweight and 11.9% had obesity. As regards the prevalence of underweight, according to BMI-for-age, 1.6% of measured children were categorised as underweight.

Based on region, presented in Table 2, lowest rate of children with overweight and obesity (29.7%) was reported in the City of Zagreb, where 20.8% of 8-year-olds had overweight, and 8.9% had obesity. In the Continental region, 36.0% of children had a too high BMI-for-age i.e. had overweight or obesity, of which more had obesity than overweight, 18.1% and 17.9%, respectively. Compared to other regions, the rate of children with overweight and obesity was the highest in the Adriatic region, and was 36.9%, of which 23.1% of children had overweight and 13.8% had obesity.

Comparing boys and girls by region, depicted in Table 2, the greatest prevalence of overweight in girls was found in the Adriatic region, where it affected 25.5% of girls. The prevalence of obesity in girls was the greatest in the Continental region where it equaled 15.6%. The overweight problem equally affected boys in the City of Zagreb and the Adriatic region, 21.0% and 20.9% respectively. It was higher in these two regions compared to the Continental region, where 17.1% of boys had overweight. Obesity in boys was more common in the Continental and the Adriatic region, where it was established in nearly one in five boys, than in the City of Zagreb where it affected 8.1% of boys. Comparison by sex within regions indicated that in the Continental and Adriatic region overweight and obesity were more common in boys than in girls. In the City of Zagreb, prevalence of overweight and obesity among girls was slightly higher than prevalence among boys.

Table 2. Nutritional status of children by sex and regions, CroCOSI 2018/2019.

	Underweight		Normal weight		Overweight		Obesity		Total
	N	%	N	%	N	%	N	%	N
Republic of Croatia									
Boys	19	1.4	834	61.7	259	19.2	240	17.8	1352
Girls	25	1.8	882	65.0	288	21.2	162	11.9	1357
Total	**44**	**1.6**	**1716**	**63.3**	**547**	**20.2**	**402**	**14.8**	**2709**
Continental region									
Boys	14	2.3	371	59.8	106	17.1	129	20.8	620
Girls	16	2.5	410	63.3	121	18.7	101	15.6	648
Total	**30**	**2.4**	**781**	**61.6**	**227**	**17.9**	**230**	**18.1**	**1268**
Adriatic region									
Boys	4	0.9	271	58.9	96	20.9	89	19.3	460
Girls	3	0.7	285	66.0	110	25.5	34	7.9	432
Total	**7**	**0.8**	**556**	**62.3**	**206**	**23.1**	**123**	**13.8**	**892**
City of Zagreb									
Boys	1	0.4	192	70.6	57	21.0	22	8.1	272
Girls	6	2.2	187	67.5	57	20.6	27	9.7	277
Total	**7**	**1.3**	**379**	**69.0**	**114**	**20.8**	**49**	**8.9**	**549**

Comparison of the first and the second round of CroCOSI research, Figure 4, reveals slight differences in prevalence of both overweight and obesity in children. In this sense, Croatia is on track in accomplishing one of the objectives set by the WHO directed at global prevention of chronic non-communicable diseases, which is to halt the rising trend in childhood obesity by 2025 (20).

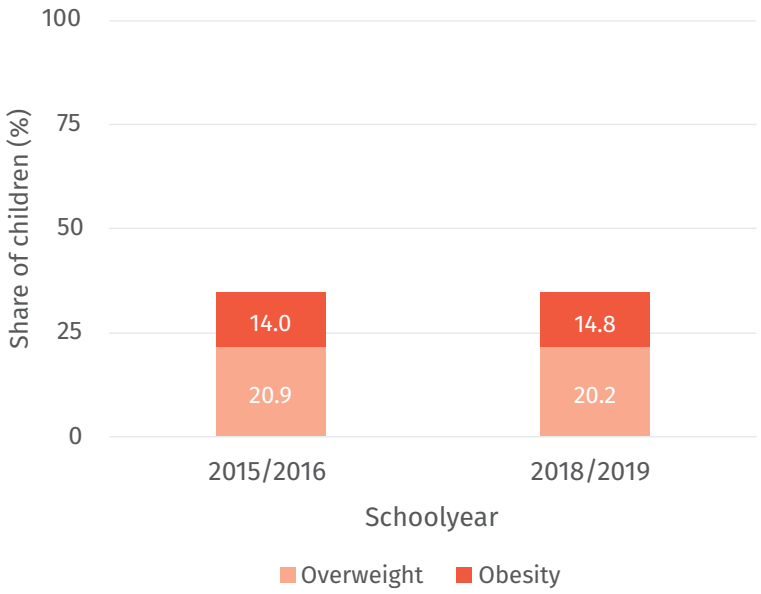

Figure 4. Prevalence of overweight and obesity in children in the first and in the second round of CroCOSI research, 2015/2016 and 2018/2019.

Results presented in Table 3 indicate that only one in seven parents in Croatia thought that their child had overweight or obesity. This indicates that parents' perception is inconsistent with the actual measured nutritional status of their children in this research, which established that one in three children in Croatia have overweight or obesity.

Table 3. Parents' perception of their children's weight by sex, CroCOSI 2018/2019.

	Underweight		Normal weight		A little overweight		Extremely overweight		Total
	N	%	N	%	N	%	N	%	N
Boys	25	1.9	1114	84.2	166	12.5	18	1.4	1323
Girls	18	1.4	1107	84.5	168	12.8	17	1.3	1310
Total	**43**	**1.6**	**2221**	**84.4**	**334**	**12.7**	**35**	**1.3**	**2633**

Urbanisation shapes the lifestyles of children and families. Research indicates that in developed countries children in rural areas have a greater risk of obesity in comparison to children from larger cities (21). The findings of our research, depicted in Table 4, indicate that this pattern also applies to Croatia, where prevalence of obesity in children was the lowest in cities, somewhat higher in towns and suburban areas, and the highest in rural areas. In cities, approximately one in ten children had obesity, whereas in rural areas this problem affected almost one in five children. Therefore, prevalence of childhood obesity was found to increase as the level of urbanisation decreases.

Table 4. Nutritional status of children based on urbanisation, CroCOSI 2018/2019.

	Underweight		Normal weight		Overweight		Obesity		Total
	N	%	N	%	N	%	N	%	N
Cities									
Boys	1	0.3	271	68.6	78	19.7	45	11.4	395
Girls	8	1.9	279	65.5	94	22.1	45	10.6	426
Total	**9**	**1.1**	**550**	**67.0**	**172**	**21.0**	**90**	**11.0**	**821**
Towns and suburban areas									
Boys	9	1.6	347	61.0	101	17.8	112	19.7	569
Girls	9	1.7	345	67.0	106	20.6	55	10.7	515
Total	**18**	**1.7**	**692**	**63.8**	**207**	**19.1**	**167**	**15.4**	**1084**
Rural areas									
Boys	9	2.3	216	55.7	80	20.6	83	21.4	388
Girls	8	1.9	258	62.0	88	21.2	62	14.9	416
Total	**17**	**2.1**	**474**	**59.0**	**168**	**20.9**	**145**	**18.0**	**804**

The mean values of waist and hip circumference are presented in Table 5. Mean waist circumference amongst girls was 59.4 cm, while hip circumference was 72.1 cm. Amongst boys, mean waist circumference was 61.1 cm, and hip circumference was 72.8 cm.

Table 5. Waist and hip circumference in centimetres, CroCOSI 2018/2019.

	Waist circumference			Hip circumference		
	N	Mean (cm)	SD	N	Mean (cm)	SD
Boys	1353	61.1	7.2	1353	72.8	7.2
Girls	1356	59.4	7.3	1356	72.1	7.3
Total	**2709**	**60.3**	**7.3**	**2709**	**72.4**	**7.3**

Family characteristics

In this second round of CroCOSI research, presented in Table 6, the family record form was mostly, in 83.9% of children, filled out by mothers. Record forms of 13.4% of children were filled out by fathers. In situations where parents were unable to do so, the record forms were usually completed by siblings, grandmothers or caregivers, such as foster family members.

Table 6. Surveyed family members, CroCOSI 2018/2019.

Relationship to the child	N	%
Mother	2274	83.9
Father	364	13.4
Other	23	0.8
Missing	50	1.8
Total	**2711**	**100.0**

A person who shares the same household has the best insight into the child's environment and habits. If a child does not live with both parents, it is necessary to know if the person who completed the family record form lives with the child, in order to be certain that the obtained information are relevant. In our research, 96.7% of children lived with the person who completed the family record form.

Marital status of parents

Table 7 depicts the marital status of parents of surveyed children. Most parents of surveyed children, 88.6% of them, were married or domestic partners, while 8.0% of parents were divorced.

Table 7. Marital status of parents of surveyed children, CroCOSI 2018/2019.

Marital status of parents	N	%
Married	2246	82.8
Domestic partnership	156	5.8
Separated after marriage or domestic partnership	217	8.0
Widower/widow	18	0.7
Other	25	0.9
Missing	49	1.8
Total	**2711**	**100.0**

Children's nutritional status is highly correlated with their parents' nutritional status. The reason for this is a combination of genetic, behavioural and environmental factors (22, 23). Therefore, for targeted preventive intervention it is important to be familiar with the weight status of parents, as well as information on the family's lifestyle habits and environment. Based on parents' answers presented in Table 8, 32.4% of surveyed mothers had overweight and obesity, while this problem affected 75.4% of fathers.

Table 8. Nutritional status of parents of surveyed children, CroCOSI 2018/2019.

	Underweight		Normal weight		Overweight		Obesity		Total
	N	%	N	%	N	%	N	%	N
Mothers	82	3.2	1638	64.3	600	23.5	228	8.9	2548
Fathers	1	0.0	603	24.6	1300	53.1	546	22.3	2450

Socioeconomic family indicators

SES, measured by education level, employment status and monthly household income, is another determinant of obesity. Research indicates that persons with lower SES have greater problems with body weight (9). Based on the information on parents' education presented in Table 9, obtained from the family record forms, in 51.0% families both parents of a surveyed child have completed secondary or primary education, while in 46.7% of families at least one parent has completed higher education.

Table 9. Education level of parents of surveyed children, CroCOSI 2018/2019.

	N	%
At least one parent with completed higher education	1265	46.7
Both parents with secondary or primary education	1383	51.0
Missing	63	2.3
Total	**2711**	**100.0**

Data in Table 10 indicate that 63.5% of surveyed children had both employed parents or, in a single-parent family, the parent was employed. In families with at least one parent unemployed lived 32.2% of children.

Table 10. Employment status of parents, CroCOSI 2018/2019.

	N	%
Employed	1722	63.5
At least one parent unemployed	874	32.2
Missing	115	4.2
Total	**2711**	**100.0**

Average monthly income in households where children lived was 11,424.27 kn (median and mode were 10,000.00) with standard deviation of 6727.53, which indicates big differences in income across the families of surveyed children.

Characteristics of early development

Some characteristics of early childhood associated with childhood obesity are mother's weight during pregnancy, child's birth weight, increase in weight during infancy, duration of breastfeeding etc. (24, 25).

Duration of pregnancy

According to some research, there is a possible connection between premature birth, especially before 32nd week, and metabolic disorders such as obesity in adults (26). Therefore, gestation age or duration of pregnancy are another factor to be monitored as a part of epidemiologic monitoring of obesity. Data on duration of pregnancy of the mothers of surveyed children, collected from the family record forms, are presented in Table 11. They indicate that 83.6% of children were born at full term, while 15.7% of children were born out of term, before 37 weeks + 1 day of pregnancy or after due date, which is after 41 weeks + 6 days of pregnancy.

Table 11. Duration of pregnancy in weeks, CroCOSI 2018/2019.

	≤32 weeks		33 – 36 weeks		37 – 41 weeks		≥42 weeks		Don't know		Total
	N	%	N	%	N	%	N	%	N	%	N
Boys	30	2.3	50	3.8	1112	83.7	131	9.9	6	0.5	1329
Girls	34	2.6	56	4.2	1107	83.5	117	8.8	12	0.9	1326
Total	64	**2.4**	106	**4.0**	2219	**83.6**	248	**9.3**	18	**0.7**	**2655**

Birth weight

A birth weight greater than 4000 g is associated with obesity and increased amount of fat tissue in childhood, while a birth weight lower than 2500 g is associated with central obesity. Data on surveyed children's birth weight were obtained from the family record form. Table 12 depicts the average birth weight which was 3495.3 grams for boys, and was higher compared to girls' average birth weight of 3369.9 g.

Table 12. Average birth weight of surveyed children in grams, CroCOSI 2018/2019.

	N	M±SD (g)
Boys	1309	3495.3 ±563.9
Girls	1291	3369.9 ±572.2
Total	**2600**	**3432.7±571.4**

Breastfeeding

WHO recommends initiation of breastfeeding within the first hour of birth, and exclusive breastfeeding for the first six months of the child's life. Exclusive breastfeeding means that the infant receives only breast milk. No other liquids or solids are given - not even water – with the exception of oral rehydration solution, or drops/syrups of vitamins, minerals drops or medicines. WHO recommends breastfeeding on demand, while no bottles, teats or pacifiers should be used. After the age of six months, infants should receive safe and adequate complementary foods, while continuing to breastfeed for up to two years or beyond (27). Data obtained from family record forms, presented in Table 13, indicate that 72.6% of children were exclusively breastfed. Percentage of children who were exclusively breastfed for at least 6 months, in line with WHO recommendations, was 27.1%, equally for boys and girls. According to findings on duration of breastfeeding presented in Table 14, 93.0% were breastfed at some point, of which 12.8% for less than a month. Average duration of breastfeeding in surveyed children was 11.7 months, equally for boys and girls.

Table 13. Exclusive breastfeeding based on WHO recommendations, CroCOSI 2018/2019.

	No		Yes, less than 6 months		Yes, 6 months or longer		Total
	N	%	N	%	N	%	N
Boys	317	26.9	539	45.7	324	27.4	1180
Girls	326	27.8	532	45.4	314	26.8	1172
Total	**643**	**27.3**	**1071**	**45.5**	**638**	**27.1**	**2352**

Table 14. Breastfeeding and average duration of breastfeeding in months, CroCOSI 2018/2019.

	No		Yes, but for less than 1 month		Yes		M	Don't know		Total
	N	%	N	%	N	%	months	N	%	N
Boys	78	5.9	172	13.0	1069	80.7	11.7	5	0.4	1324
Girls	89	6.7	167	12.5	1063	79.7	11.8	14	1.1	1333
Total	**167**	**6.3**	**339**	**12.8**	**2132**	**80.2**	**11.7**	**19**	**0.7**	**2657**

Figure 5 depicts rates of breastfed children by months. The slope indicates that the rates of breastfed children decline with age. At 24 months, which is the minimal breastfeeding duration recommended by the WHO, 10.3% of children were still breastfed.

Figure 5. Rates of breastfed children by months, CroCOSI 2018/2019.

Physical activity and sedentary lifestyles

Physical activity

Regular physical activity is an important factor in the prevention of overweight and obesity, and preservation of health in children and adults. According to WHO recommendation, children and adolescents aged 5 to 17 years should do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity across the week. Children and adolescents should engage in vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, at least three days a week (28). Habits of regular physical activity in school age can be encouraged in various ways, such as active traveling to and from school, active play, participating in sports or dance activities, and reduced time spent in sedentary activities such as watching television or using electronic devices (29).

The results of our research, presented in Table 15, indicate that almost half of the surveyed children lived within one kilometre from school, while a little less than one-third of children lived between 1 and 2 kilometres from school. The smallest percentage of children, 4.2% of them, lived more than 6 km away from school. Based on the information on the method of transport to and from school presented in Table 16, half of the children walked, cycled, skated or used non-motorized scooter to get to the school, while the other half used the school bus, public transport or private motorized vehicles. More children walked or used active transport when returning from school than when going to school, equally boys and girls.

Table 15. Distance between school and home, CroCOSI 2018/2019.

	<1 km		1-2 km		3-4 km		5-6 km		>6 km		Total
	N	%	N	%	N	%	N	%	N	%	N
Boys	654	49.5	386	29.2	170	12.9	65	4.9	46	3.6	1321
Girls	645	48.8	381	28.8	164	12.4	68	5.1	65	4.9	1323
Total	**1299**	**49.1**	**767**	**29.0**	**334**	**12.6**	**133**	**5.0**	**111**	**4.2**	**2644**

Table 16. Method of transport to and from school, CroCOSI 2018/2019.

	Walking		Cycling, skating or non-motorised scooter		School bus or public transport		Private motorized vehicles		Total
	N	%	N	%	N	%	N	%	N
To school									
Boys	650	49.5	7	0.5	173	13.2	483	36.8	1313
Girls	649	49.5	7	0.5	195	14.9	461	35.1	1312
Total	**1299**	**49.5**	**14**	**0.5**	**368**	**14.0**	**944**	**36.0**	**2625**
From school									
Boys	708	56.1	7	0.6	154	12.2	394	31.2	1263
Girls	680	53.8	5	0.4	165	13.0	415	32.8	1265
Total	**1388**	**54.9**	**12**	**0.5**	**319**	**12.6**	**809**	**32.0**	**2528**

Over two-thirds of eight-year-olds were regularly physically active through membership in one or more sport clubs or dancing courses, e.g. football, soccer, running, hockey, swimming, tennis, basketball, gymnastics, ballet, fitness, ballroom dancing, et cetera, as presented in Table 17, 72.9% of boys compared to 66.7% of girls.

Table 17. Distribution of children's membership in one or more sport clubs or dancing courses, CroCOSI 2018/2019.

	Yes		No		Total
	N	%	N	%	N
Boys	961	72.9	357	27.1	1318
Girls	879	66.7	439	33.3	1318
Total	**1840**	**69.8**	**796**	**30.2**	**2636**

Time spent on sports and physical activities with these sport clubs or dancing courses over a typical week (including weekends) is presented in Table 18. Most girls who attended a sport club or a dance course, 66.9% of them, engaged in such activities for up to three hours a week, while 33.1% engaged in such activities longer than three hours a week. Of boys participating in a sport club or dance course, 51.5% engaged in these activities for up to three hours a week, while 48.5% longer than three hours a week.

Table 18. Time spent on sports and physical activities within sport clubs or dancing courses over a typical week, CroCOSI 2018/2019.

	≤ 3 hours/week		≥ 4 hours/week		Total
	N	%	N	%	N
Boys	491	51.5	462	48.5	953
Girls	586	66.9	290	33.1	876
Total	**1077**	**58.9**	**752**	**41.1**	**1829**

Child's play is an activity that contributes to physical, mental and social development (30). Through active play children engage in moderate to vigorous physical activities, which is recommended for at least one hour daily (28, 31). According to the findings presented in Table 19, on weekdays 91.0% of children spent one hour or longer engaging in active/vigorous play. This includes running, jumping outside or moving and fitness games inside. On weekends, 97.5% of children spent one hour or longer in active/vigorous play, and 59.9% spent three hours or longer in active/vigorous play. Less than 1 hour of active/vigorous play on weekdays was reported for 9.1% of children, and for 2.5% on weekends.

Table 19. Time children spend playing actively/vigorously during a normal week, outside school hours, CroCOSI 2018/2019.

	Never at all		<1 hour		1 hour		2 hours		≥3 hours		Total
	N	%	N	%	N	%	N	%	N	%	N
Weekdays											
Boys	11	0.8	102	7.7	475	35.8	540	40.7	199	15.0	1327
Girls	19	1.4	110	8.3	500	37.7	523	39.4	174	13.1	1326
Total	**30**	**1.1**	**212**	**8.0**	**975**	**36.8**	**1063**	**40.1**	**373**	**14.1**	**2653**
Weekends											
Boys	8	0.6	26	2.0	83	6.5	383	29.9	781	61.0	1281
Girls	8	0.6	22	1.7	103	8.0	395	30.8	755	58.8	1283
Total	**16**	**0.6**	**48**	**1.9**	**186**	**7.3**	**778**	**30.3**	**1536**	**59.9**	**2564**

Sedentary behaviour

Sedentary behaviour includes time spent in a seated, reclined position or lying down, when energy consumption is low (32). In children and adolescents, prolonged time spent in sedentary activities is associated with adverse health outcomes: greater occurrence of obesity, poor cardiac and metabolic health, and reduced sleep duration. All children and young people should reduce as much as possible time spent sitting and, whenever possible, interrupt prolonged periods of inactivity with at least light physical activity (28).

Sedentary time spent in activities such as doing homework or reading a book, watching television or using electronic devices, is presented in Tables 20 and 21. According to the information reported in family record forms, on weekdays 46.3% of children spent 2 hours or longer doing homework or reading a book, while on weekends 38.3% of children spent the same amount of time doing homework or reading a book, either at home or somewhere else.

Table 20. Time children spend doing homework or reading a book during a normal week, outside school hours, CroCOSI 2018/2019.

	Never at all		<1 hour/day		1 hour/day		2 hours/day		≥3 hours/day		Total
	N	%	N	%	N	%	N	%	N	%	N
Weekdays											
Boys	5	0.4	205	15.1	537	40.3	511	38.4	73	5.5	1331
Girls	1	0.1	134	10.1	546	41.1	553	41.6	94	7.1	1328
Total	**6**	**0.2**	**339**	**12.7**	**1083**	**40.7**	**1064**	**40.0**	**167**	**6.3**	**2659**
Weekends											
Boys	17	1.4	274	22.3	485	39.5	374	30.5	77	6.3	1227
Girls	21	1.7	235	18.9	495	39.7	400	32.1	95	7.6	1246
Total	**38**	**1.5**	**509**	**20.6**	**980**	**39.6**	**774**	**31.3**	**172**	**7.0**	**2473**

The habit of spending time in front of a screen such as TV, computer, tablet, smartphone or other electronic device (not including moving or fitness games), is widespread among children and young people. Greater availability of computers, cell phones, tablets and other electronic devices led to findings presented in Table 21 which indicate that on weekdays 41.2% of children spent 2 hours or longer watching TV or playing with electronic devices such as computer, tablet, smartphone and other electronic devices. On weekends, as many as three out of four surveyed children, on average 78.3%, boys and girls equally, spent 2 or more hours watching screens, either at home or outside home (e.g. Internet cafes, game centres etc).

Table 21. Time children spend watching TV or playing with electronic devices, outside school hours, CroCOSI 2018/2019.

	Not at all		<1 hour/day		1 hour/day		2 hours/day		≥3 hours/day		Total
	N	%	N	%	N	%	N	%	N	%	N
Weekdays											
Boys	36	2.7	115	8.8	585	44.7	428	32.7	146	11.1	1310
Girls	44	3.4	138	10.6	623	47.6	372	28.4	131	10.0	1308
Total	**80**	**3.1**	**253**	**9.7**	**1208**	**46.1**	**800**	**30.6**	**277**	**10.6**	**2618**
Weekends											
Boys	11	0.8	26	2.0	220	16.8	477	36.4	575	43.9	1309
Girls	12	0.9	39	3.0	260	19.9	494	37.9	499	38.3	1304
Total	**23**	**0.9**	**65**	**2.5**	**480**	**18.4**	**971**	**37.2**	**1074**	**41.1**	**2613**

In addition to physical activity and sedentary behaviour, daily activity is also affected by sleep habits. For eight-year-old children, healthy sleep requires sleeping nine hours or longer each night (33). Our findings indicate that average sleep duration in surveyed children was a little over 9 hours, as presented in Table 22. This indicates that average sleep hours of Croatian children follow the recommended guidelines.

Table 22. Average sleep duration, CroCOSI 2018/2019.

	N	M±SD (hours)
Boys	1325	9:46±0:42
Girls	1327	9:45±0:47
Total	**2652**	**9:45±0:45**

Dietary habits

Healthy dietary habits, as one of the crucial determinants in prevention of obesity, are important for growth and development of schoolchildren. They affect dietary habits in adulthood and health throughout life.

Breakfast

Breakfast is one of the basic components of healthy lifestyles. Regular consumption of breakfast is associated with reduced possibility of developing overweight and obesity. Breakfast is especially important for children because it contributes to a balanced daily nutritional intake (34).

Data presented in Table 23 represent family's answers on children's frequency of having breakfast, that is more than just a beverage such as milk, tea or juice. More than two-thirds of parents, 68.3% of them, reported that their child had breakfast daily, 28.3% reported that their child had breakfast some or most days, while 3.5% of parents reported that their child never had breakfast. Breakfast habits were similar among boys and girls.

Table 23. Frequency of having breakfast over a typical or usual week, CroCOSI 2018/2019.

	Never		Some days (1-3 days)		Most days (4-6 days)		Every day	
	N	%	N	%	N	%	N	%
Boys	38	2.9	180	13.6	198	15.0	907	68.6
Girls	54	4.1	181	13.8	186	14.1	894	68.0
Total	**92**	**3.5**	**361**	**13.7**	**384**	**14.6**	**1801**	**68.3**

During measurement, in addition to information obtained from the family record form, field examiners asked children whether they had breakfast that day and, if yes, where. Table 24 indicates that 82.6% of children had breakfast on the day of measurement, of which 60.6% had breakfast at home, 1.8% had only consumed a beverage such as milk, tea or juice, while 15.6% of children did not have breakfast. The children's answers correspond with the information on breakfast habits reported in the family record form.

Table 24. Having breakfast on the morning of measurement, CroCOSI 2018/2019.

	No		Yes		Only beverages		Total
	N	%	N	%	N	%	N
Boys	221	16.3	1111	82.1	21	1.6	1353
Girls	202	14.9	1126	83.0	28	2.1	1356
Total	**423**	**15.6**	**2237**	**82.6**	**49**	**1.8**	**2709**

Table 25 indicates that most children who had breakfast, had their breakfast at home; one in five children had breakfast at school, and a fifth of children had breakfast twice, both at home and at school.

Table 25. Location of breakfast on the morning of measurements, CroCOSI 2018/2019.

	Home		Store, bakery		School		Combined (e.g., at home and at school)		Total
	N	%	N	%	N	%	N	%	N
Boys	653	59.0	3	0.3	234	21.1	217	19.6	1107
Girls	698	62.2	9	0.8	222	19.8	193	17.2	1122
Total	**1351**	**60.6**	**12**	**0.5**	**456**	**20.5**	**410**	**18.4**	**2229**

Frequency of consumption of different foods

Frequency of consumption of different foods and beverages in children, based on family's answers, is presented in Table 26. WHO recommends daily consumption of five servings of fruits and vegetables, in order to ensure optimal intake of fibres and prevention of NCDs (35). Despite this recommendation, only 20.5% of children ate vegetables every day, 36.9% of children ate vegetables four to six days a week, and 42.5% ate vegetables three days a week or less often. The consumption of fresh fruit was somewhat greater. Fresh fruit was consumed every day by 33.7% of children, 32.6% of children ate fresh fruit four to six days a week, while 33.7% of children ate fresh fruit three days a week or less often. Results indicate that it was not common for children in Croatia to drink 100% fruit juice, which is an adequate substitute for one serving of fruit. Thus, 7.0% of children drank 100% fruit juice daily, while every day 20.7% of children drank soft drinks containing sugar, which are the most common source of added sugar in children.

Consumption of sugar has many negative health consequences. It increases the risk of developing overweight and obesity, influences blood pressure and fats, and entices development of cavities. For this reason, WHO recommends to limit the intake of free sugars to less than 10% of total energy intake (35). However, frequency of consumption of sugar-sweetened products in children is quite high. In fact, 34.1% of children ate sweet snacks such as cakes, biscuits and candy desserts four times a week or more. Only 16.7% of children ate sweet snacks less than weekly or never.

High intake of salt also increases the risk of developing high blood pressure and, consequently, NCDs. Reducing daily intake of salt to less than 5 g would significantly increase the percentage of healthy population. The most common sources of salt are processed foods such as cured meat, bakery products or salty snacks (35). Based on parents' answers, 31.2% of children ate bakery products other than bread (pretzels, rolls, croissants, puff pastry, burek etc.) on most days or every day, 43.0% of children ate them one to three times a week, while 25.7% ate such foods less than once a week or never. Savoury snacks such as potato chips, popcorn or peanuts were consumed every day by 15.3% of children, 46.9% of children ate them between one and three days a week, while 37.8% ate these foods less than once a week or never. Foods rich in salt and unhealthy trans-fatty acids are known as fast food. This includes pizza, french fries, hamburgers, kebabs or sausages. Our findings indicate that 2.9% of children ate this kind of food most days or daily, 26.1% ate it one to three times a week, while 71.1% ate it less than once a week or never.

Table 26. Frequency of consumption of different kinds of food and beverages over a typical or usual week, CroCOSI 2018/2019.

	Never		Less than once a week		Some days (1-3 days)		Most days (4-6 days)		Every day		Total
	N	%	N	%	N	%	N	%	N	%	N
Fresh fruit	53	2.0	98	3.7	744	28.0	864	32.6	894	33.7	2653
Vegetables (including vegetable soup, excluding potatoes)	48	1.8	131	4.9	948	35.8	978	36.9	542	20.5	2647
Soft drinks containing sugar	195	7.4	651	24.5	825	31.1	431	16.3	550	20.7	2652
Breakfast cereals	325	12.3	442	16.8	1212	46.0	413	15.7	244	9.3	2636
Meat	11	0.4	55	2.1	740	28.1	1380	52.4	450	17.1	2636
Fish	196	7.4	1196	45.4	1186	45.0	52	2.0	6	0.2	2636
Egg dishes	108	4.1	608	23.0	1626	61.6	247	9.4	51	1.9	2640
Potatoes	23	0.9	234	8.9	1640	62.3	641	24.3	96	3.6	2634
Milk	107	4.1	153	5.8	410	15.6	597	22.7	1366	51.9	2633
Flavoured milk	1174	45.1	657	25.3	402	15.5	166	6.4	202	7.8	2601
Cheese	317	12.2	596	22.9	1180	45.4	382	14.7	124	4.8	2599
Yoghurt, milk pudding, cream cheese/quark or other dairy products	78	3.0	200	7.6	1038	39.4	829	31.5	490	18.6	2635
100% fruit juice	297	11.6	887	34.7	880	34.4	314	12.3	178	7.0	2556
Diet or „light“ soft drinks	2151	82.2	291	11.1	119	4.5	28	1.1	28	1.1	2617
Savoury snacks	87	3.3	908	34.5	1233	46.9	291	11.1	111	4.2	2630
Sweet snacks	26	1.0	414	15.7	1299	49.2	583	22.1	317	12.0	2639
Bread	26	1.0	113	4.3	478	18.2	595	22.7	1408	53.7	2620
Other bakery products	54	2.0	625	23.7	1134	43.0	505	19.2	317	12.0	2635
Fast food	124	4.7	1752	66.4	688	26.1	65	2.5	11	0.4	2640

Children's purchasing of snack food

Dietary habits are formed in the environments where children spend most of their time, which is at home and at school. However, children can take in additional calories through sweet or savoury snacks which they purchase on their own. This way, dietary habits are harder to control as children are becoming more independent in selecting the products they buy, which increases the likelihood of buying nutrient-poor products and thus increasing the risk of developing overweight and obesity (36). During school measurement, examiners asked all children whether they buy sweet or savoury snacks in nearby stores on their own. As presented in Table 27, almost three out of four children replied affirmative.

Table 27. Purchase of sweet or savoury snacks, based on children's answers, CroCOSI 2018/2019.

	Yes		No		Total
	N	%	N	%	N
Boys	1022	75.6	329	24.4	1351
Girls	1041	76.9	313	23.1	1354
Total	**2063**	**76.3**	**642**	**23.7**	**2705**

Characteristics of school environments

The information on the characteristics of school environment described in this section were obtained from school record forms which, as presented in Table 28, were mostly filled in by teachers (48.7%). The remaining 51.2% of school record forms were filled in by headmasters/ headmistresses/ principals or other school personnel such as administrators, peripheral school managers, school counsellors (pedagogues, psychologists, social pedagogues) and secretaries.

Table 28. School personnel who filled in the school record form, CroCOSI 2018/2019.

	N	%
Teacher	113	48.7
Headmaster/Headmistress/Principal	53	22.8
Other	66	28.4
Total	**232**	**100.0**

Schools are educational institutions that encourage the development of healthy lifestyles. They are the environment where children spend almost half of their day. Therefore, in addition to educating them on the importance of healthy lifestyles, schools should also promote regular physical activity and healthy dietary habits in children.

Physical activity in school environments

Pursuant to the Decision on establishing a curriculum for Physical Education (PE) in Croatia's primary and secondary schools (37), PE is compulsory for all classes. From the first to the third grade of primary school, the weekly accumulated PE duration is three school-hours or 135 minutes, while from the fourth grade until graduation, it is two school-hours or 90 minutes. Pursuant to the aforementioned Decision, all pupils from the 482 sampled second and third grades should have had 135 minutes of PE per week. However, 90 minutes of PE per week were reported for five classes, 105, 125 and 165 minutes were reported for two classes each, and only 45 minutes of PE per week were reported for one class.

PE is usually conducted in an indoor gym or outdoor playground area(s). Data presented in Table 29 indicate that 90.1% of sampled schools had outdoor playground area(s). However, in extreme weather conditions such as rain, snow, wind or heat, 68.3% of schools did not allow children to actively play in outdoor playing area(s). On the other hand, 35.8% of schools did not have an indoor gym, and thus could not have PE indoors in extreme weather conditions.

Furthermore, in order to meet the WHO recommendation for physical activity of children, which is a daily average of 60 minutes of moderate- to vigorous-intensity physical activity across the week, schools should enable and motivate children to regularly use its indoor and outdoor sports facilities in their free time. More than half of schools, 55.5% of them, had organised sport/physical activities for their pupils outside school hours. As shown in Table 29, only 2.0% of schools reported that they allowed their pupils to use the indoor gym outside school hours. Of 55.5% of schools which reported that they organised sport/physical activities for their pupils outside school hours at least once a week, 17.0% organised such activities only for selected grades. However, participation of pupils in organised sport/physical activities was relatively low. Nearly three-quarters of schools, 73.6% of them, reported that student participation in these activities was 50% or lower.

Table 29. Existence and availability of outdoor playground area(s) and indoor gym; participation in organized sport/physical activities outside school hours, CroCOSI 2018/2019.

	N	%
Does the school have outdoor playground area(s)?		
Yes	209	90.1
No	23	9.9
Total	**232**	**100.0**
Does the school have an indoor gym?		
Yes	149	64.2
No	83	35.8
Total	**232**	**100.0**
Are the children allowed to actively play in extreme weather conditions in outdoor playground areas?		
Yes	66	31.7
No	142	68.3
Total	**208**	**100.0**
Are the children allowed to use the outdoor playground areas outside school hours?		
Yes	195	93.3
No	13	6.7
Total	**208**	**100.0**
Are the children allowed to use the indoor gym outside school hours?		
Yes	3	2.0
No	146	98.0
Total	**149**	**100.0**
Does the school organise any sport/physical activities at least once a week for primary school children outside school hours?		
Yes, for all grades	88	38.5
Only for pupils of selected grades	39	17.0
No	102	44.5
Total	**229**	**100.0**

Table 29. (continued) Existence and availability of outdoor playground area(s) and indoor gym; participation in organized sport/physical activities outside school hours, CroCOSI 2018/2019.

	N	%
How many children attend these organised sport/physical activities?		
More than 50% of children	33	26.4
25-50% of children	63	50.4
Less than 25% of children	29	23.2
Total	**125**	**100.0**

Healthy nutrition in school environments

Table 30 depicts availability of food and beverages that pupils can obtain on the school premises, excluding lunch provided by the school. Municipal water is safe for drinking in most parts of Croatia. Therefore, 98.2% of schools indicated in the school record form that drinking water was free and available for all pupils. In order to increase the intake of fresh fruits and vegetables, as well as milk and dairy products, and to raise awareness on the importance of healthy nutrition in schoolchildren, Croatia is conducting a Fruits and Vegetables Scheme and Milk in Schools Programme, where free fruits, vegetables and milk are distributed to schoolchildren. Subsequently, 72.4% of primary schools offered their pupils free fresh fruit at least once a week, whereas 42.5% of primary schools provided one free dairy product per week. Furthermore, the most available beverages for purchase to children in schools were sweetened hot beverages such as cocoa, tea or coffee with milk which were sold in 31.8% of primary schools, followed by fruit juices or other non-carbonated drinks, and flavoured milk, which were sold in 25.3% of schools. From the perspective of healthy habits, i.e. daily consumption of vegetables and limited intake of added sugars, vegetables were unavailable to children in nearly three out of four schools or 72.0% whereas sugar-sweetened beverages were available for purchase in 25.3% of schools. Sweet snacks (e.g. chocolate, sugar confectionery, cakes, breakfast and/or cereal bars, sweet biscuits and/or pastries) were available for purchase in 17.7% of schools.

Table 30. Availability of foods and beverages in schools, CroCOSI 2018/2019.

	Availability						
	Free		Paid		Not available		Total
	N	%	N	%	N	%	N
Water	221	98.2	0	0.0	4	1.8	225
Tea	46	21.5	58	27.1	110	51.4	214
100% fruit juices	6	2.9	10	4.8	193	92.3	209
Fruit juices or other non-carbonated drinks	23	10.6	55	25.3	139	64.1	217
Carbonated (soft) drinks	0	0.0	2	1.0	207	99.0	209
Flavoured milk	19	8.8	55	25.3	143	65.9	217
Hot drinks (cocoa, tea, coffee with milk)	23	10.6	69	31.8	125	57.6	217
Milk, yoghurt, kefir	93	42.5	38	17.4	88	40.2	219
Energy drinks	0	0.0	0	0.0	211	100.0	211
Fresh fruit	163	72.4	16	7.1	46	20.4	225
Vegetables	21	10.0	38	18.0	152	72.0	211
Sweet snacks	4	1.9	38	17.7	173	80.5	215
Ice-cream	3	1.4	28	13.3	180	85.3	211
Savoury snacks	4	1.9	31	14.8	175	83.3	210

As presented in Table 31, 70.3% of participating schools had a school canteen with a kitchen facility. Furthermore, 5.6% of schools had vending machines where children were allowed to purchase food or beverages other than water, fruits and vegetables, usually containing food low in nutrients, mostly sweet and salty snack food high in processed sugars, trans-fatty acids and rich in salt.

Table 31. Food facilities in schools, CroCOSI 2018/2019.

	N	%
School canteen	163	70.3
Vending machines (containing something other than water, fruits and vegetables)	13	5.6

According to the ombudsperson for children in Croatia, advertising in schools is inappropriate. Pursuant to the Act on Education in Primary and Secondary Schools, any form of advertising and sales of products which are not in line with goals of education is banned in schools (38). During research, as presented in Table 32, 78.8% of schools were compliant with this recommendation. Our findings indicate that one fifth of schools did not comply with this regulation, i.e. they did not recognize energy-dense and nutrient-poor foods as something that is not in line with goals of education.

Table 32. Schools free from advertising and marketing of any energy-dense and nutrient-poor foods and beverages, CroCOSI 2018/2019.

	N	%
Yes	182	78.8
No	49	21.2
Total	**231**	**100.0**

Promoting healthy lifestyles in school environments

According to the National Curriculum Framework, healthy lifestyles and healthy nutrition are taught within the concept titled Health. Health is taught in primary and secondary schools in order to gain knowledge and competences, as well as develop a positive attitude towards health and healthy lifestyles. Health is taught across subjects, with emphasis on examples from real life (39). Numbers of surveyed schools which provided nutrition education for their pupils are presented in Table 33.

Table 33. Nutrition education in school curricula, either given as a separate lesson or integrated into other lessons, CroCOSI 2018/2019.

	N	%
Yes	217	95.2
No	11	4.8
Total	**228**	**100.0**

For educational purposes and encouraging active lifestyles, many international, national and local public health interventions, initiatives and projects are implemented in schools. These interventions promote all aspects of health: physical, mental and sexual. Schools and classes participating in such projects contribute to maintaining and improving the health of their pupils throughout life. As presented in Table 34, 78.7% of sampled classes had some form of organised initiative or project which promotes healthy lifestyles of pupils (e.g. promoting physical activity and/or healthy eating). Majority of schools, 68.3% of them, participated in the School Fruit Scheme. Some schools, 37.2% of them, organised and implemented their own health promotion projects and activities, while 36.6% of schools participated in some international, national or local project.

Table 34. Organised initiatives/projects promoting healthy lifestyles in participating classes in the current school year, CroCOSI 2018/2019.

	N	%
Yes	366	78.7
No	99	21.3
Total	**465**	**100.0**

Conclusion

Participation of Croatia in the COSI research of the WHO Regional Office for Europe enables regular monitoring and understanding of the nutrition status of Croatian 8-year olds, compared to children of the same age throughout Europe. With expert researchers and sufficient regionally representative samples, regular implementation of CroCOSI research also provides methodologically comparable insight into trends of childhood obesity as one of the leading and fastest growing public health concerns. In addition, providing information on dietary habits, activity behaviours, characteristics of early development, family, and school environment somewhat clarifies the complex issue of obesity in children and facilitates planning and implementation of targeted interventions for the prevention of this problem.

Results of the CroCOSI 2018/2019 research indicate that 35.0% of children aged 8.0-8.9 years in Croatia have overweight and obesity. On a national level, the obesity problem is greater in boys; it affects 17.8% of boys and 11.9% of girls.

These results, compared with the results from the first round of CroCOSI research in 2015/2016, where a 34.9% prevalence of overweight and obesity in children of the same age was reported, send out two messages. On one hand, from the perspective of halting the rise in childhood overweight and obesity by 2025, the fact that in the three year period there was no significant rise in childhood obesity is favourable and contributes to achieving this goal set by the WHO (20). On the other hand, the fact that one in three children have overweight or obesity remains a significant public health concern. Primarily, one in three children aged 8.0-8.9 years have an increased risk of having overweight or obesity in adulthood, which in turn increases the risk of developing NCDs and posing a burden on the healthcare system, with associated financial costs and loss in human resources.

Comparing results across regions, City of Zagreb had the lowest prevalence of children with overweight and obesity, 29.7%, followed by 36.0% and 36.9% in the Continental and Adriatic region, respectively. When it comes to obesity, the difference between the sexes is especially pronounced in the Adriatic region, where 19.3% of boys and 7.9% of girls are affected by this problem. Overweight and obesity are omnipresent. However, their prevalence is lowest in cities (32.0%); it rises with the decrease in urbanisation and is highest in rural areas (38.9%). This indicates the importance of interventions targeted at rural areas which are remote from central healthcare and education institutions which usually implement preventive programs. The reported misconception of parents regarding their child's weight is especially worrying. Of 35.0% of children with established overweight or obesity, only 14.0% of parents considered that their child has overweight or obesity. Therefore, targeted public health interventions are necessary to support recognition of childhood overweight and obesity, with emphasis on prevention and long-term health preservation.

Together with data on nutrition status of children, CroCOSI research gathered information on children's lifestyles, dietary habits and habits regarding physical activity and sedentary behaviour. The findings of this research indicate that Croatian eight-year-olds do not meet the recommended intake of fruits and vegetables; one in three children eat fruits every day, while only one in five children eat vegetables every day. In contrast, 37.0% of children drink sugar-sweetened beverages as the most common source of hidden calories, four times a week or more often.

As regards physical activity and sedentary behaviour, this research established that around half of the children travel to and from school on foot or use non-motorised transport, while other children travel to school in motorised vehicles. Croatian eight-year-olds spend time in active play outdoors, in line with physical activity recommendations for children. Therefore, 91.0% of children spend one hour or longer actively playing on weekdays, and 97.5% on weekends. In contrast, 41.2% of eight-year-olds in Croatia spend two hours or longer watching television or using electronic devices on weekdays and almost 80% on weekends. Subsequently, targeted interventions aimed at adopting healthy habits and prevention of overweight and obesity should be based on encouraging the established positive habits of spending free time outdoors in active play, with the aim of reducing the amount of time spent in sedentary activities, especially screen time..

Additional information on school environment indicate how much schools, where children spend a large portion of their time, invest in forming healthy habits and adopting healthy lifestyles. Our findings indicate that 95.2% of schools have healthy lifestyles and nutrition education in their curriculum, taught independently or integrated in other subjects. Regular physical activity is necessary for maintaining schoolchildren's health. In order to further motivate them to be physically active in their free time, 55.5% of schools organise extracurricular physical activity for their pupils. However, only between a quarter and a half of pupils participate in such activities. In addition, the possibilities for encouraging regular physical activity of pupils are limited by space conditions as 35.8% of sampled schools do not have an indoor gym. All primary schools should provide meals for their pupils when they are at school. In order to increase the intake of fresh fruits and vegetables, Croatia is conducting a school scheme where free servings of fruits and vegetables are distributed to pupils. The scheme involves 68.3% of sampled schools. Some foods are available for purchase, usually sweetened hot beverages such as cocoa, tea or coffee with milk that are available in 31.8% of primary schools. This information, along with information on the intake of sugar-sweetened beverages in family environment, indicates the importance of acting on both domestic and school environments, in order to reduce the intake of sugar-sweetened beverages.

As overweight and obesity are preventable diseases and effort must be made to preserve health, with this detailed overview of nutritional status, environment and habits of Croatian eight-year-olds we invite governmental institutions to create national policies that are inclusive, multisectoral and aimed at health

preservation from the earliest age. In addition, we hereby invite parents, grandparents, relatives, teachers and principals to set a positive example for children, to teach them healthy habits and use the formative years of childhood to create a foundation for a healthy life, preventing overweight and obesity in children, and subsequently, in adults. By doing so, in addition to raising healthy generations and relieving the healthcare system, we will also prevent the expected shortening of life expectancy due to obesity, and thus contribute to the prosperity and development of the entire society.

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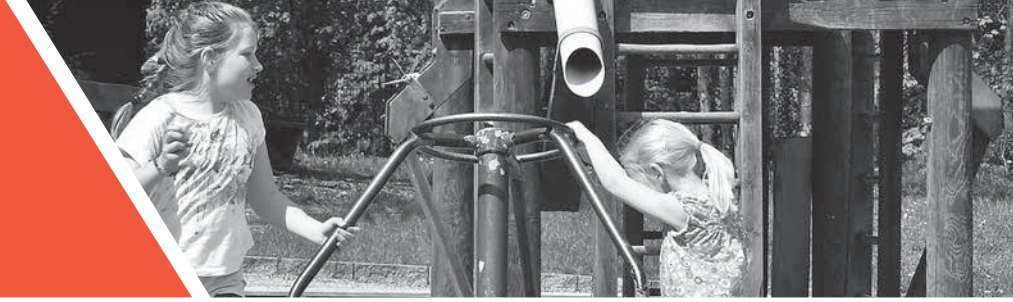
Appendix



Guidelines for Media Reporting

When reporting on the findings of this research, media representatives should follow the guidelines below:

1) **Use people-first language.**
   Rather than using terms such as “fat child” or “fat people”, which label individuals by their disease, use “child with obesity”, or “people with obesity” instead. This sends a message that they are people who, among other things, are affected by this disease.

2) **Avoid using pejorative and offensive adjectives or adverbs.**

3) **Emphasize that the findings presented in this publication are the result of the scientific research CroCOSI 2018/2019.**

4) **When reporting on obesity, emphasize that it is a disease, and not a personal choice.**
   Obesity is a disease with complex causes– environmental, biological, genetic, economic, social, and individual.

5) **Carefully select the images used for journalistic purposes.**
   The images should be positive and should not exacerbate the existing prejudice on persons with obesity. Images should depict the entire body of the person with obesity, not just individual body parts without headshots. Editors can download and use images from the following link. These images were carefully selected to avoid additional stigmatisation of persons with obesity:
   www.worldobesity.org/resources/image-bank

✔ Use	✘ Avoid using
Children with obesity	Obese/fat/chubby children, fatties
There are many 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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Ministry of Health

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