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Comparison of body mass index percentiles for schoolchildren in Croatia with international reference values

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The aim was to determine body mass index (BMI) percentiles in Croatian children aged 6.5-18.5 years and to compare them with the United States Centers for Disease Control and Prevention (USCDC 2000) and World Health Organisation (WHO 2007) BMI reference values in order to show the pattern of differences. A representative cross-sectional national survey with standardized body height and weight measurements included 12,389 schoolchildren (6372 boys and 6017 girls) aged 6.5-18.5 years (response rate 94.5%). BMI percentile curves were established using the Lambda-Mu-Sigma method. BMI percentiles of the Croatian schoolchildren differed from analogical percentiles in two international reference populations. The 5th percentile in boys and girls was similar to both reference populations until the age of about 13 years, and in the age onwards it showed an upward shift. The 50th, 85th and 95th percentiles in boys showed an upward shift in boys in all ages observed; in girls, an upward shift was observed until the age of about 14 years and downward shift in the age onwards. The differences observed between BMI percentiles of Croatian schoolchildren and USCDC 2000 and WHO 2007 references imply that BMI percentiles developed on a nationally representative sample would be more appropriate for assessment of nutritional status at the national level, whereas international standards could be used for comparison of nutritional status among different populations.

Key words: body mass index, percentiles, reference values, children, adolescents

INTRODUCTION

Monitoring of child growth and development by plotting changes in body height and body weight has been commonly used as a key and time-honoured characteristic of physical condition (1). Body mass index (BMI) values are recommended by the World Health Organisation (WHO) and used routinely in epidemiological studies to screen for underweight, overweight and obesity, due to the high correlation with body mass and body fatness (2, 3). BMI is derived from the equation: body weight in kilograms divided by body length or body height in squared meters (kg/m^2) (4-6). In children and adolescents, because of growth-related changes in body proportions, the BMI cut-offs for underweight, overweight and obesity cannot be the same as in adults. Different sets of BMI cut-off points for children and adolescents have been developed for international use. WHO derived the latest BMI references for schoolchildren and adolescents in 2007. WHO has recommended a set of thresholds for underweight, overweight and obesity based on single standard deviation (SD) spacing: smaller than -2 SD for thinness, between +1 SD and +2 SD for overweight, and greater than +2 SD for obesity (1, 7-9). The International Obesity Task Force (IOTF) has proposed cut-offs which at the age of 18 years correspond to the adult cut-off points, for thinness 17 kg/m^2, overweight 25 kg/m^2 and obesity 30 kg/

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m^2 (10-12). The United States Centers for Disease Control and Prevention (USCDC) labels children as underweight if their BMI is less than 5th percentile, at risk of overweight if their BMI exceeds 85th percentile and obese if BMI exceeds 95th percentile (6, 13-16). These reference values enable cross-national comparisons, but their suitability for populations whose data were not included in the reference population is doubtful. Studies from many countries report differences of native children populations compared to WHO, USCDC and IOTF reference populations, thus suggesting development and use of national BMI reference values in the assessment of nutritional status (6, 17-23). In Croatia, first BMI percentiles for schoolchildren were developed on a non-representative sample of Zagreb children. Boys and girls from Zagreb, compared to reference data on their American white counterparts, had generally higher BMI except for the upper percentile positions. The 85th and 95th percentiles of Croatian adolescents at the age of 14 years onwards were markedly lower (24). Differences in cut-offs used to identify children at risk have considerable implications for both those categorised as being at risk and those categorised as not being at risk because of consequent decisions on treatment or lifestyle changes (10, 18, 25).

The purpose of this study was to introduce Croatian BMI percentiles for children aged 6.5-18.5 years and to compare them with the USCDC 2000 and WHO 2007 BMI reference values in order to show the pattern of differences.

SUBJECTS AND METHODS

Study design and sampling

The Cardiovascular Risk Factors in School Age – Intervention Model Development, a project of the Ministry of Science, Education and Sports of the Republic of Croatia, was a population-based, nationally representative cross-sectional study. The study was carried out from November 2006 to January 2008 on a sample of 12,389 schoolchildren (6372 boys and 6017 girls) aged 6.5-18.5 years living in Croatia, students of primary (first- to eighth-graders) and secondary (first- to fourth-graders) schools. Sampling methodology was developed during the School Health Survey 2003-2004 project and has been previously published elsewhere (26, 27).

Measuring tools and data collection

Data were collected by a questionnaire and anthropometric measurements performed by a previously trained team of examiners, nurses and physicians, using a newly installed and calibrated equipment. A standardized measuring technique was ensured by instruction sessions, illustrated cards and material developed for the survey. Children were measured while wearing light clothes and no shoes in a calm, quiet and comfortable setting in schools. Body weight was measured on a calibrated digital scale (Seca 862, Germany) and recorded to the nearest 0.1 kilogram (kg). Body height was measured by fixed wall-mounted meter and recorded to the nearest 0.1 centimetres (cm). The child was encouraged to stand straight and breathe normally with heels, buttocks and shoulders against the wall, arms hanging loosely on the sides and head in Frankfurt plane, defined as the lowest point on the lower edge of orbit and upper edge of tragus.

Data analysis

Data were entered and analysed by manual and computerized checking using STATISTICA version 10.0 (StatSoft. Inc., Tulsa, US, 2011). Out of the selected individuals, response was obtained for 11,702 individuals (6046 boys and 5656 girls), yielding an overall response rate of 94.5%. Out of these, 64 (0.6%) of subjects were excluded from analysis because of missing data on the date of birth, body height and/or body weight and those with a diagnosis of chronic diseases that could affect growth, leaving 11,638 children (6013 boys and 5625 girls) for calculation of percentiles. Age was calculated to the precise day by subtracting the date of birth from the date of examination. Age groups were defined as follows: the six-year group included children aged 6.50 to 6.99 years, seven-year group included children aged 7.00 to 7.99 years, and so on. BMI was computed from the measured body weight and body height as body weight/(body height)^2 (kilograms/square meter). Mean and standard deviation (SD) values were calculated according to age and sex. The Lambda-Mu-Sigma (LMS) method was used to model the age and gender specific percentile curves (28, 29). The LMS method assumes that the variable of interest has Gaussian distribution after a Box-Cox power transform has been applied. Each variable specific growth curve is summarized by three curves representing the median (M), coefficient of variation (S) and skewness (L), as they change with the independent variable (age). The percentiles were obtained with LMS Chart maker version 2.4 (30). The appropriate number of equivalent degrees of freedom (EDF) was selected as described by Pan and Cole (31). The adequacy of EDF for the L, M and S curves was tested by Q Tests for Fit. The 3rd, 5th, 10th, 15th, 25th, 50th, 75th, 85th, 90th, 95th and 97th percentile curves obtained represent the Croatian reference values for BMI for boys and girls aged 6.5 to 18.5 years. In order to compare the present study BMI percentile curves with other internationally used BMI percentile curves, the age- and gender-specific 5th, 50th, 85th and 95th percentiles were overlapped with the USCDC 2000 and WHO 2007 BMI analogical percentiles.

The survey was approved by the Ethics Committee of the University of Zagreb, School of Medicine (No. 04-1106-2006). Because of the non-invasive nature of the survey protocol, consisting of a short questionnaire and measurements considered routine for school-entry/sports-participation and regular physical examinations (i.e. body height and body weight), a 'passive consent' process was used. The parents/guardians and children were provided with a consent form on the first page of the questionnaire.

RESULTS

The present study included data on 11,638 children, 6013 boys and 5625 girls, aged 6.5-18.5 years. The male-female ratio was 1.07 with 51.7% of boys and 48.3% of girls. Boys had a generally higher mean BMI than girls, except for the age range of 6.5-7 years, 11-12 years and 13-15 years. Difference in the mean BMI between boys and girls was lowest in the 15-16 age range and greatest in the 18-18.5 age group (Table 1). The mean BMI increased with age in both boys and girls. A noticeable increase in the mean BMI was observed in 10-15 age range in girls and in the 13-18.5 age range in boys, which could be explained by body changes due to pubertal development. At the age of 18, the adult overweight and obesity cut-offs of 25 and 30 kg/m2 (2, 3) correspond to the 75th and 97th BMI percentiles in boys, and to the 90th and greater than 97th BMI percentile in girls, respectively (Table 2). In Croatian boys, the 5th BMI percentile was lower in the 6.5-7 age range as compared to USCDC 2000, and in the age range from 11 years and 8 months to 13 years and 2 months as compared to both reference populations. The 50th, 85th and 95th BMI percentiles showed an upward shift in all ages observed as compared to both reference populations (Figure 1). In Croatian girls, the 5th BMI percentile was lower in the age range from 6.5 years to 8 years and 2 months and from 9 years and 10 months to 12 years and 2 months as compared to USCDC 2000. Compared to WHO 2007, the 5th BMI percentile was lower at the age of 6.5 years and from 10.5 years to 13 years and 4 months. The 50th BMI percentile was lower in the age range from 17.5 to 18.5 years as compared to USCDC 2000 and from 17 to 18.5 years as compared to WHO 2007. The 85th percentile showed a downward shift from 15 years and 4 months to 18.5 years as compared to USCDC 2000 and from 16 years to 18.5 years as compared to WHO 2007. The 95th percentile showed a downward shift from 13 years and 8 months to 18.5 years as compared to USCDC 2000 and from 15 years and 10 months to 18.5 years as compared to WHO 2007 (Figure 2).

DISCUSSION

During the last three decades, a secular increase in weight has been observed, beyond that explained by taller stature. This observation could explain the global epidemic of overweight and obesity in children and adolescents, and as a result, growth references contain BMI (17, 22, 23, 32-37).

The Cardiovascular Risk Factors in School Age – Intervention Model Development study provides the first population-based, nationally representative standardized BMI measurements in a large sample of children and adolescents living in Croatia. Based on these data, we present BMI percentiles smoothed with the LMS method for boys and girls aged 6.5-18.5 years and compare them with the USCDC

TABLE 1. Body mass index (BMI) mean values for Croatian boys and girls aged 6.5 to 18.5 years

Age (years)	Boys			Girls		
	n	BMI Mean (kg/m^2)	BMI SD (kg/m^2)	n	BMI Mean (kg/m^2)	BMI SD (kg/m^2)
6.50-6.99	80	16.43	2.37	111	16.49	2.53
7.00-7.99	491	16.96	2.82	458	16.67	2.79
8.00-8.99	499	17.47	3.22	491	17.34	3.11
9.00-9.99	502	18.2	3.53	470	17.68	3.08
10.00-10.99	489	18.59	3.42	533	18.41	3.64
11.00-11.99	488	19.04	3.74	498	19.08	3.52
12.00-12.99	489	19.91	4.1	492	19.71	3.66
13.00-13.99	520	19.92	3.6	513	20.38	3.64
14.00-14.99	550	20.98	3.81	521	21	3.49
15.00-15.99	539	21.64	3.92	402	21.57	3.25
16.00-16.99	550	22.52	3.93	461	21.39	3.14
17.00-17.99	507	22.79	3.76	452	21.53	3.2
18.00-18.50	309	23.12	3.66	223	21.25	2.95
Total	6013	20.02	3.69	5625	19.53	3.06

TABLE 2. Smoothed body mass index (BMI) percentiles for Croatian boys and girls aged 6.5 to 18.5 years

Age (years)														
Boys (N=6013)	L	M	S	3rd	5th	10th	15th	25th	50th	75th	85th	90th	95th	97th
6.50	-2.512	16.094	0.126	13.37	13.62	14.06	14.38	14.90	16.09	17.71	18.85	19.79	21.56	23.05
7.00	-2.433	16.287	0.130	13.44	13.71	14.16	14.50	15.04	16.29	17.97	19.17	20.16	22.02	23.60
7.50	-2.344	16.507	0.134	13.53	13.81	14.28	14.63	15.20	16.51	18.28	19.54	20.59	22.55	24.22
8.00	-2.251	16.728	0.139	13.62	13.91	14.40	14.77	15.36	16.73	18.59	19.91	21.00	23.06	24.82
8.50	-2.157	16.946	0.143	13.70	14.01	14.52	14.90	15.52	16.95	18.89	20.27	21.41	23.55	25.37
9.00	-2.059	17.171	0.147	13.79	14.11	14.64	15.04	15.69	17.17	19.19	20.62	21.81	24.01	25.88
9.50	-1.962	17.401	0.151	13.89	14.22	14.77	15.18	15.86	17.40	19.49	20.97	22.19	24.44	26.33
10.00	-1.872	17.632	0.154	13.99	14.34	14.91	15.34	16.04	17.63	19.79	21.30	22.54	24.83	26.73
10.50	-1.792	17.856	0.156	14.11	14.46	15.05	15.49	16.22	17.86	20.06	21.61	22.87	25.18	27.08
11.00	-1.721	18.071	0.158	14.22	14.58	15.19	15.65	16.39	18.07	20.32	21.89	23.17	25.48	27.37
11.50	-1.654	18.301	0.159	14.35	14.73	15.35	15.82	16.58	18.30	20.59	22.18	23.46	25.77	27.64
12.00	-1.593	18.551	0.159	14.52	14.90	15.54	16.02	16.80	18.55	20.87	22.47	23.76	26.06	27.90
12.50	-1.542	18.818	0.159	14.71	15.10	15.76	16.24	17.04	18.82	21.16	22.77	24.05	26.32	28.13
13.00	-1.502	19.133	0.158	14.96	15.36	16.03	16.52	17.33	19.13	21.49	23.10	24.37	26.61	28.38
13.50	-1.479	19.537	0.156	15.31	15.71	16.40	16.90	17.72	19.54	21.91	23.51	24.77	26.99	28.72
14.00	-1.479	19.992	0.154	15.72	16.13	16.82	17.33	18.15	19.99	22.37	23.98	25.23	27.44	29.15
14.50	-1.493	20.423	0.151	16.11	16.52	17.22	17.74	18.57	20.42	22.82	24.42	25.68	27.89	29.60
15.00	-1.506	20.835	0.149	16.48	16.90	17.61	18.13	18.97	20.83	23.24	24.85	26.12	28.32	30.02
15.50	-1.513	21.251	0.147	16.87	17.29	18.00	18.53	19.37	21.25	23.66	25.27	26.53	28.72	30.41
16.00	-1.509	21.631	0.144	17.23	17.66	18.37	18.90	19.75	21.63	24.03	25.63	26.87	29.03	30.68
16.50	-1.495	21.928	0.142	17.52	17.95	18.67	19.20	20.05	21.93	24.31	25.88	27.10	29.20	30.81
17.00	-1.480	22.153	0.139	17.75	18.19	18.91	19.44	20.29	22.15	24.51	26.06	27.26	29.31	30.86
17.50	-1.470	22.337	0.137	17.95	18.38	19.10	19.63	20.48	22.34	24.67	26.20	27.38	29.38	30.90
18.00	-1.460	22.515	0.135	18.14	18.57	19.30	19.82	20.67	22.52	24.83	26.33	27.49	29.45	30.93
18.50	-1.451	22.691	0.133	18.33	18.77	19.49	20.01	20.86	22.69	24.98	26.46	27.60	29.52	30.96
Girls (N=5625)														
6.50	-1.865	15.776	0.137	12.79	13.08	13.56	13.91	14.49	15.78	17.45	18.60	19.50	21.11	22.38
7.00	-1.834	16.028	0.140	12.92	13.22	13.72	14.09	14.69	16.03	17.78	18.98	19.94	21.64	22.99
7.50	-1.798	16.288	0.144	13.06	13.37	13.88	14.27	14.89	16.29	18.13	19.39	20.40	22.20	23.64
8.00	-1.757	16.535	0.148	13.18	13.50	14.04	14.43	15.08	16.54	18.45	19.77	20.83	22.72	24.24
8.50	-1.712	16.780	0.152	13.30	13.63	14.19	14.60	15.27	16.78	18.78	20.15	21.25	23.23	24.81
9.00	-1.662	17.006	0.155	13.41	13.75	14.33	14.75	15.45	17.01	19.07	20.49	21.63	23.67	25.31
9.50	-1.610	17.215	0.157	13.51	13.86	14.45	14.89	15.61	17.21	19.34	20.80	21.97	24.07	25.74
10.00	-1.555	17.422	0.160	13.61	13.97	14.58	15.03	15.77	17.42	19.61	21.10	22.30	24.44	26.14
10.50	-1.493	17.650	0.162	13.73	14.10	14.73	15.19	15.95	17.65	19.89	21.42	22.63	24.80	26.51
11.00	-1.427	17.924	0.164	13.89	14.27	14.92	15.40	16.18	17.92	20.21	21.77	23.00	25.17	26.88
11.50	-1.366	18.242	0.164	14.10	14.49	15.16	15.65	16.45	18.24	20.57	22.14	23.38	25.56	27.25
12.00	-1.315	18.588	0.164	14.35	14.76	15.44	15.95	16.76	18.59	20.95	22.53	23.77	25.94	27.61
12.50	-1.280	18.958	0.162	14.65	15.07	15.76	16.28	17.11	18.96	21.33	22.92	24.15	26.29	27.93
13.00	-1.275	19.326	0.159	14.99	15.42	16.12	16.64	17.47	19.33	21.69	23.26	24.48	26.59	28.19
13.50	-1.294	19.674	0.154	15.37	15.79	16.50	17.01	17.84	19.67	22.00	23.54	24.73	26.77	28.32
14.00	-1.339	20.025	0.148	15.81	16.22	16.91	17.42	18.24	20.02	22.29	23.77	24.92	26.88	28.36
14.50	-1.416	20.394	0.140	16.31	16.71	17.38	17.87	18.66	20.39	22.57	23.99	25.08	26.95	28.35
15.00	-1.508	20.691	0.132	16.75	17.14	17.79	18.26	19.03	20.69	22.78	24.13	25.17	26.95	28.28
15.50	-1.585	20.867	0.127	17.04	17.42	18.05	18.52	19.26	20.87	22.88	24.19	25.19	26.90	28.17
16.00	-1.633	20.957	0.124	17.20	17.58	18.20	18.65	19.38	20.96	22.92	24.20	25.18	26.84	28.09
16.50	-1.656	20.995	0.122	17.28	17.65	18.27	18.71	19.43	21.00	22.94	24.20	25.17	26.81	28.04
17.00	-1.662	21.004	0.122	17.30	17.67	18.28	18.73	19.45	21.00	22.95	24.20	25.17	26.80	28.03
17.50	-1.680	21.033	0.121	17.35	17.72	18.33	18.78	19.49	21.03	22.96	24.20	25.16	26.78	27.99
18.00	-1.707	21.076	0.119	17.44	17.80	18.41	18.85	19.55	21.08	22.97	24.20	25.14	26.74	27.93
18.50	-1.738	21.124	0.117	17.54	17.90	18.49	18.93	19.62	21.12	22.99	24.20	25.13	26.69	27.86

LMS method: L = skewness; M = median, S = coefficient of variation

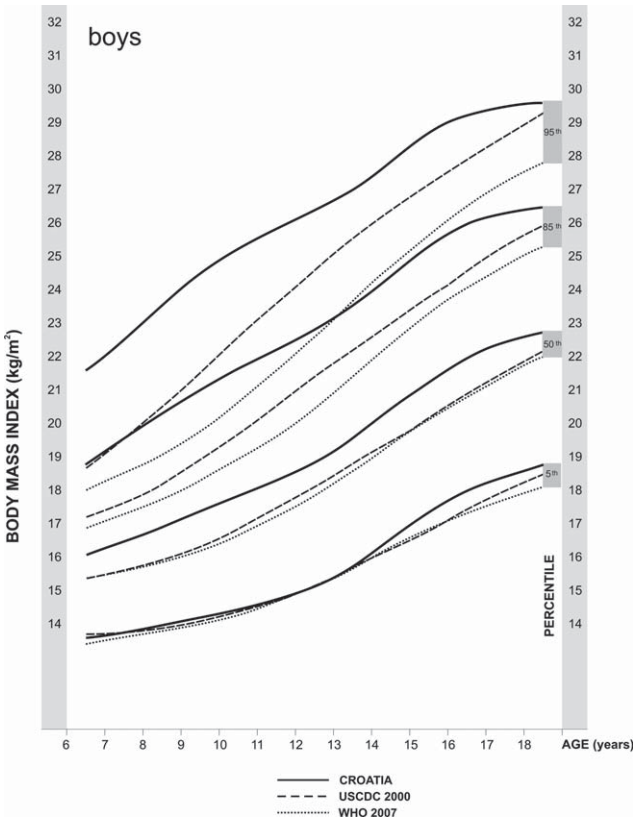

FIGURE 1. Comparison of the Croatian, USCDC 2000 and WHO 2007 age- and gender-specific 5th, 50th, 85th and 95th body mass index (BMI) percentile curves for boys.

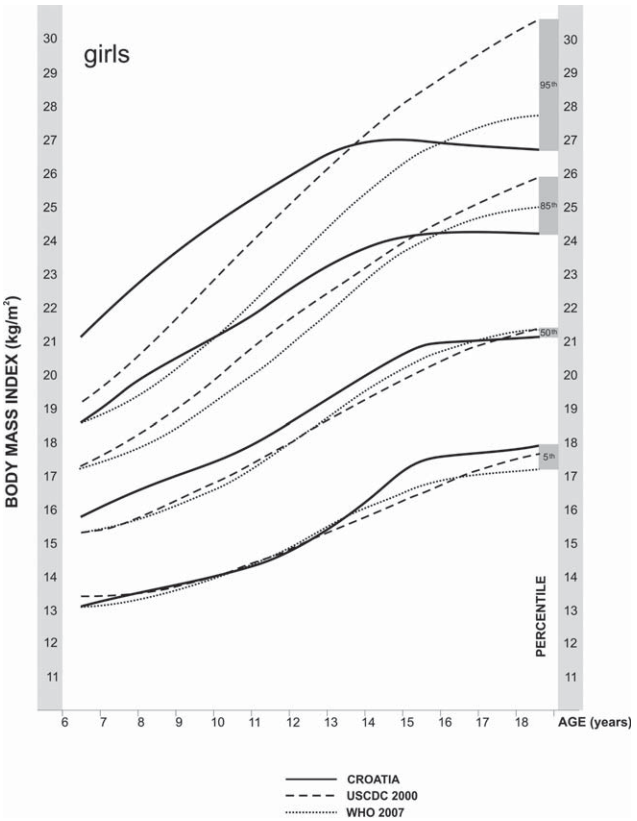

FIGURE 2. Comparison of the Croatian, USCDC 2000 and WHO 2007 age- and gender-specific 5th, 50th, 85th and 95th body mass index (BMI) percentile curves for girls.

2000 and WHO 2007 reference populations. Compared to both, the 50th, 85th and 95th BMI percentiles in boys showed an upward shift in all the ages observed. In girls, the 50th, 85th and 95th BMI percentiles showed an upward shift until the age of 13 years, at which point it showed a downward shift, especially noticeable for the 85th and 95th percentiles. The 5th BMI percentile in Croatian boys and girls was similar to both reference populations until the age of about 13 years, when it showed an upward shift. The patterns of difference in percentile BMI values compared to WHO 2007, IOTF and USCDC 2000 reference populations are very diverse worldwide. Kulaga *et al*. compared BMI percentiles of a nationally representative sample of Polish children and adolescents (7-18 years) to USCDC 2000 BMI references. A high level of consistency was observed on the 3rd and 50th BMI percentiles in boys and girls. The 97th percentile of Polish boys was greater in the age range 7-13 years, but lower in the age range 14-18 years. The 97th percentile in Polish girls was lower from the age of 9 years onwards (20). Rosario *et al*. compared BMI percentiles of a German nationally representative sample of children aged 2-17 years, the German Health Interview and Examination Survey for Children and Adolescents (KiGGS 2003-2006) to WHO 2007. Higher values of the 10th, 50th and 90th percentiles were observed in children aged 6 years onwards. The authors emphasised the necessity of regular renewing growth charts for children and adolescents, considering the presence of secular trend and proposed the use of national growth charts and reference values for estimation of overweight and obesity rather than those proposed for international use, such as WHO and IOTF (22). Pirinçci *et al*. compared BMI percentiles of 6-11-year-old Turkish children from Elazığ to WHO 2007. The 50th BMI percentile was noticeably lower in girls and similar in boys. In general, BMI percentiles of 6-11-year-old Turkish children from Elazığ differed from WHO 2007 and also from Turkish children of the same age from other regions (38). In a Chinese nationally representative sample of children (7-18 years), Ma *et al*. observed that younger boys (7-12 years) had higher values of percentiles above the median and lower below the median, suggesting that they had larger proportions of extreme BMI values in both directions. Girls and older boys (15-18 years) had considerably lower BMI percentiles than their counterparts in the USCDC 2000 and WHO 2007 reference populations, particularly those high percentiles among older age groups (39). Baya Botti *et al*. report a higher 5th percentile in Bolivian boys from the nationally representative sample in the age range 12-18 years, and higher 50th percentile in the age range 12-16 years,

compared to USCDC 2000 and WHO 2007. The 85th and 95th percentiles were higher than those from WHO 2007 in boys aged 12-15 years. The 85th percentile was higher than USCDC 2000 in boys aged 12-14 years and 95th percentile in boys aged 12-13 years. In girls, the 5th, 50th and 85th BMI percentiles were higher compared to both reference populations. The 95th BMI percentile was higher than WHO 2007 in the age range 12-18 years, similar to USCDC 2000 in the age range 12-14 years, and lower in the age range 14-18 years. The authors emphasise that it has been broadly considered that populations from developing countries have lower BMI, but it was not observed in Bolivian adolescents. The use of USCDC 2000 and WHO 2007 references underestimated the prevalence of thinness at particular ages, while the prevalence of overweight was overestimated when IOTF reference was applied. However, the use of USCDC 2000, IOTF and WHO 2007 references overestimated the prevalence of overweight in girls aged 13-18 years, and the use of IOTF references in boys aged 12-14 years (18). In Pakistani children aged 5-12 years, Mushtaq *et al*. observed lower 50th BMI percentile as compared to USCDC 2000 and WHO 2007 (35). Al Herbish *et al*. have reported lower 50th BMI percentile as compared to USCDC 2000 for Saudi Arabian boys aged 2-19 years and higher for girls. The 85th and 95th percentiles for boys were higher in the age range 9-19 years and for girls in the age range 9.5-19 years (17). Zanetti Passos *et al*. compared BMI percentiles of Brazilian children aged 10-15 years from São Paulo to USCDC 2000. Boys aged 10 and 11 years had noticeable higher 5th, 50th, 85th and 95th percentiles. In the age range 12-15 years, the 5th percentile was similar, while the 50th, 85th and 95th percentiles were higher. At the age of 15 years, the 5th, 50th and 85th percentiles were similar, while the 95th percentile was noticeably higher. Brazilian girls had higher 5th, 50th, 85th and 95th percentiles in the age range 10-13 years. At the age of 14 years, the 5th, 50th and 85th percentiles were higher, while the 95th percentile was lower. At the age of 15 years, the 5th and 50th percentiles were higher, the 85th percentile was similar, and the 95th percentile was lower. The observed differences showed that international standards might not reflect the real nutritional status, underlining the importance of using appropriate BMI values in assessment (40).

The large, nationally representative sample size and standardized measurements of body height and body weight were the major strengths of the Cardiovascular Risk Factors in School Age – Intervention Model Development study. The number of about 500 subjects *per* age and gender group from 7-18 years resulted in curves with stable outer percentiles.

The small number of observations in the 6.5-7 and 18-18.5 age groups may have resulted in curves without stable outer percentiles in these age groups, possibly contributing to the limitation of the study.

CONCLUSION

The observed differences between BMI percentiles of Croatian schoolchildren and USCDC 2000 and WHO 2007 references imply that BMI percentiles developed on a nationally representative sample would be more appropriate for assessment of nutritional status at the national level. International standards could be used for comparison of nutritional status among different populations.

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Autori su popunili *the Unified Competing Interest form na www.icmje.org/coi_disclosure.pdf (dostupno na zahtjev)* obrazac i izjavljuju: nemaju potporu niti jedne organizacije za objavljeni rad; nemaju financijsku potporu niti jedne organizacije koja bi mogla imati interes za objavu ovog rada u posljednje 3 godine; nemaju drugih veza ili aktivnosti koje bi mogle utjecati na objavljeni rad./*All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.*

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SAŽETAK

Usporedba centila indeksa tjelesne mase za školsku djecu u Hrvatskoj s međunarodnim referentnim vrijednostima

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Cilj istraživanja bio je utvrditi centile indeksa tjelesne mase (ITM) školske djece u Hrvatskoj u dobi od 6,5 do 18,5 godina i usporediti ih s referentnim vrijednostima Centara za kontrolu i prevenciju bolesti Sjedinjenih Država (USCDC 2000.) i Svjetske zdravstvene organizacije (WHO 2007.) kako bi se ispitale razlike među tim vrijednostima. Ovo reprezentativno poprečno ispitivanje obuhvatilo je 12.389 školske djece (6372 dječaka and 6017 djevojčica) u dobi od 6,5 do 18,5 godina (stopa odgovora 94,5%). Provedeno je standardizirano mjerenje tjelesne visine i težine. Centilne krivulje za ITM utvrđene su metodom Lambda-Mu-Sigma. Centile ITM školske djece u Hrvatskoj razlikovale su se od analognih centila u dvjema međunarodnim referentnim populacijama. Peta centila bila je u dječaka i djevojčica slična objema referentnim populacijama do dobi od otprilike 13 godina, dok je nakon te dobi pokazala pomak naviše; 50., 85. i 95. centila pokazala je pomak naviše u dječaka svih dobnih skupina, dok je u djevojčica pomak naviše zabilježen do dobi od otprilike 14 godina te pomak naniže nakon te dobi. U zaključku, zabilježene razlike u centilama ITM kod školske djece u Hrvatskoj u usporedbi s referentnim vrijednostima USCDC 2000. i WHO 2007. ukazuju na to da su centile ITM izvedene prema nacionalnom reprezentativnom uzorku primjerenije za procjenu stanja uhranjenosti na nacionalnoj razini. Međunarodni standardi mogli bi se rabiti za usporedbu stanja uhranjenosti među različitim populacijama.

Ključne riječi: indeks tjelesne mase, centile, referentne vrijednosti, djeca, adolescenti