Sex differences in younger school age children's body weight categories

Vendula Zbořilová[1], Miroslava Přidalová[1], Dagmar Sigmundová[2]

[1] Department of Natural Sciences in Kinanthropology, Faculty of Physical Culture,
Palacký University Olomouc
[2] Institute of Active Lifestyle, Faculty of Physical Culture, Palacký University Olomouc

ABSTRACT: The issue of inadequate or excessive children's body weight, particularly in relation to their health, is also discussed by Czech experts in physical anthropology, auxology, paediatrics, endocrinology, etc. Overweight and obesity occur already at a younger school age, and some domestic and foreign sources report a higher prevalence in boys.
The objective of this study was to describe distribution range in body weight categories among Czech children of younger school age (6 to 11 years) taking into account age and sex.
Our research was carried out at 23 primary schools in 5 regions of the Czech Republic between 2014 and 2018. The research group consisted of 2,099 children aged 6 to 11 years (boys n = 1,015, 48.4%; girls n = 1,084, 51.6%). Probands were subjected to the standard anthropometric examination with body weight being assessed using the following assessment standards: the Czech national growth references, Nationwide Anthropological Survey of Czech Children and Adolescents (NAS), World Health Organisation (WHO) growth standards, and International Obesity Task Force (IOTF) references were used. Statistical tests were carried out at a significance level of $p \leq 0.05$; residual analysis.
According to all three assessment standards, the highest prevalence of children with normal body weight was in both sexes; 45.8% of girls and 48.4% of boys, using the Czech assessment reference. Overweight and obesity were more predominant in boys (7.9% and 8.7%) than in girls (7.7% and 7.5%). One point seven percent of boys and girls were equally underweight, whereas the percentage of girls (22.3%) with reduced body weight was higher than in boys (20.3%). A significant difference between boys and girls was found in the category of reduced body weight in nine-year-old children. Using internationally recommended BMI references, more children fell into the category of normal body weight. Significant differences, in accordance with IOTF, between the number of severely underweight boys and girls were observed in 7-year-olds, slightly underweight in 9- and 11-year-olds, and overweight in 7-year-olds. In accordance with the WHO growth standards, significant differences appeared between eight-year-olds and eleven-year-olds obese boys and girls.
Our research study revealed the prevalence in younger school age children body weight categories. Different BMI references were used to classify body weight. Significant differences between the number of boys and girls were observed in certain weight categories in seven-year-old, eight-year-old, nine-year-old and eleven-year-old children. Thus, the study confirmed the presence of differences in the number of boys and girls in specific body weight categories.

KEY WORDS: Body Mass Index, children; underweight; overweight; obesity; normal weight

Introduction

The somatic status of children's population is an area of interest for doctors, anthropologists, and other specialists worldwide (Hermanussen 2013). The issue of optimal body weight, particularly in relation to health and negative health, as well as social and economic consequences, is a debated topic within the entire population spectrum.

According to the World Health Organization (WHO), the number of obese people worldwide has tripled since 1975. Obesity and overweight now commonly affect younger age groups. In 2016, more than 340 million overweight and obese children and adolescents were identified worldwide, and in 2019, an estimated 38 million children under the age of five were so affected (World Health Organization 2020).

The Czech children population is also facing overweight and obesity. According to the results of the 6th Nationwide Anthropological Survey (NAS) 2001, in 6 to 11-year-old children the proportion of overweight boys increased to 8.9% and 8.5% in girls (compared to the Czech BMI reference data from 1991, which reported 7% of overweight children and 3% with obesity). Compared to 1991, the incidence of overweight children increased by 1.9% in boys and 1.5% in girls. In 2001, the proportion of obese boys was 6.6% and girls 5.6%. Thus, between 1991 and 2001, the percentage of obese boys increased by 3.6% and obese girls by 2.6%. Over the ten-year period, between 1991 and 2001, the number of overweight, obese and also underweight children increased, particularly among adolescent girls. Consequently, the prevalence of normal body weight was reduced in total (Vignerová et al. 2006).

NAS in the Czech Republic has not taken place since 2001. Newer comprehensive anthropological data of Czech children are not available, with the exception of data from paediatric surgeries, where participation was voluntary. The data are not sufficiently representative (Caterpillar Research 2013).

Common foodborne obesity in children prevails, which arises on a polygenic basis as a typical civilisation disease (Marinov and Pastucha 2012). It is caused by an energy imbalance between the nutritional intake and energy output, stemming from inappropriate dietary and exercise stereotypes. Poor energy output caused by a negligible level of physical activity, the predominance of sedentary lifestyle in front of television, tablet or other devices and poor eating habits, essential for the appropriate development of a growing organism, are the cause of childhood obesity (Sigmundová et al. 2014; Pařízková et al. 2019).

An increase in childhood latent obesity is often described which, however, may be influenced by the acceleration of biological development or may be explained by abdominal obesity, in the sense of increasing circumferential parameters on the torso, particularly the abdomen. Latent or hidden obesity is characterised by increased body fat and smaller skeletal muscle mass. However, this proportion of the relevant body fractions is not reflected in the total body weight of the individual (Conus et al. 2004; Madeira et al. 2013; Sedlak et al. 2013).

The consequences of childhood obesity may be mitigated by timely primary prevention; it is essential to find out the factual situation early and to commence treatment. Preventive programs for reducing overweight and obesity advise the childbearing age population on op-

timising their and their children's body weight. Primary prevention may prevent many health complications, namely cardiometabolic, respiratory, gastrointestinal, orthopaedic, neurological and psychosocial with a serious negative economic impact (Kelly et al. 2013; Marinov 2009; Marinov 2012).

Healthy children are the starting point for the health of the whole adult population (Pařízková and Hills 2005). Primary prevention strategies against childhood obesity and monitoring of the children's optimal body weight, have revealed a lack of collaboration between paediatricians, parents and educators, which has also been informed by the GDPR guidelines (Regulation of the European Parliament and the Council of the EU 2016).

Systematic somatic diagnostics is able to detect growth disorders in children in appropriate time, inadequate body weight relating to the age and sex or other deviations from the normal development (Riegerová et al. 2006). For the up-to-date assessment of optimal body weight, it is always required to assess body weight in relation to current body height, age and sex. This may be carried out by the Body Mass Index (BMI), which changes significantly with a child's age. Consequently, the BMI should be assessed in relation to the growth references, using the BMI percentile distribution in a given population in the form of percentile charts (Sedlak et al. 2016). In many countries, growth charts are generated on the basis of a larger or smaller national anthropological, auxological or paediatric research (Hermanussen 2014; Mumm et al. 2014).

The Nationwide Anthropological Surveys (NAS 1951–2001) had a long tradition in the Czech Republic (Vignerová et al. 2006). Curren, NASs are to some extent compensated by the transversal anthropological research at the regional level. In addition to the nationwide growth references, the international growth standards and references according to the WHO (World Health Organization 2006), IOTF (International Obesity Task Force) (Cole and Lobstein 2012) or CDC (Center for Disease Control and Prevention) (Kuczmarski et al. 2000) are now recommended and used.

The objective of our study was to describe distribution range in the body weight categories among Czech children of younger school age, namely 6 to 11 years, taking into account the age and sex.

Methods and Subjects

Research sample and anthropometric measurements

Primary schools from different regions within the Czech Republic were invited to participate in the research. The addressed schools were selected randomly or on the basis of previous collaboration in other research. Twenty-three primary schools (approx. 1/3 of all addressed schools) from five regions of the Czech Republic (approx. 1/3 of all regions within the Czech Republic) stated interest in participating. The primary schools' management gave consent for their participation in the research; this was preceded by the project program presentation sent by our team. Data collection took place between 2014 and 2018. The research sample consisted of 2,099 healthy children aged 6–11 years (boys, n = 1,015, 48.4%; girls, n = 1,084, 51.6%). The chronological age of probands was defined in accordance with the IBP principles (Weiner and Lourie 1969) in tenths

of a year. Probands with a chronological age in the annual range, for example 11 years = 11.00 to 11.99 years, thus belong to the relevant age category. Numerical differences between the children's age categories were affected by the specific number of pupils in individual years of the first stage of the relevant primary schools. Only children with the signed informed consent by their legal representatives were included in the research sample.

Anthropometric measurements took place in designated primary school classrooms. The rooms were well lit, aerated with the optimal temperature, so that the standard and hygienic measurement conditions were complied with. The measurements were carried out before noon by an experienced and trained person (physical anthropologist) using the same anthropometric equipment. Children were clad in underwear or light exercise clothing and measured separately according to their sex. Each proband's body height was measured using A-226 anthropometer (Trystom, Olomouc, Czech Republic) to the nearest 0.1 cm and body weight to the nearest 0.1 kg using the InBody 720 device (Biospace Co., Ltd., Seoul, Korea). Body Mass Index (BMI) was calculated using the following equation: BMI = body weight [kg]/body height [m²].

The research was approved by the Faculty of Physical Culture, Palacký University in Olomouc Ethics Committee (No. 20/2014) and was carried out in accordance with the Declaration of Helsinki.

Statistical data processing

The research data were sorted out using MS Excel spreadsheet and statistically processed by IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., New York, United States). Residual analysis was used to assess the statistical significance of differences in the representation of boys and girls in each weight category. The level of statistical significance was selected as $\alpha = 0.05$.

The probands body weight was assessed using the following assessment standards: the Czech national growth references, the BMI percentile bands in accordance with CAV (Vignerová et al. 2006), the WHO growth standards (World Health Organization 2006), and the IOTF references (Cole and Lobstein 2012).

The Czech BMI references classify individuals into six weight categories; children placed below the 3rd percentile (P) are deemed as underweight, and is also referred in Czech terminology as a very low body weight; between 3rd and 25th P are children with reduced body weight also referred to as slim; between 25th and 75th P are children with normal body weight, thus proportionate; between 75th and 90th P are children with increased body weight, so-called robust children; between 90th and 97th P are overweight children and over 97th P are obese children. Particular cut off points for each weight category according to Czech BMI standards for children are presented in Table 5. The WHO growth standards work with the BMI standard deviation (Z-score) according to the sex and age. Overweight children aged 5–19 years are classified above +1 SD, with obesity above +2 SD and underweight below -2 SD. The IOTF works with age- and sex-specific BMI cut-off limits, which correspond to the BMI limits used to define underweight (18.5 kg/m²), overweight (25 kg/m²) and obesity (30 kg/m²) in adults.

Results

Table 1 shows the representation of children in each weight category, assessed in accordance with the Czech BMI references. A significant difference between the sex was found only in the reduced weight category among nine-year-old children. Underweight children were equally represented in 1.7% of boys and girls. 22.3% of girls and 20.3% of boys fell in the reduced weight category. The greatest representation was in the normal weight category; 45.8% of girls and 48.4% of boys were proportionate. Increased weight was observed in 15% of girls and 13.1% of boys. A higher insignificant prevalence of overweight and obesity was observed in boys. Overweight boys were 7.9% compared to 7.7% of girls. 8.7% of boys and 7.5% of girls were found to be obese.

In addition to the Czech BMI references, we also used the internationally recommended IOTF and WHO growth standards Table 2 shows the number of children in each weight category in accordance with the IOTF BMI references, which also classifies the body weight into six groups: severe underweight, slight underweight, normal weight, overweight, obesity and morbid obesity. Using these references, we found more significant differences between the sexes. These were found in the severe underweight and overweight categories in seven-year-olds, slight underweight in nine-year-olds and eleven-year-olds. More girls were represented in the severe and slight underweight categories (2.5% and 12.1%) than boys (1.5% and 9.0%). Sixty-nine point nine percent of girls and 74.5% of boys had normal body weight. Eleven point six percent of girls and 10.9% of boys were overweight. The representation in the obesity and morbid obesity categories was more or less comparable in girls and boys. Three percent of obese girls and 3.3% of obese boys were recorded, of which 0.9% of girls and 0.8% of boys were morbidly obese.

Table 1. Prevalence of children in each body weight category in accordance with the Czech BMI references

	Under-weight		Reduced weight		Normal weight		Increased weight		Overweight		Obesity	
	n	%	n	%	n	%	n	%	n	%	n	%
Total (n = 2,099)	35	1.7	448	21.3	989	47.1	296	14.1	163	7.8	169	8.0
Boys (n = 1,015)	17	1.7	206	20.3	492	48.4	133	13.1	80	7.9	88	8.7
6 years	2	2.7	16	21.6	38	51.4	6	8.1	7	9.5	5	6.8
7 years	3	1.3	63	27.8	108	47.6	26	11.5	12	5.3	15	6.6
8 years	5	2.0	45	17.7	123	48.4	30	11.8	20	7.9	31	12.2
9 years	2	1.1	29*	16.1*	94	52.2	26	14.4	15	8.3	14	7.8
10 years	2	1.3	29	19.3	68	45.3	26	17.3	14	9.3	11	7.3
11 years	3	2.3	24	18.3	61	46.6	19	14.5	12	9.2	12	9.2
Girls (n = 1,084)	18	1.7	242	22.3	497	45.8	163	15.0	83	7.7	81	7.5
6 years	3	3.2	16	16.8	44	46.3	15	15.8	6	6.3	11	11.6
7 years	7	2.8	56	22.0	119	46.9	35	13.8	17	6.7	20	7.9
8 years	1	0.4	47	18.7	124	49.4	37	14.7	24	9.6	18	7.2
9 years	2	1.1	47*	27.0*	76	43.7	29	16.7	7	4.0	13	7.5
10 years	1	0.6	43	24.3	76	42.9	29	16.4	17	9.6	11	6.2
11 years	4	3.0	33	24.8	58	43.6	18	13.5	12	9.0	8	6.0

Note: n – number of probands; *$p \leq 0.05$.

Results presented in Table 3 were derived using the WHO BMI standards, which classifies the body weight into four categories: underweight, normal weight, overweight and obesity. Significant sex differences were observed in 8 and 11

Table 2. Prevalence of children in each body weight category in accordance with IOTF BMI references

	Severe underweight		Slight underweight		Normal weight		Overweight		Obesity		Morbid obesity	
	n	%	n	%	n	%	n	%	n	%	n	%
Total (n = 2,099)	42	2.0	222	10.6	1,515	72.1	237	11.3	66	3.1	18	0.9
Boys (n = 1,015)	15	1.5	91	9.0	757	74.5	111	10.9	34	3.3	8	0.8
6 years	2	2.7	8	10.8	54	73.0	7	9.5	3	4.1	0	0.0
7 years	1*	0.4*	29	12.8	172	75.8	14*	6.2*	8	3.5	3	1.3
8 years	5	2.0	17	6.7	190	74.8	32	12.6	6	2.4	4	1.6
9 years	2	1.1	13*	7.2*	138	76.7	20	11.1	6	3.3	1	0.6
10 years	2	1.3	14	9.3	109	72.7	18	12.0	7	4.7	0	0.0
11 years	3	2.3	10*	7.6*	94	71.8	20	15.3	4	3.1	0	0.0
Girls (n = 1,084)	27	2.5	131	12.1	758	69.9	126	11.6	32	3.0	10	0.9
6 years	4	4.2	6	6.3	68	71.6	9	9.5	6	6.3	2	2.1
7 years	11*	4.3*	26	10.2	178	70.1	31*	12.2*	6	2.4	2	0.8
8 years	2	0.8	21	8.4	182	72.5	37	14.7	7	2.8	2	0.8
9 years	3	1.7	25*	14.4*	126	72.4	12	6.9	5	2.9	3	1.7
10 years	3	1.7	26	14.7	121	68.4	20	11.3	7	4.0	0	0.0
11 years	4	3.0	27	20.3*	83	62.4	17	12.8	1	0.8	1	0.8

Note: n – number of probands; *$p \leq 0.05$.

Table 3. Prevalence of children in each body weight category in accordance with WHO BMI growth standards

	Underweight		Normal weight		Overweight		Obesity	
	n	%	n	%	n	%	n	%
Total (n = 2,099)	48	2.3	1,584	75.4	308	14.7	159	7.6
Boys (n = 1,015)	20	2.0	747	73.5	151	14.9	97	9.5
6 years	2	2.7	59	79.7	8	10.8	5	6.8
7 years	3	1.3	183	80.6	24	10.6	17	7.5
8 years	7	2.8	176	69.6	39	15.4	31*	12.3*
9 years	2	1.1	132	73.3	29	16.1	17	9.4
10 years	2	1.3	106	70.7	29	19.3	13	8.7
11 years	4	3.1	91	69.5	22	16.8	14*	10.7*
Girls (n = 1,084)	28	2.6	837	77.2	157	14.5	62	5.7
6 years	3	3.2	70	73.7	13	13.7	9	9.5
7 years	9	3.5	196	77.2	36	14.2	13	5.1
8 years	2	0.8	189	75.3	46	18.3	14*	5.6*
9 years	3	1.7	139	79.9	20	11.5	12	6.9
10 years	4	2.3	141	79.7	23	13.0	9	5.1
11 years	7	5.3	102	76.7	19	14.3	5*	3.8*

Note: n – number of probands; *$p \leq 0.05$.

year old obese children. The underweight and overweight categories were comparable for boys and girls, 2.6% of girls and 2% of boys were underweight; 14.5% of girls and 14.9% of boys were overweight. An insignificant difference was observed in the normal body weight and obesity categories. Seventy-seven point two percent of girls and 73.5% of boys with the normal body weight were found. By contrast, obesity was found in 9.5% of boys compared to 5.7% of girls.

If we assess the sex differences in relation to the incidence of overweight and obesity categories we find that in accordance with the Czech BMI references and the WHO growth standards, there was a higher proportion of boys in these categories. By contrast, according to the IOTF, a higher proportion of girls may be observed in the severe and slight underweight categories. Using all three assessment references, the highest prevalence of children with normal body weight was found in both sexes.

Discussion

The change in social lifestyles is also reflected in the change in the somatic condition. The Czech population's somatic parameters have been regularly measured

Table 4. Comparison of the prevalence of underweight, overweight and obesity in accordance with the Czech BMI and IOTF BMI references in 2001 and 2020

Gender, age (years)		n	CAV			IOTF	
			Underweight	Overweight	Obesity	Overweight	Obesity
Boys 6–11	CAV 2001	5,933	7.6%	8.9%	6.6%	13.1%	3.6%
	2020*	1,015	1.7%	7.9%	8.7%	10.9%	4.1%
Girls 6–11	CAV 2001	5,936	8.1%	8.5%	5.6%	13.4%	3.2%
	2020*	1,084	1.7%	7.7%	7.5%	11.6%	3.9%

Note: n – number of probands; *our research group; CAV – Nationwide Anthropological Survey of Children and Adolescents 2001.

Table 5. The Czech BMI references for children (Vignerová et al. 2006)

	3. P	10. P	25. P	50. P	75. P	90. P	97. P
Boys							
6 years	13.1	13.7	14.5	15.4	16.5	17.6	18.9
7 years	13.1	13.8	14.6	15.6	16.8	18.0	19.5
8 years	13.2	13.9	14.8	15.9	17.2	18.6	20.3
9 years	13.5	14.2	15.1	16.3	17.7	19.3	21.3
10 years	13.7	14.5	15.5	16.7	18.3	20.1	22.3
11 years	14.1	14.9	15.9	17.2	18.9	20.8	23.3
Girls							
6 years	12.7	13.4	14.2	15.3	16.4	17.6	18.9
7 years	12.7	13.5	14.4	15.5	16.8	18.1	19.6
8 years	12.8	13.7	14.6	15.9	17.3	18.9	20.6
9 years	13.0	13.9	14.9	16.2	17.8	19.5	21.5
10 years	13.2	14.2	15.2	16.6	18.3	20.2	22.4
11 years	13.6	14.5	15.7	17.1	18.9	20.9	23.3

Note: P – percentile.

and recorded in the Nationwide Anthropological Surveys since 1951. Based on these surveys the Czech Republic has acquired an extensive database of the said parameters. This has enabled experts to assess the change in the population's somatic profile according to the monitored parameters over a long time period and this also facilitated in describing secular trends. As already mentioned, the tradition of Nationwide Anthropological Survey in the Czech Republic ceased, and with it the availability of relevant current data in a representative form. The importance of transversal research at the regional level, which at least partially provides data reflecting the somatic condition of the Czech children's population, is increasing all the more.

Table 4 shows the comparison between the percentage of children aged 6 to 11 years in the underweight, overweight and obesity categories in accordance with the Czech BMI and the IOTF BMI references in 2001 (Vignerová et al. 2006) and our research group. In the underweight category we recorded a significant decrease; in overweight category, this decrease was at the level of approximately 1% to 2%. In the category of obese individuals, we recorded an increase of up to two percent compared to 2001. In 2001, the CAV revealed a higher proportion of overweight and obese boys compared to girls. This finding is also supported by our results.

The WHO points to the generally increasing prevalence of overweight and obesity in children and adolescents aged 5-19 years. This is evinced by the dramatic increase from 4% in 1975 to 18% in 2016. This increase is recorded in both sexes, though it shows one percent more overweight and obese boys (19%) then girls (18%) (World Health Organization 2020).

This trend is confirmed by other European studies that report a similar situation, namely a higher proportion of overweight and obese boys compared to girls, such as Poland, which recorded 7% of obese boys and 3% of obese girls (Bac et al. 2011). In Austria, reported obesity in children and adolescents was between 3.1% and 9% for boys and between 2.2% and 7.3% for girls (Dorner 2016). Greece presents 29.5% overweight boys and girls, however, there was 13.1% of obese boys in comparison to 9% of obese girls (Farajian et al. 2012). Italy has similar data, reporting 7.1% of eight-year-old boys with severe obesity and 2.5% of girls, of which 5.6% of nine year old boys and 1.8% of nine year old girls are severely obese (Lombardo et al. 2015). In Portugal, 30.6% of boys are overweight and obese, compared to 28.4% of girls (Gomes et al. 2014).

In contrast, there is a higher proportion of obese girls, 7.3% compared to 6.2% of obese boys, in the Serbian population of 6-9-year-old children (Djordjic et al. 2016). Another example is seven-year-olds in Slovakia, which consist of 8.8% of obese boys and 9.5% of obese girls (Tichá et al. 2018). However, we can argue that when comparing the Czech and Slovak seven-year-old children, the prevalence within each weight category is analogous.

The family lifestyle, particularly in terms of nutritional and exercise habits, is often the primary factor determining the children's weight. The differences between boys and girls may seem very small at first. With increasing age, some individuals become increasing independent of direct family influence, and make their own decisions regarding nutrition. During adolescence boys and girls are also increasingly influenced by second-

ary socialisers and social institutions regarding dietary habits. Nutritional intake may vary between boys and girls. In relation to the phases of the menstrual cycle, girls may have a preference for foods rich in carbohydrates and lipids, which alternates with periods of preference for less energy-intensive nourishment. For boys during puberty, an increase in muscle mass is crucial, which is aided with the optimal diet composition, particularly the high proportion of protein and overall relatively high energy intake. These nutritional differences may highlight differences in the proportion of each body component, in terms of the quantity of body fat and skeletal muscle, which, however, are also reflected in the total body weight (Sweeting 2008).

Body height is the indicator predominantly used to indicate the children's growth; however, with increasing body height the total body weight increases (Krásničanová and Lebl 1996). Our study had identified sex differences in the outermost categories of body weight, and that this occurrence may be explained by the growth spurts taking place. The course of growth spurts is essentially the same in all children, but its speed and relationships may differ. Growth is also influenced by sex as there are sex differences in growth rate (Riegerová et al. 2006). Using the Czech BMI references, we observed a statistically significant difference between the number of boys and girls with reduced body weight who most likely had undergone a late childhood spurt (9 years old).

When we used the IOTF BMI references to assess the body weight, we found a significant difference in the number of 7-year-old boys and girls who were severely underweight and overweight. It might be due to mid-spurt. We also ob-served a difference in the number of boys and girls with a slight underweight. It is possible to consider the influence of late childhood (9 years) and prepubescent (11 years) growth spurt.

When using the WHO BMI growth standards, we found a statistically significant difference in the number of obese boys and girls during the late childhood (8 years) and prepubescent (11 years) growth spurt.

Anthropological research in the Czech Republic is predominantly carried out at the regional level. In the Olomouc Region, many studies focus on monitoring the somatic status of children and adolescents. These usually deal with key somatic parameters, such as body height, body weight, circumferential parameters or parameters reflecting the body composition, that are aimed at assessing overweight, obesity, or latent obesity, in the general population (Přidalová et al. 2001; Dostálová et al. 2007; Kopecký and Přidalová 2008; Kopecký et al. 2014; Zbořilová et al. 2016; Zbořilová et al. 2018) and individuals who engage in sports (Kopecký and Přidalová 2001). In a similar model, anthropological research has been conducted in the Moravian-Silesian Region (Kutáč 2013; Kutáč 2017). In other parts of the Czech Republic, auxological studies dealing with the physiological growth and development of children and the influence of hypokinesis on the growth and development of children and adolescents are being organised (Sedlak et al. 2015; Sedlak et al. 2017).

Conclusion

The study provides statistical evidence on the representation of younger school age children in each weight category us-

ing the Czech BMI references for children and adolescents, IOTF BMI references and WHO growth standards. The majority of children were classified in the normal weigh category. The numbers of children in other weight categories differed in relation to the use of the relevant assessment references. In the severe underweight, slight underweight, reduced weight, overweight and obesity categories significant differences were recorded between the number of boys and girls in seven-year-olds, eight-year-olds, nine-year-olds and eleven-year-olds. The study thus confirmed that the differences in the numerical representation of boys and girls occur only in the specific body weight categories.

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The Authors' contribution

All authors were involved in data collecting. VZ and MP led conceptualization, design and revision of the manuscript. VZ wrote the manuscript. All authors read and approved the final manuscript

Conflict of interest

The authors declare that there is no conflict of interest.

Corresponding author

Department of Natural Sciences in Kinanthropology, Faculty of Physical Culture, Palacký University Olomouc
e-mail: vendula.zborilova@upol.cz

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