

# A CONTRIBUTION TO THE RESEARCH OF OBESITY INCIDENCE AMONG CHILDREN OF YOUNGER SCHOOL AGE

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**Abstract:** The article gives information on the measurement of selected anthropometric parameters of 11-year-old children attending primary schools in Brno. Body weight and height were measured and the acquired data was used to calculate the BMI (body mass index). Further, the volume of body fat was calculated as a sum of thicknesses of three skinfolds (the skinfold above biceps brachii, the subscapular and the supraspinal skinfolds). The results show that most children fall within the category that corresponds to the norm, both when the BMI method or the method of fatty tissue volume are used. The method of fatty tissue volume calculated from the thickness of the three skinfolds seemed to be more suitable for eleven-year-old children.

**Keywords:** body weight, height, BMI (body mass index), skinfold thickness, skinfold over biceps brachii, subscapular skinfold, supraspinal skinfold, volume of fatty tissue

## Theoretical Foundations

Younger school age starts at the age of 6 or 7 and it is characteristic for the fact the child starts attending school. The period ends at the age of 11 or 12 when there are first signs of sexual maturation (MACHOVÁ, 1993; SUCHÝ et al., 1985). When children start attending school, their way of life changes. The main activity is then the class; the pupils have to submit to the requirements of school life, to cope with the demands laid on them. Their position in the family changes as well, their new role of a pupil is respected. At this stage of school age there is new progress in the development of their personality, their moral behaviour, their hobbies, their cognitive processes, their feelings and will, and considerable changes occur in the pupils' socialization process.

The pupil's personality is formed step by step and the class, learning, work activities and the socialization play an important role in the process of personality formation. The cognitive abilities develop, pupils learn moral norms, and their will strengthens. Pupils attempt to meet certain principles and social rules of their own will. Their needs and interests become more pronounced and this leads to better self-

cognition and self-assertion. Their interests are still changeable but the effort to satisfy them has a positive effect on the motivation and the performance of the personality being formed (KURIC, 2001).

The younger school age is a period when children get a lot of movement. They find the movement satisfactory and they attempt at its perfection. The coordination of muscles improves, especially the small muscles of the hand. Movement is one of children's basic needs in this period. There is also the typical enjoyment and the spontaneity of the movement (PÁVKOVÁ, 2002).

The way children of young school age spend their free time and the way they choose their hobbies are strongly influenced by the social environment. The environment children spend their free time in can be very varied. It can be home, school, various social organizations and institutions. The most considerable is the influence of the family, where parents serve as role models. An interest or a hobby can arise as a response to parents' support or in connection with parents. If the family is not able to play its upbringing role, schools or other educational institutions with qualified staff can compensate for the deficiency up to certain extent. If the compensation is not efficient enough, the children are in danger of being influenced by an undesirable group of their peers and even their healthy development can be threatened. One of the strong social influences nowadays is the media. The media, especially TV, can influence the children and their choice of hobbies. The children who spend too much time watching TV tend not to have enough time for their own interests; they replace their own activity with passive watching of TV programmes (PÁVKOVÁ, 2002; ŠULCOVÁ, 2005). Woynarowska (2005) states that 29 % of boys and 23 % of girls of younger school age watch TV for 4 and more hours a day in the Czech Republic. Most children watch TV in Latvia (43 % of boys and 35 % of girls), fewest boys watch TV in Sweden (18 %) and fewest girls watch TV in Greece (14 %).

In the younger school age, children grow vertically, their lower limbs get longer, their muscles get stronger, in general they get more strength and they gain weight. Bone ossification continues and the organs become more efficient. The development of movement and other abilities is heavily dependent on the body growth.

Consistently, studies from around the world have reported that children's physiques are changing, in particular that height, weight and waist girth of children have been steadily increasing. While some of these physique changes are attributable to "secular trend" (TANNER, 1962) related to healthier living conditions and better access to food than earlier generations, the changes seem to be escalating.

Obesity is an increasing problem for children and adolescents (BOOTH et al., 2003). In addition to obesity many young people show early signs of heart disease, high blood pressure and diabetes, and rates of diagnosis are increasing (kol., 2001; McMAHON et al., 2004). Excess energy intake and high intakes of saturated fat, salt and sugar contribute to these problems, which compound in the adult population. Developing good eating habits that can be carried into adulthood is very important for the short and long term health of young people (HANDS et al., 2004).

Several large anthropometric surveys of Western Australian children have been conducted (BLANKSBY et al., 1974; BLANKSBY et al., 1986). Using these data sets Hands

et al. (2001) compared height, weight and Body Mass Index (BMI) for ages 6 to 16 years. They found that the children were heavier and taller in 2 000 than the previous data sets, with a similar trend in both sexes. Of concern was the finding that there was a strong upward trend in weight, particularly between the 1 974 and 2 000 data sets, and particularly for 10- to 12-year-old children.

Schlüter says that in technologically advanced countries, the obesity occurs with 5–30 % of children, out of which 70–80 % remain obese when adults. About 30 % of obese adults were also obese when they were children (LISÁ et al., 1990).

Obesity is a condition when excessive amount of fatty tissue accumulates in the body. For children, the weight exceeding the ideal body weight by 20 % is considered obesity (SOTHERN et al., 1999).

Chart I shows the classification of obesity.

BMI value	BMI category
< 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 – 34.9	1 <sup>st</sup> grade obesity
35.0 – 39.9	2 <sup>nd</sup> grade obesity
> 40	3 <sup>rd</sup> grade obesity – ‘morbid obesity’

Chart I - Classification of obesity (according to WHO, 1997 – in: Hainer et al., 2004, adapted)

## Research Aims

Woynarowska et al. (2005) researched how children of younger school age see themselves – if they feel to be “too fat”, “all right” or “too thin”. 19 % of Czech 11-year-old boys said they feel to be too fat, 61 % felt all right and 20 % felt too thin. With Czech eleven-year-old girls the situation was as follows: 34 % saw themselves as too fat, 51 % felt all right and 15 % had the impression they are too thin.

The aim of our research was to find out what the situation is like when we measure some of the anthropometric parameters. 98 eleven-year-old children (54 boys and 44 girls) who attend primary schools in Brno were examined. Basic anthropometric parameters, such as height and body weight, were found out and used to calculate the body mass index so that children could be divided into BMI categories. Then the thickness of skinfolds was measured and their sum made the fatty tissue volume.

## Hypotheses

Literature states global spread of obesity, also for the population of children. The research hypothesis was that the sample of eleven-year-old children from primary schools in Brno, Czech Republic is not influenced by globalization so much as to find a higher incidence of obesity.

## Material and Methods

The body composition of children of younger school age was measured using anthropometric parameters. The set of children under research consisted of 54 boys and 44 girls; in total, there were 98 children from Brno primary schools. All the children were 11 years old.

The following anthropometric measurements were taken:

1. body weight and height for the calculation of BMI, classification of children into BMI categories
2. thickness of three skinfolds and classification of children into categories according to the volume of fatty tissue in the body

Ad 1)

The body weight was taken using SOENHLE medical electronic scales, 75xxLED type, resolution 0.1 kg, capacity 150 kg. Each child was in their underwear with no shoes when being weighed (KLEINWACHTEROVÁ et BRÁZDOVÁ, 1992). The weight of underwear was not taken into consideration.

The height was taken using a Sieber Hegner Co. anthropometer. Each measured child was standing upright, with their heels together, toes slightly apart, a fixed body, a slight breath in and a balanced head. The anthropometer measurements were taken with 1 mm resolution.

Body Mass Index (BMI) is a complementary indicator that is derived from the body weight and height. BMI measuring is generally spread both in the civil and the military sectors (JUŘÍKOVÁ et al., 2001). BMI is calculated using the following formula:

$$\text{BMI} = \frac{\text{body weight [kg]}}{(\text{height [m]})^2}$$

The body weights and heights the researchers found out were used to calculate BMI. The results were classified into a 6-grade scale. Individual categories are derived from percentile values (according to et al., 1995) – see Chart II.

Category	Percentile	Evaluation
1.	< 10	Serious malnutrition
2.	10 – 25	Malnutrition
3.	25 – 75	Norm
4.	75 – 90	Overweight
5.	90 – 97	Overweight / obesity
6.	> 97	Obesity

Chart II – Categories of BMI values (according to Prokopec in: et al., 1995)

## Ad 2)

Skinfold thickness was taken using Harpenden-type Bests callipers, i.e. with constant spring pressure set by international agreement to 10 p/mm<sup>2</sup> with the size of bezels at least 40 mm<sup>2</sup>, with 0.1 mm resolution. When measuring a skinfold, first the skin is to be drawn away from the muscles and the skinfold is caught between fingers (the thumb and the index finger), then the skinfold is to be taken by the plastic arms of the callipers – the distance between the bezels of callipers and the fingers is about 1 cm. The measurement has to be read from the scale in 2 s at latest (BRÁZDOVÁ et FIALA, 1998). The skinfolds were taken on the left or the right side of the body, in dependence on the right-handedness or left-handedness of each child.

These 3 skinfold were measured:

1. the skinfold above the *triceps brachii*
2. the *subscapular* skinfold
3. the *supraspinal* skinfold

The sum of thicknesses of the three above-mentioned skinfolds was classified into a 5-grade scale. Then the number of members of each category was expressed in percents. The five-grade scale includes the following categories, the marginal categories are open (MĚKOTA et KOVÁŘ, 1995) – see Chart III.

Group	Fatty tissue volume				
	very low	bellow average	average	over average	very high
Boys	< 13,5	13,6 – 17,5	17,6 – 28,0	28,1 – 52,0	> 52,1
Girls	< 15,0	15,1 – 19,5	19,6 – 41,0	41,1 – 62,0	> 62,1

Chart III – Categories of fatty tissue volume (according to Měkota et Kovář, 1995)

## Results and Discussion

The measured values of body weight and height and the calculated BMI values are shown in Chart IV.

Group	Weight [kg]		Height [m]		BMI	
	m	s	m	s	m	s
Boys	39,5	8,50	1,476	0,064	18,14	2,88
Girls	60,1	9,36	1,720	0,065	20,21	2,24

Chart IV – Average weight, height and BMI of the children under research

Key: m – arithmetic mean, s – standard deviation

There was a minimum weight difference between sexes of the eleven-year-old children. The girls were found to be taller on average than the boys but the BMI values were not considerably different for both sexes. Chart V shows the numbers of children in individual BMI categories.

Group	BMI Category					
	1	2	3	4	5	6
Boys	4	12	22	12	2	2
Girls	6	8	18	7	5	0
in total	10	20	40	19	7	2

Chart V – Number of children in individual BMI categories

Most children were classified as category 3 which corresponds to the norm. Almost the same number of children is in categories 2 and 4: 20 children in the Malnutrition category and 19 children in the Overweight category.

Chart VI shows the classification of children according to the fatty tissue volume calculated from the sum of thicknesses of three skinfolds.

Group	Fatty tissue volume				
	very low	bellow average	average	above average	very high
Boys	0	8	24	16	6
Girls	2	8	26	7	1
in total	2	16	50	23	7

Chart VI – Number of children in individual categories according to the fatty tissue volume

The category of the average fat volume is the largest both for each group and in total, the category of the very low fat volume is the smallest.

## Conclusions

The results of the measurement of fatty tissue volume show that more than half of the children (51.5 %) have an average fatty tissue volume, 23.7 % are above average and 7.2 % have a high volume of fat. 16.5 % of the children are bellow average and only 2 % of the children are very low on fat. It is obvious that the number of children with the above average and very high fatty tissue volume considerably (almost twice) exceeds the number of children with the bellow average and very low fatty tissue volume.

In comparison to the measurement of skinfold thickness, the results of Body Mass Index were slightly different. The highest number of the children is also in the normal category – 41.2 %. However, there are 19.6 % of the children in the Overweight category and 20.6 % of the children in the Malnutrition category.

For the purposes of this work, the method of measuring skinfold thickness seems to be more suitable as it expresses the proportion of fatty tissue. BMI value is not able to express this proportion and it causes inaccuracies in the measurement characteristics. For example, a person with a high proportion of muscle and therefore with weight above average would be characterized as overweight.

## PŘÍSPĚVEK KE SLEDOVÁNÍ VÝSKYTU OBEZITY U DĚTÍ MLADŠÍHO ŠKOLNÍHO VĚKU

**Abstrakt:** Práce podává informaci o měření vybraných antropometrických parametrů u jedenáctiletých dětí navštěvujících základní školy v Brně. U vyšetřovaných dětí byla měřena tělesná výška, tělesná hmotnost a ze získaných údajů byl vypočten BMI (body mass index). Dále bylo u dětí zjišťováno množství tělesného tuku pomocí součtu tloušťky tří kožních řas (jednalo se o kožní řasu nad biceps brachii, kožní řasu subskapulární a supraspinální). Z výsledků měření bylo zjištěno, že nejvíce dětí se nachází v kategorii odpovídající normě, ať už byla použita metoda využívající BMI, nebo metoda stanovující množství podkožního tuku. Metoda stanovující množství podkožního tuku výpočtem z tloušťky tří kožních řas se pro soubor jedenáctiletých dětí jevila jako vhodnější.

**Klíčová slova:** tělesná hmotnost, tělesná výška, BMI (body mass index), tloušťka kožních řas, kožní řasa nad biceps brachii, kožní řasa subskapulární, kožní řasa supraspinální, množství podkožního tuku