

THE PREVALENCE OF OVERWEIGHT AND OBESITY AMONG CHILDREN IN MIDDLE SCHOOL WITHIN THE BIHOR – HAJDÚ-BIHAR EUROREGION

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ABSTRACT. Introduction. The early stage of adolescence, between the age of 11 and 14, is accompanied by a great fluctuation of the values of sudden physical growth, of temperament and of personality. Periodical monitoring of somatic indicators and determining the body mass index (BMI) are methods necessary for monitoring the state of health of schoolchildren. **Goals.** The goal of this study is to assess the prevalence of overweight and obesity among children in middle school within the Bihor–Hajdú-Bihar Euroregion and to compare the obtained results with the results of other studies of this nature. **Subjects and methods.** The sample group was made up of 934 middle school students from the Bihor–Hajdú-Bihar Euroregion. The method used was anthropometry. The body mass index was calculated in accordance with the BMI reference chart according to age and gender. The results of the measurements were statistically processed with the SPSS program. The descriptive analysis was performed and the differences between the average values were tested with the independent samples t-test. **Results.** The results of the study have shown increased values of height and weight for both genders, from one grade to the other; for girls higher mean values than for boys. 15.31% of the total number of subjects were overweight and 11.99% were obese, resulting a total percentage of 27.30% of individuals with excess weight. The independent samples t-test: $t(933) = -.443, p=0.658$, shows that statistically speaking there are no significant differences between the mean BMI values of the subjects from Bihor ($M=20.42, SD=4.10, n=474$) and the mean BMI values of the subjects from Hajdú-Bihar ($M=20.54, SD=4.16, n=460$). **Conclusions.** The prevalence of overweight and obesity in Bihor decreases with age, from 35.5% in 5th grade to 19.5% in 7th grade, after which again it tends to increase. In Hajdú-Bihar this decrease is uninterrupted from 34% in 5th grade to 19% in 8th grade.

Keywords: *overweight, obesity, preadolescence, height, weight*

REZUMAT. Incidența supraponderalității și obezității la copiii din ciclul gimnazial din euroregiunea Bihor–Hajdú-Bihar. Introducere. Parcurgerea adolescenței timpurii, cu limite între 11 și 14 ani se produce cu o mare variabilitate a indicilor creșterii fizice bruște, ai temperamentului și ai personalității. Supravegherea

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periodică a indicatorilor somatici și determinarea valorii indicelui de masă corporală (IMC) reprezintă metode necesare de monitorizare a stării de sănătate a școlărilor. **Obiective.** Obiectivul acestui studiu a fost să evaluăm incidența supraponderalității și obezității la copiii gimnaziali din Euroregiunea Bihor, Hajdú-Bihar și să comparăm rezultatele obținute cu cele din alte studii asemănătoare. **Subiecți și metode.** Eșantionul a fost format din 934 de elevi din ciclul gimnazial din euroregiunea Bihor-Hajdú-Bihar. Metoda de lucru a fost antropometria. Indicele de masă corporală s-a calculat conform hărții de referință a IMC după vârstă și gen. Datele măsurătorilor au fost prelucrate statistic cu ajutorul programului SPSS. A fost făcută analiza descriptivă iar diferențele dintre medii au fost testate cu ajutorul testului t pentru eșantioane independente. **Rezultate.** Rezultatele studiului au evidențiat valori crescute, de la o clasă la alta, ale taliei și greutateii la ambele genuri; valori medii superioare la fete, comparativ cu băieții. Din totalul populației 15.31% din subiecți au fost supraponderali și 11.99% obezi, rezultând o pondere de 27.30% a celor cu excident de greutate. Testul t pentru eșantioane independente: $t(933) = -.443$, $p = .658$, arată că din punct de vedere statistic nu sunt diferențe semnificative între mediile IMC subiecților din Bihor ($M=20.42$, $SD=4.10$, $n=474$) și ale celor din Hajdú-Bihar ($M=20.54$, $SD=4.16$, $n=460$). **Concluzii.** Prevalența supraponderalității și obezității în Bihor scade cu vârsta, de la 35% în clasa a V-a la 19% în clasa a VII-a, după care apare din nou o tendință de creștere. În Hajdú-Bihar această descreștere este neîntreruptă de la 33% în clasa a V-a la 19% în clasa a VIII-a.

Keywords: *supraponderalitate, obezitate, preadolescență, talie, greutate*

Introduction

According to recent studies, obesity has reached alarming proportions among adults as well as among children. One of three children in Europe is overweight or obese; in the last 30 years obesity has doubled among children (World Health Organization [WHO], 2013).

The action plan of WHO (2013) for prevention and control of non-communicable diseases and adoption of a healthy lifestyle between 2013-2020, is meant to decrease with at least 25% the rates of premature mortality caused by cardiovascular diseases, cancer, diabetes or chronic diseases of the respiratory system. Overweight and obese people present high risk of developing certain diseases: type 2 diabetes, high blood pressure, osteoarthritis or coronary artery diseases (Lavie et al., 2009). Periodical monitoring of somatic indicators and determining the body mass index (BMI) are methods necessary for monitoring the state of health of schoolchildren.

According to a study of Lobstein & Frelut (2003) the percentage of 11 years old overweight and obese children in some countries is: Serbia 18 %, Croatia 17%, France 19% , Spain 34% or Italy 36%.According to the study called Health Behaviours for School-aged Children (HBSC), in Romania in the 2013-2014 school year, the percentage of overweight or obese girls of age 11 was 14%, of age 13 it was 11% and of age 15 it was 10%. For boys of age 11 this percentage was 33%, for the ones of age 13 it was 26% and for the 15 years old boys it was 21% (Ahluwalia et al., 2015).According to the same study HBSC, in Hungary for the school year 2013-2014, among the 11 years old girls the percentage of those who were overweight or obese was 15%, among the ones of age 13 it was 16% and among the ones of age 15 it was 13%.

Among boys, this percentage was 31% for 11 years old boys, 28% for 13 year old boys and 24% for 15 years old boys (Ahluwalia et al., 2015).Most overweight or obese children will probably be obese in their youth as well (Freedman et al., 2005), or will suffer of non- communicable diseases (Guo et al., 2000). BMI is an instrument that represents the standard in the assessment of the risks, which appear because of the weight excess. People whose BMI is too high or too low are predisposed to develop certain health problems. In order to determine the weight excess the current weight is referred to the ideal weight depending on height, age and gender. In this regard, the Centre for Disease Control and Prevention (CDC) recommends the use of growth charts. In 2004, upon the recommendation of CDC, 15 health care organizations have revised the BMI values.

Children whose BMI by age and gender was located between the 85th - 95th percentile, were considered as overweight and those with higher values were classified as being obese (Barlow, 2007).The goal of this study is to assess the prevalence of overweight and obesity among children in middle school within the Bihor–Hajdú-Bihar Euroregion and to compare the obtained results with the results of other studies of this nature.

Subjects and methods

The study was conducted over a sample group of 934 students, 474 from Bihor county and 460 from Hajdú-Bihar county, that were gathered from nine schools from Romania and six from Hungary. The schools were selected from urban regions as well as from rural regions, the measurements being performed in the 2014-2015 school year.

In this study, the anthropometric method was used to measure the two somatic indicators: height and weight using a Seca 213 (Marsden, UK) height measure and an Omron BF511 (Omron Corporation, Kyoto, Japan) digital scale. The body mass index was calculated according to the BMI reference chart based on age and gender, the percentile categories being the ones in Table 1 (Barlow, 2007).

Table 1. Percentile categories regarding body mass index (Barlow, 2007)

| BMI Percentile | Nutritional status |
|--|---------------------------|
| BMI<5 percentile/gender/age | Underweight |
| BMI between 5-84 percentile/ gender/age | Normal weight |
| BMI between 85-95 percentile/ gender/age | Overweight |
| BMI ≥ 95 percentile/ gender/age | Obese |

It is known that genetic inheritance and growth and development rates are different for every individual. Thus, after the BMI is calculated, the obtained results are compared with the reference values observing the growth lane that corresponds to the respective gender and age. In order to determine these values the EXCEL BMI by Barlow (2007) was used. The program analyses and interprets the results according to the reference values by age and gender, giving us this way a true image about overweight and obesity among the sample group. The data of the individual measurements were processed statistically on computer with the Statistical Package for Social Sciences: version 20.0 SPSS Inc. (SPSS) program. The descriptive analysis was performed (weighted arithmetic mean (X_p), standard deviation (τ)) and the differences between the means were tested with the independent samples t-test.

Results

The processing of the gathered data showed that the measurements were performed on 473 girls and 461 boys from the Bihor – Hajdú-Bihar Euroregion. The numbers and percentages of the subjects are presented in Table 2 by grade, gender and county.

Table 2. Distribution regarding the number and percent of the subjects by county, grade and gender

| Grade | Girls | | Boys | |
|--------------|--------------|----------|-------------|----------|
| | N | % | n | % |
| Bihor | | | | |
| V | 65 | 13.71 | 62 | 13.08 |
| VI | 73 | 15.41 | 64 | 13.50 |
| VII | 62 | 13.08 | 48 | 10.12 |
| VIII | 49 | 10.34 | 51 | 10.76 |
| Total | 249 | 52.54 | 225 | 47.46 |
| Hajdú-Bihar | | | | |
| V | 57 | 12.39 | 66 | 14.34 |
| VI | 68 | 14.78 | 68 | 14.79 |
| VII | 61 | 13.26 | 56 | 12.17 |
| VIII | 38 | 8.26 | 46 | 10 |
| Total | 224 | 48.69 | 236 | 51.31 |

The descriptive analysis was not performed for boys of age 10 and girls of age 10, 15 because of the low number of subjects. The mean values of height for boys of age 11 from Hungary is 0.9 cm higher than the ones of the boys from Romania, and the difference increases: 1.3 cm at age 12; 3.6 cm at age 13 and 5.8 cm at age 14. The differences of weight of the boys from the two countries follow the same tendency to increase in the favour of the boys from Hungary: 0.8 kg at age 11; 0.1 kg at age 12; 3 kg at age 13 and 2.4 kg at age 14. According to WHO (2007) standards of growth in height of the subjects depending on age and gender, we find that the mean values of the subjects are close to each other (Table 3).

Table 3. Mean values and standard deviation values of weight and height for boys of age 11-15

| Age | N | Height M (SD) | Weight M (SD) | WHO Height M (SD) |
|-------------|----|------------------|------------------|----------------------|
| Bihor | | | | |
| 11 years | 47 | 147.4±6.7 | 43.7±11.1 | 145.7±6.8 |
| 12years | 61 | 154.6±7.6 | 48.8±12.0 | 152.1±7.2 |
| 13years | 50 | 159.3±8.6 | 53.3±12.5 | 159.3±7.5 |
| 14years | 43 | 163.7±6.6 | 55.8±13.5 | 165.9±7.7 |
| 15years | 18 | 171.2±6.5 | 62.9±12.6 | 170.9±7.8 |
| Hajdú-Bihar | | | | |
| 11years | 50 | 148.3±8.7 | 44.5±13.5 | 145.7±6.8 |
| 12years | 65 | 155.9±9.3 | 48.9±12.5 | 152.1±7.2 |
| 13years | 56 | 162.9±7.7 | 56.3±15.0 | 159.3±7.5 |
| 14years | 47 | 169.5±7.4 | 58.2±11.6 | 165.9±7.7 |
| 15years | 12 | 171.0±8.1 | 58.1±11.4 | 170.9±7.8 |

Note. WHO height =standards regarding growth in height WHO (2007)

The mean values of height for female students of age 11 from Hungary are higher than the mean values for the ones from Romania by 1.3 cm and it increases gradually: 2.6 cm at age 12; 6.7 cm at age 13 and 4.9 cm at age 14. Regarding the mean values of weight, the female students from Romania have lower weight values and the difference increases gradually: 2.2 kg at age 11 ; 3.9 kg at age 12; 5.3 kg at age 13 and 6 kg at age 14 (Table 4).

Starting with the age of 10, no reference charts can be applied regarding weight values. This indicator cannot distinguish a relation regarding height and body mass for each age separately. The explosion in height during and after puberty is different for each person and it can be found at girls and boys as well (WHO, 2007). According to the growth chart of CDC, the mean BMI value for girls from Bihor was 20.26 and for boys it was 20.59. For girls from Hajdú-

Bihar the mean BMI was 20.79 and for boys it was 20.30. With small exceptions, in Bihor we find that the BMI tends to increase along with the increase of age (Table 5).

Table 4. Mean values and standard deviation values of weight and height for girls of age 11-14

| Age | N | Height M (SD) | Weight M (SD) | WHO Height M (SD) |
|-------------|----|------------------|------------------|----------------------|
| Bihor | | | | |
| 11 years | 64 | 149.6±7.1 | 44.7±12.4 | 147.89±6.7 |
| 12 years | 67 | 155.2±7.2 | 48.0±11.7 | 153.71±6.8 |
| 13 years | 53 | 155.1±6.5 | 48.6±11.9 | 158.07±6.9 |
| 14 years | 45 | 158.8±5.7 | 53.7±9.2 | 160.75±6.9 |
| Hajdú-Bihar | | | | |
| 11 years | 52 | 150.9±7.8 | 46.9±13.7 | 147.89±6.7 |
| 12 years | 61 | 157.8±6.7 | 51.9±12.0 | 153.71±6.8 |
| 13 years | 66 | 161.8±7.3 | 53.9±11.7 | 158.07±6.9 |
| 14 years | 39 | 163.7±6.0 | 59.7±12.6 | 160.75±6.9 |

Note. WHO Height = standards regarding growth in height WHO (2007)

Table 5. BMI by county, gender and grades

| Grade | Girls | | Boys | |
|-------------|-------|-----------|------|-----------|
| | N | M (SD) | n | M (SD) |
| Bihor | | | | |
| V | 65 | 20.12±4.7 | 62 | 20.12±4.2 |
| VI | 73 | 19.73±3.8 | 64 | 20.18±4.0 |
| VII | 62 | 20.01±3.5 | 48 | 20.82±4.0 |
| VIII | 49 | 21.56±3.5 | 51 | 21.46±4.4 |
| Hajdú-Bihar | | | | |
| V | 57 | 19.68±3.7 | 66 | 20.23±5.0 |
| VI | 68 | 21.03±4.6 | 68 | 20.25±4.0 |
| VII | 61 | 21.37±4.0 | 56 | 20.22±3.6 |
| VIII | 38 | 21.11±4.0 | 46 | 20.56±3.4 |

Comparing the mean values of the data of the subjects from the two regions using the independent samples t-test - (933) = - 0.443, p = 0.658 – it results that there is no significant difference between the mean BMI values of children from Bihor (M = 20.42, SD = 4.10, n = 474) and those of the children from Hajdú-Bihar (M = 20.54, SD = 4.16, n = 460) (Table 6 and 7).

Table 6. BMI mean values and standard deviations for the two counties

| County | N | M | SD |
|-------------|-----|---------|---------|
| Bihor | 474 | 20.4190 | 4.10254 |
| Hajdú-Bihar | 460 | 20.5388 | 4.16615 |

Table 7. Comparing the BMI using the t-test

| t | Df | P | Mean difference | Std. Error Difference | 95% CI | |
|-------|-----|------|-----------------|-----------------------|---------|--------|
| | | | | | LL | UL |
| -.443 | 933 | .658 | -.11984 | .27042 | -.65054 | .41086 |

The recorded data show that 322 subjects out of the 474 from Bihor had a normal weight for their age. A number of 71 subjects were overweight and 57 students were categorized as being obese. In addition, 315 subjects out of the 460 from Hungary had normal weight for their age. 72 subjects from Hajdú-Bihar were overweight and 55 were categorized as being obese (Table 8).

Table 8. BMI distribution by the gender of the subjects from the Bihor-Hajdú-Bihar Euroregion

| BMI percentile/ Nutritional status | Bihor | | | | | | Hajdú-Bihar | | | | | |
|---|-------|-----|-----|-----|-----|-----|-------------|-----|-----|-----|-----|------|
| | G | | B | | G+B | | G | | M | | G+B | |
| | n | % | N | % | N | % | n | % | n | % | N | % |
| Underweight BMI < 5 percentile | 10 | 74 | 14 | 6 | 24 | 5 | 4 | 2 | 14 | 6 | 18 | 4 |
| Normal weight BMI 5-85 percentile | 183 | 74 | 139 | 62 | 322 | 68 | 157 | 70 | 158 | 67 | 315 | 68.5 |
| Overweight and obesity BMI >85 percentile | 56 | 22 | 72 | 32 | 128 | 27 | 63 | 28 | 64 | 27 | 127 | 27.5 |
| Obesity BMI ≥ 95 percentile | 25 | 10 | 32 | 14 | 57 | 12 | 22 | 10 | 33 | 14 | 55 | 12 |
| Total | 249 | 100 | 225 | 100 | 474 | 100 | 224 | 100 | 236 | 100 | 460 | 100 |

Note: G=girls, B=boys

The BMI distribution of children from the Euroregion based on their residency area is presented in Table 9. In Bihor, we can notice a bigger prevalence of overweight and obesity within the urban regions 30% in comparison to the rural regions with 24%. On the other hand, in the schools from the neighbouring country the difference between the urban regions and the rural regions is only 1%. In both counties the number of children with normal weight is bigger in the province areas (RO: 71%; HU: 69%) compared to those living in cities (RO: 65%; HU: 68%). Comparing the mean BMI values of the students from the urban regions (M = 20.44, SD = 4.20, n = 525) and the values of the students from rural regions (M = 20.52, SD = 4.04, n = 409) from the Euroregion, we found that there is no significant difference in this regard: $t(933) = -.295, p = 0.77$.

Table 9. BMI distribution by residency area from Bihor-Hajdú-Bihar Euroregion

| BMI percentile/ Nutritional status | Bihor | | | | | | Hajdú-Bihar | | | | | |
|---|-------|-----|-----|-----|-----|-----|-------------|-----|-----|-----|-----|------|
| | U | | R | | U+R | | U | | R | | U+R | |
| | n | % | n | % | n | % | n | % | n | % | N | % |
| Underweight BMI < 5 percentile | 12 | 5 | 12 | 5 | 24 | 5 | 13 | 5 | 5 | 3 | 18 | 4 |
| Normal weight BMI 5-85 percentile | 170 | 65 | 152 | 71 | 322 | 68 | 180 | 68 | 135 | 69 | 315 | 68.5 |
| Overweight and obesity BMI >85 | 78 | 30 | 50 | 24 | 128 | 27 | 71 | 27 | 56 | 28 | 127 | 27.5 |
| Obesity BMI ≥ 95 percentile | 34 | 13 | 23 | 11 | 57 | 12 | 34 | 13 | 21 | 11 | 55 | 12 |
| Total | 261 | 100 | 213 | 100 | 474 | 100 | 264 | 100 | 196 | 100 | 460 | 100 |

Note: U= urban area, R= rural area

According to the recorded data, we found that simultaneously with the increase of the age, there is an almost continuous increase in the number of children with normal weight and the decrease of the number of overweight or obese children. The most spectacular decrease we can find at the Hungarian students in 8th grade, where the percentage of those with BMI > 85 percentile has gone under 20% (Table 10).

Table 10. Distribution of BMI by grades from the Bihor-Hajdú-Bihar Euroregion

| | V | | VI | | VII | | VIII | |
|---|-------|-------|-------|-------|-------|-------|-------|------|
| BMI percentile/ Nutritional status | % BH | % HB | % BH | % HB | % BH | % HB | % BH | % HB |
| | n=127 | n=123 | n=137 | n=136 | n=110 | n=117 | n=100 | n=84 |
| Underweight BMI < 5 percentile | 5 | 3 | 4.5 | 2 | 6.5 | 6 | 5 | 6 |
| Normal weight BMI 5-85 percentile | 59.5 | 63 | 69.5 | 67 | 74 | 70 | 69 | 75 |
| Overweight and obesity BMI >85 | 35.5 | 34 | 26 | 31 | 19.5 | 24 | 26 | 19 |
| Obesity BMI ≥ 95 percentile | 17.5 | 18 | 13.5 | 11.5 | 8 | 11 | 8 | 6 |

Note. BH=Bihor, HB= Hajdú-Bihar

Discussions

According to a study performed in Timișoara in 2004, the average height for boys of age 11-14 was 153.25 cm and for the same age category in Oradea in 2015 it was 157.64 cm. In 2004 in Timișoara the average weight for boys of age 11-14 from Timișoara was 41.82 kg and in Oradea for the same category of age, in 2015 it was 52.45 kg. The evolution regarding the prevalence of overweight and obesity in Romania seems to increase. According to a study performed in Dâmbovița in 2007 to a sample group of 718 subjects of ages between 10 and 16, the percentage of children with weight problems was 17.68% (Preda, 2011).

According to a study of Vălean et al., (2009) regarding the prevalence of overweight and obesity, performed in Cluj-Napoca to students of ages between 10-14, 22.54% of the subjects out of 2,568 subjects, had excessive nutrition disorders. According to a current study in Oradea 30% of the children are overweight or obese. Simultaneously with the increase of age, we also witness an almost continuous increase of the number of children with normal weight and the decrease of the number of overweight or obese children. The most spectacular decrease we can find in Hungarian students in the 8th grade, where the percentage of those with BMI > 85 percentile has gone under 20%. In a population of schoolchildren, the chronological variability of maturation depends on: the level of urbanization, environmental factors and individual factors. BMI is an indirect indicator to determine the adipose tissue. Due to the big differences between the biological

age and the chronological age, the body mass index cannot be considered an instrument of diagnosis. It is rather considered a screening indicator and for additional tests, we recommend using simultaneously the skinfold test or the analysis of the adipose tissue by bioimpedance.

Conclusions

The prevalence of overweight and obesity within the studied group had similar values in both neighbouring counties. The number of children with weight problems was higher among boys (136 cases) than among girls (119 cases) reaching a percent of 27.30 % of the sample group. This number exceeds by far the number of underweight children (42 subjects) representing 4.5%. We notice that the prevalence of overweight or obesity in Bihor decreases with age from 35.5% in 5th grade to 19.5% in 7th grade after which again it shows a tendency to increase reaching 26% in 8th grade. In middle school in Hajdú-Bihar this decrease is uninterrupted from 34% in 5th grade to 19% in 8th grade.

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