INTRODUCTION

World-wide organizations focus research to the infancy and early childhood development because adolescence is not considered vulnerable as previous two stages. But it is very complicated period of life (physical and cognitive growth and development) with high impact of risky behaviour and the deadlines for establishment of good practices including food habits. The study included 630 participants, 133 adolescents from the rural part (60 boys and 73 girls) and 497 adolescents from urban part (264 boys and 233 girls) of Canton Sarajevo. Participants were 13-15 years old. Anthropometric measurements were used: measurement of body weight and body height in order to calculate the BMI-for-age percentiles and skinfold thickness at four sites (biceps, triceps, subscapula, stomach) as additional parameters for determining category of nutritional status. Data were statistically analyzed using SPSS 13.0. Results show no statistical significance of the place of residence in relation to any tested parameter among girls. While among boys statistical significance was demonstrated in relation to the differences in the mean skin fold of subscapula (U = 6138.5, p = 0.02), stomach (U = 5847.5, p = 0.005), biceps (U = 6297.5, p = 0.038), triceps (U = 6161.5, p = 0.022), and mean values of measured four skinfolds (U = 7661.5, p = 0.007) where boys from rural areas have lower levels of skinfolds and lower mean of all four measured skinfolds. Results of BMI-for-age percentiles according to sex and the place of residence, show that normal weight is prevalent among adolescents in the Canton Sarajevo followed by overweight and obesity. Results indicate that adolescents in the urban part of Canton Sarajevo are thicker, there is higher number of overweight adolescents and among them is a higher percentage of adolescent girls.

Keywords: adolescents, place of residence, BMI-for-age, skinfold thickness.
whose BMI-for-age is between 90th-97th percentile are overweight. If the BMI-for-age is above the 97th percentile its’ childs’ or juvenile obesity.

OBJECTIVE

Because of the lack of data and the importance of maintaining optimal weight status during adolescence, objective of this research was evaluation of nutritional category of adolescents according to gender and type of settlement (urban or rural) in Canton Sarajevo, Bosnia and Herzegovina.

SUBJECTS AND METHODS

Subjects: The study included 630 participants, 133 adolescents from the rural part (60 boys and 73 girls) and 497 adolescents from urban part (264 boys and 233 girls) of Canton Sarajevo. Participants were 13-15 years old. Distribution of participants is accordant to the demographic data of the Federal Bureau of Statistics of the Canton Sarajevo (5).

Settlement: Research has been conducted in Canton Sarajevo. Since, Urbanistic Studies of the Sarajevo Canton are in its’ development, division of Canton Sarajevo by the type of settlement (urban and rural area) has been done according to the Spatial Plan of the Sarajevo Canton for the period 2003-2023 (6).

Methods: Anthropometric measurements included: measurements of body weight and body height; measurements of skinfold thickness at four sites (biceps- m. biceps brachi, triceps- m. triceps brachi, subscapula- subscapula, stomach- umbilicus) and calculation of BMI-for-age percentiles. Anthropometric measurements were conducted according to current methodology (7, 8). Data were statistically analyzed using SPSS 13.0.

RESULTS

BMI categories are presented in graph 1 and skinfold thickness in tables 1 and 2.

Graph 1 shows that normal weight is prevalent among adolescents in the Sarajevo Canton: 70.00% of boys from rural area is in a normal weight category as well as 58.33% of boys from urban area. 65.75% of girls from rural area as well as 54.98% in rural area are among normal weight category. Overweight follows normal weight: 20.00% of boys in rural areas are overweight as well as 24.24% in the urban area. There is 19.18% of overweight girls in rural area and 25.54% in urban area. Obesity is present among 10.00% of boys in rural and 14.39% of boys in an urban area and among 15.07% of girls in rural and 16.88% of girls in the urban part of Sarajevo Canton. Underweight category is not present among adolescents in rural part of Canton Sarajevo. It is present among 3.0% of boys and 2.60% of girls in urban part. Man Whitney test (U) showed that differences in the mean BMI-for-age among adolescent girls from urban and rural areas are not statistically significant (U = 7883.0, p = 0.402). BMI of rural girls, BMIr = 20.56 (18.53 - 23.13) is slightly lower than the BMI of urban girls, BMIu = 21.24 (18.93 - 23.77) but this difference was not statistically significant. Man Whitney test showed that differences in the mean BMI-for-age among adolescent boys in urban and rural areas are not statistically significant (U = 7111.5, p = 0.438). BMI-for-age of rural boys is BMIr = 20.07 (18.33 - 21.99) and is slightly lower than the BMI-for-age of adolescents in urban areas, BMIu = 20.25 (18.33 - 22.36) and is slightly lower than the BMI-for-age of adolescents in urban areas, BMIu =
20.78 (18.49 - 23.38), but this difference was not statistically significant.

There is no statistical significance of any of measured four skinfold thickness in girls in relation to type of settlement but thickness of three skinfolds: subscapula, biceps, triceps and mean four skinfolds is higher in urban adolescents (rural vs urbano: subscapula: 13.00 (11.00 - 17.50)mm vs 14.00 mm (11.00 - 19.00)mm; stomach: 20.00 (15.00 - 26.00)mm vs 19.00 mm (14.00 - 25.00) mm; biceps: 15.00 (12.00 - 20.00)mm vs 16.00 mm (12.50 - 20.00)mm; triceps: 18.00 (15.00 - 24.00)mm vs 20.00 mm (15.00 - 25.00)mm; mean of four skinfolds: 16.75 (13.75 - 20.63)mm vs 18.25 mm (14.00 - 21.63)mm).

Man Whitney test showed that the differences in the mean values of skinfolds: subscapula (U = 6138.5, \(p = 0.02\)), stomach (U = 5847.5, \(p = 0.005\)), biceps (U = 6297.5, \(p = 0.038\)), triceps (U = 6161.5, \(p = 0.022\)) and the mean value of the four skinfolds (U = 7661.5, \(p = 0.007\)) among adolescent boys in urban and rural areas are statistically significant. Where adolescents from rural areas have lower values of skinfolds and lower the mean of all four measured skinfolds (rural vs urbano: subscapula: 10.00 (8.00 - 12.00)mm vs 10.00 mm (9.00 - 15.00)mm; stomach: 19.00 mm (14.00 - 25.00)mm vs 14.00 mm (11.00 - 22.00)mm; biceps: 10.00 (6.00 - 15.00)mm vs 14.00 mm (8.00 - 15.25)mm; triceps: 12.00 (10.00 - 16.00)mm vs 14.50 (11.00 - 20.00)mm; mean of four skinfolds: 12.50 (9.75 - 18.25)mm).

DISCUSSION

There are mixed and conflicting evidences about the differences of children and adolescents from rural and urban areas. According to one study (9) of the total number of children in urban areas 44.0% are classified as overweight or at risk of overweight (20.0% overweight; 24.0% in the risk of overweight), and the remaining 56.0% had a BMI below 85th percentile. In a sample of children from rural areas 42.8% was considered overweight or at risk of overweight. According to the study, urban boys had a lower BMI than rural boys, with a mean BMI of 18.36 (15.00 - 21.63) for urban boys and 18.16 (15.00 - 21.63) for rural boys. The differences in the mean values of skinfolds: subscapula (U = 6138.5, \(p = 0.02\)), stomach (U = 5847.5, \(p = 0.005\)), biceps (U = 6297.5, \(p = 0.038\)), triceps (U = 6161.5, \(p = 0.022\)) and the mean value of the four skinfolds (U = 7661.5, \(p = 0.007\)) among adolescent boys in urban and rural areas are statistically significant. Where adolescents from rural areas have lower values of skinfolds and lower the mean of all four measured skinfolds (rural vs urbano: subscapula: 10.00 (8.00 - 12.00)mm vs 10.00 mm (9.00 - 15.00)mm; stomach: 19.00 mm (14.00 - 25.00)mm vs 14.00 mm (11.00 - 22.00)mm; biceps: 10.00 (6.00 - 15.00)mm vs 14.00 mm (8.00 - 15.25)mm; triceps: 12.00 (10.00 - 16.00)mm vs 14.50 (11.00 - 20.00)mm; mean of four skinfolds: 12.50 (9.75 - 18.25)mm).

There are mixed and conflicting evidences about the differences of children and adolescents from rural and urban areas. According to one study (9) of the total number of children in urban areas 44.0% are classified as overweight or at risk of overweight (20.0% overweight; 24.0% in the risk of overweight), and the remaining 56.0% had a BMI below 85th percentile. In a sample of children from rural areas 42.8% was considered overweight or at risk of overweight. According to the study, urban boys had a lower BMI than rural boys, with a mean BMI of 18.36 (15.00 - 21.63) for urban boys and 18.16 (15.00 - 21.63) for rural boys. The differences in the mean values of skinfolds: subscapula (U = 6138.5, \(p = 0.02\)), stomach (U = 5847.5, \(p = 0.005\)), biceps (U = 6297.5, \(p = 0.038\)), triceps (U = 6161.5, \(p = 0.022\)) and the mean value of the four skinfolds (U = 7661.5, \(p = 0.007\)) among adolescent boys in urban and rural areas are statistically significant. Where adolescents from rural areas have lower values of skinfolds and lower the mean of all four measured skinfolds (rural vs urbano: subscapula: 10.00 (8.00 - 12.00)mm vs 10.00 mm (9.00 - 15.00)mm; stomach: 19.00 mm (14.00 - 25.00)mm vs 14.00 mm (11.00 - 22.00)mm; biceps: 10.00 (6.00 - 15.00)mm vs 14.00 mm (8.00 - 15.25)mm; triceps: 12.00 (10.00 - 16.00)mm vs 14.50 (11.00 - 20.00)mm; mean of four skinfolds: 12.50 (9.75 - 18.25)mm).

Table 1. Skinfolds of girls by type of settlement

<table>
<thead>
<tr>
<th>Type of settlement</th>
<th>Skinfolds</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>Median</th>
<th>U</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>Subscapula</td>
<td>73</td>
<td>1.24</td>
<td>5.25</td>
<td>6.00</td>
<td>3.00</td>
<td>8.00</td>
<td>10.00</td>
<td>6138.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Rural</td>
<td>Stomach</td>
<td>73</td>
<td>1.45</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>5847.5</td>
<td>0.005</td>
</tr>
<tr>
<td>Rural</td>
<td>Biceps</td>
<td>73</td>
<td>1.39</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>6297.5</td>
<td>0.038</td>
</tr>
<tr>
<td>Rural</td>
<td>Triceps</td>
<td>73</td>
<td>1.34</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>6161.5</td>
<td>0.022</td>
</tr>
<tr>
<td>Rural</td>
<td>Mean</td>
<td>73</td>
<td>1.36</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>7661.5</td>
<td>0.007</td>
</tr>
</tbody>
</table>

Table 2. Skinfolds of boys by type of settlement

<table>
<thead>
<tr>
<th>Type of settlement</th>
<th>Skinfolds</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>Median</th>
<th>U</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>Subscapula</td>
<td>59</td>
<td>1.24</td>
<td>5.25</td>
<td>6.00</td>
<td>3.00</td>
<td>8.00</td>
<td>10.00</td>
<td>6138.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Rural</td>
<td>Stomach</td>
<td>59</td>
<td>1.39</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>5847.5</td>
<td>0.005</td>
</tr>
<tr>
<td>Rural</td>
<td>Biceps</td>
<td>59</td>
<td>1.34</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>6297.5</td>
<td>0.038</td>
</tr>
<tr>
<td>Rural</td>
<td>Triceps</td>
<td>59</td>
<td>1.24</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>6161.5</td>
<td>0.022</td>
</tr>
<tr>
<td>Rural</td>
<td>Mean</td>
<td>59</td>
<td>1.36</td>
<td>5.25</td>
<td>6.00</td>
<td>5.00</td>
<td>8.00</td>
<td>11.00</td>
<td>7661.5</td>
<td>0.007</td>
</tr>
</tbody>
</table>
risk of overweight (25.7% and 17.1% respectively), while the remaining 57.1% had a BMI below the 85th percentile. The differences between urban and rural samples in terms of percentage in each BMI category was not statistically significant (N = 135, χ² = 0.949, p = 0.622). Other study (10) examined differences in adolescents in urban and rural part of Italy, Pistoia, Tuscany, and the results showed that BMI was significantly higher in children from rural areas (p = 0.047), but there was no difference in the z-BMI (p = 0.072). The percentage of children with a BMI / 85th percentile is higher in rural (24%) than urban children (18%) (p = 0.012, Fisher’s Exact Test). Another study (11) examining the nutritional status of adolescents also in Italy (Emilia-Romagna) found that the prevalence of malnutrition among boys was quite stable (3.3 to 3.9%) among 11-13 years old, while a lower percentage was iat 14 year olds. Overweight participants were more common in the age of 11 years (35.2%) and this share is decreasing with age (18.7% at age 14), while the percentage of obese was quite stable with age.

For girls, the highest percentage of malnutrition was at 13 year old, and the lowest in 14 year-old. In boys, overweight and obesity decreases with age. The prevalence of overweight and obesity is higher in boys than in girls at all age groups, except in participants 11 year olds. Examining the nutritional status of adolescents in rural and urban areas of Cameroon (12) have proven that there is a significant difference between urban and rural adolescents by gender. BMI and overall skinfold are different although not significant.

Greater proportion of urban adolescents was above the WHO reference for body weight and height. Characteristics of urban children versus rural are: years (12.79 ± / 0.7 vs. 13.79 ± 1.1), body weight (45.39 ± / 8.5 vs 47.99 ± / 8.1), body height (152.29 ± / 9.3 vs. 152.99 ± / 8.4), BMI (19.49 ± / 2.1 vs 20.69 ± / 2.3), SFT in mm (10.19 ± / 4.8 vs 9.89 ± / 3.2), the SFSS mm (7.39 ± / 2.5 vs 6.39 ± / 2.5), SFB mm (8.89 ± / 3.0 vs 9.19 ± / 2.9), total skin fold in mm (33.19 ± / 11.6 vs 31.99 ± / 9.8). While examining obesity, energy intake and physical activity in urban and rural children of New Zealand (13) got results showing that rural children had significantly lower BMI and thinner skinfolds than urban children. The differences in skinfold thickness remained after controlling the race and socio-economic status. Furthermore, the boys from urban areas had 1.3 times more likely to become overweight or obese than boys from rural areas (95% CL 1.1-1.6, p <0.01), and girls from urban areas had 1.4 times more likely to become overweight and obese from rural areas (95% CL 1.2-1.7, p <0.01). A cross sectional study (14) among American adolescents has shown that rural children have higher levels of obesity (16.5%) compared to urban children (14.3%). This is supported by the study of children aged 8-12 years from the Midwestern state in America where more rural children were overweight (25.1%) compared to urban children (19.4%), and urban children were less active. Furthermore, the cross sectional study of Canadian children (11-15 years) found that the degree of overweight and obesity increase with increasing ‘rurality’ (15). In a study designed to assess psychiatric disorders among children from rural areas, it was found that overweight and risk of being overweight is 3-4 times more prevalent in the rural sample in comparison with national standards (16). In a study of direct comparison of rural and urban children (17), found that 29.5% of rural children in their sample were overweight compared to urban, 21.7%. In a study involving the children of New York found that the prevalence of the risk of overweight and obesity was 25% in a large sample of children (18).

There are two studies made in Canton Sarajevo, although, influence of residence was not examined, it is relevant to point out the available results: one study (19) found that students from fifth to eighth grade were malnourished (male vs female: 4.65% : 4.51%), normal weight (male vs female: 37.98% : 31.82%), overweight (male vs female: 7.49% : 5.19%) and obese (male vs female: 3.69%: 4.31%) and the other research was done among adolescents aged 13 to 15 years of age, showed that the largest percentage of adolescents was in the category of normal weight (50.5%), followed by the overweight 26.3% and obese with 10.2% (20).

CONCLUSION

Results of this study, although not showing statistical significance of BMI-for-age towards gender and type of settlement, differences in the categories are small between boys and girls who grow up in different environments, however there are more adolescents with normal weight in a rural area, and obese and overweight participants in urban area of Sarajevo Canton. It is interesting that in addition to greater overweight and obesity in urban area, category of malnutrition is present in 3.00% of boys and 2.60% of girls in urban, while there is no malnutrition in rural area.

Skinfold thickness at four sites and mean skinfold of adolescent girls from rural and urban areas of Sarajevo Canton have no statistical significance, though the BMI-for-age, and skinfold of subscapula, biceps, triceps and mean skinfolds are slightly lower in adolescent girls from rural areas. Statistical significance of type of settlement to the thickness of skinfolds at all four measured places (subscapula, stomach, biceps and triceps) and the mean of these four skinfolds was proven in boys, where adolescents from rural areas have lower values of skinfolds and a lower mean of all four measured skinfolds.
REFERENCES