Underweight, Overweight and Obesity among Moscow Schoolchildren

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Abstract School-age children and adolescents were examined (2010-2011). Totally we include in investigation 15067 Moscow schoolchildren from all Moscow regions, 7760 were boys and 7307 were girls. Height, weight and other anthropometric data were obtained from participants (6-17 years old). It was found that number of girls with overweight was higher 20% of population. Number of girls with obesity is growing up from age 6 to 9 years old. Number of boys with overweight was some lower than number of girls; it also was near 20% of populations. Number of boys with overweight was higher 20% of population. Number of girls with overweight was some lower than number of girls; it also was near 20% of populations. The greatest difference between groups with and without obesity was shown by the abdominal and subscapular skinfolds. It shows that cardiovascular risk factors appear along with obesity in childhood and adolescence.

Keywords: schoolchildren, obesity, Moscow

1. Introduction

Obesity in children and adolescents has become one of the most globally challenging medical problems [2,3,5,9]. Several serious consequences of excess weight occur in adults with the most common being cardio-vascular diseases and glucose metabolism disorders [4,8]. It has also been demonstrated that different deviations from a healthy condition have been observed [3,6].

2. Material and Methods

In 2010-2011 we include in investigation 15067 Moscow schoolchildren (7760 boys and 7307 girls). Written informed consent was signed by parents. The work was approved by local ethical committee of Moscow State University of Medicine and Dentistry.

Height (in centimetres) and weight (in kilograms) were directly measured in all participants. BMI (body mass index) was calculated for each of data pair. Derived data was analysed according to the World Health Organization growth charts, for gender and age (at the children last birthday) [7]. Participants were considered to be obese if their BMI was ≥ 95 percentile. Overweight was defined if the person had a BMI < 95 and ≥ 75 percentile. Those with a BMI ≥ 25 and < 75 percentile were considered to be the normal weight group. Based on statistical analysis, age groups with the highest level of overweight and obesity were established.

Anthropometric data used as additional information about body constitution due to international recommendations [1,7]. Subsequently they underwent further examination including waist circumference (WC) and hip circumference (HC), and skinfold thickness measurement. Indicated results were derived according to standard examination methods using a measuring tape (accurate to 1cm) and a calliper (accurate to 1mm). Skinfolds were measured in three standard points: triceps (TSF), subscapular (SSF), abdominal (ASF). TSF was assessed in the upper third of the upper arm’s back (posterior) surface. SSF was assessed at the end of the lower (inferior) angle of the shoulder-blade (scapula). ASF was done on umbilicus level along the midclavicular line.

Statistics included the Student’s T-test, Wilcoxon-Whitney U test and F-Test.

3. Results

We demonstrated that number of girls with underweight was about 5% in population (Table 1). From age of 10-13 years old numbers of girls with underweight growth up to twice. In boys group number of schoolchildren with underweight was just the same. Instead of girls, number of boys with underweight was stable. Only in age 14 years old we saw increasing number of boys with underweight.

Number of girls with overweight (without obesity) was higher 20% of population except age 16-17 years old. Peak number of girls with obesity registered in age 8-14 years old. In age 11, 13-14 years old number of girls with overweight was higher than 25%. Number of boys with overweight (without obesity) was some lower then number of girls; it also was near 20% of populations. The highest levels of overweight were registered in age 12-13 years old.
dominal obesity (1). In the age of 11-17 years old number of boys with obesity is growing up from age 6 to 9 years old. In age 9-11 years old girls' population we demonstrated the highest levels of obesity prevalence. Number of girls with obesity decreases from 11 to 17 years old. In 16-17 years old number of girls with obesity is lower then 5% of population. Number of boys with obesity is growing up from 6 till 11 years old. In age of 11 years old number of boys with obesity is higher then those in girls. In age 11-17 years old number of boys with obesity decreases.

According to data indicated above, the prevalence of obesity is the highest in male adolescents. Among them, the most prominent figures are registered during prepuberty and early puberty ages (10-13 years old). In the girls prepuberty age groups (9-10 years old) have the maximum levels of obesity. The subsequently pronounced lowering of obesity levels could be explained with its relationship to a puberty growth spurt.

Detailed anthropometric examination of students from groups with the highest levels of obesity revealed a significant difference between groups in the following indices. Among boys those are: WC, TSF, SSF, and ASF. A ratio of SSF to TSF (SSF/TSF index) significantly differed only in the group of boys with obesity. Among the groups of girls with the high obesity levels, a significant difference was detected for all of mentioned indices. Obtained data is presented in Table 2.

As can be seen from Table 2, the greatest difference between groups was shown by the abdominal and subscapular skinfolds for boys with obesity which is an increase of 428.3% (4.3 times) in ASF and 397.2% (4 times) in TSF. In girls, the difference between these indices was also the largest but less pronounced when compared to boys with an increase of 336.5% (3.4 times) in ASF and of 362.5% (3.6 times) in TSF. At the same time, the difference in SSF/TSF index was slightly higher in girls with obesity with an increase of 180.4% (1.8 times) compared to the girls with normal weight. In comparison in boys the difference is 155.6% (1.5 times). There’s almost no difference in absolute values between gender groups with obesity. Furthermore, the significant difference in SSF/TSF index for participants with overweight was found only in girls groups of 152.2% (16 times) and an insignificant increase in boys groups.

Thus, within students examined during the second phase of the study of obesity, the unfavourable tendency was an increase of indices which indicate centralization of distribution of adipose tissue. That shows that cardiovascular risk factors appear along with obesity in childhood and adolescence. In male groups the main increase was revealed for indices of abdominal obesity (WC, ASF). Where as in girls, the difference between an increases of various indices of central obesity is not as high or significant.

No significant difference between values of waist-to-hip ratio (WHR) in examined groups of peripuberty age with different BMI levels was found. Changes of HC in groups with different BMI also were not significant.

### 4. Discussion

Childhood obesity has become an epidemic on a worldwide scale [9] and it continues to increase [10]. Several serious consequences of excess weight occur in adults with the most common being chronic non-communicable diseases [1,2,3,4,5]. Anthropometric measurements as BMI are important for epidemiological investigations of obesity prevalence. Anthropometric indexes can best predict childhood obesity [1,7]. In the same time there is a lack of anthropometric data in schoolchildren in the Russian Federation. We established that in Moscow, for students aged 6 to 17 years old, obesity occurs mostly in the peripuberty period. Obesity prevalence is significantly higher in male adolescents than in female.

Detailed anthropometric examination of students demonstrated the greatest difference between groups by the abdominal and subscapular skinfolds. No significant difference between values of WHR in examined groups of

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### Table 1. Percent of girls and boys with underweight, overweight and obesity due to age

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Underweight</td>
<td>Overweight</td>
</tr>
<tr>
<td>6</td>
<td>2.6</td>
<td>22.5</td>
</tr>
<tr>
<td>9</td>
<td>3.5</td>
<td>24</td>
</tr>
<tr>
<td>10</td>
<td>3.2</td>
<td>22.6</td>
</tr>
<tr>
<td>11</td>
<td>3.8</td>
<td>23.9</td>
</tr>
<tr>
<td>12</td>
<td>2.7</td>
<td>27.2</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>28.4</td>
</tr>
<tr>
<td>14</td>
<td>7.4</td>
<td>23.6</td>
</tr>
<tr>
<td>15</td>
<td>3.1</td>
<td>22.1</td>
</tr>
<tr>
<td>16</td>
<td>2.8</td>
<td>19.8</td>
</tr>
<tr>
<td>17</td>
<td>2.2</td>
<td>19.8</td>
</tr>
</tbody>
</table>

### Table 2. Difference in Anthropometric Indices in Groups with Overweight and Obesity as Compared to Groups with Normal Levels of BMI

<table>
<thead>
<tr>
<th>Index</th>
<th>Boys</th>
<th>Girls</th>
<th>Boys</th>
<th>Girls</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC, cm</td>
<td>60.2 ± 3.4</td>
<td>53.6 ± 2.4</td>
<td>66.6 ± 3.7*</td>
<td>59.0 ± 2.4*</td>
<td>77.0 ± 8.1**</td>
<td>67.2 ± 6.7**</td>
</tr>
<tr>
<td>TSF, mm</td>
<td>6.8 ± 3.1</td>
<td>7.3 ± 2.8</td>
<td>11.6 ± 3.9*</td>
<td>11.1 ± 3.1*</td>
<td>17.4 ± 4.7**</td>
<td>14.2 ± 3.1**</td>
</tr>
<tr>
<td>SSF, mm</td>
<td>3.6 ± 1.7</td>
<td>3.2 ± 1.5</td>
<td>6.8 ± 3.1</td>
<td>7.4 ± 2.3</td>
<td>14.3 ± 3.1**</td>
<td>11.6 ± 4.2**</td>
</tr>
<tr>
<td>ASF, mm</td>
<td>5.3 ± 2.7</td>
<td>5.2 ± 3.3</td>
<td>12.6 ± 6.2*</td>
<td>9.3 ± 1.9*</td>
<td>22.7 ± 7.7**</td>
<td>17.5 ± 5.8**</td>
</tr>
</tbody>
</table>
| SSF/TSF index | 0.54 ± 0.17 | 0.46 ± 0.17 | 0.59 ± 0.14 | 0.70 ± 0.3* | 0.84 ± 0.24** | 0.83 ± 0.3** * - data with significant difference as compared to normal BMI group (p<0.05) ** - data with significant difference compared to groups with normal BMI and overweight groups (p<0.05)
peripuberty age with different BMI levels was found. WHR is widely used in adults to access central obesity and as a risk factor of different complications of obesity including cardiovascular ones [11]. However, limitations of WHR using for children population are discussed [12]. Ketel I.J.G. et al. (2007) reported that trunk skinfolds and WC are appropriate for assessment of central obesity (measured by computerized tomography). Peripheral skinfolds are the best index in peripheral fat deposition assessment. Whereas WHR had a weak correlation with computerized tomography’s parameters of adipose tissue assessment [13]. Semiz S. et al. (2008) showed that thickness of subcutaneous fat in the abdominal area is a better predictor of obesity in children of peripuberty age [14]. Hence it can be supposed that ASF, SSF and SSF/TSF indices can be more valuable in children for qualitative assessment of fat mass distribution by means of a calliper.

Obesity maximum prevalence shows unfavourable features due to the predominance of central obesity indices both in boys and in girls. The most significant growth registered in thickness of abdominal and subscapular skinfolds was in boys. Botton J. et al. (2007) supported that such foundation might be associated with the high-level cardiovascular risk factor [15].

The value of ASF and SSF as a tool for cardiovascular pathology risk factors assessment in urban students aged 9-13 was confirmed by correlative analysis. These parameters have the strongest correlation with all the others evaluated in this investigation. WHR didn’t show any significance in the assessment of obesity in persons of peripubertal age.

5. Conclusion

In Moscow students aged 6 to 17 years old obesity occurs mostly in peripubertal period. At the same time obesity prevalence is significantly higher in male adolescents than in female.

Obesity in named groups with its maximum prevalence shows unfavorable features due to predominance of central obesity indices both in boys and in girls. The most significant growth registered in thickness of abdominal and subscapular skinfolds was in boys (4.3 and 4 times accordingly). In male group abdominal obesity prevails in accordance with assessment of all investigated parameters, whereas in females distribution of subcutaneous adipose tissue is more even.

Value of ASF and SSF as tool for cardiovascular pathology risk factors assessment in urban students aged 9-13 was confirmed by correlative analysis – these parameters have the strongest correlation with all the others evaluated in this investigation. WHR didn’t show any significance in assessment of obesity in persons of peripubertal age.

References