PHYSICAL ACTIVITY, SOMATOTYPE AND BODY COMPOSITION

Katalin Tóth
Eötvös Loránd University, Budapest, Hungary

Introduction

Summarized under the term of positive secular trend, changes in the patterns of growth and maturation have associated to the urbanization of settlements, along with an improvement of public hygiene and education and a social restructuration of family life (Bodzsár, Susanne, 1998). However, also psychic stress has increased, the rhythm of everyday life has become faster and is accompanied by changes in the customary style of life. Of the changes diminishing habitual exercise and a more sedentary style of leisure time activity are the most characteristic ones. Children spend a growing fraction of their freetime watching TV and/or sitting before a computer. Progressing sedentary behaviour obviously means reduced energy expenditure. Missing regular exercise in childhood and adolescence affects unfavourably not merely the existing health status and mental/physical capacity of performance, but increases the risks of chronic adult diseases as well (Due et al., 2001).

The prevalence of overweight and obesity has shockingly increased in Hungary during the past decades. One of the reasons for it may be that the reduction in energy expenditure because of an inactive life style has not been accompanied by a decrease in energy intake (Bodzsár et al., 2005).

The purpose was to study the effect of habitual activity on body build and composition in a sample of prepubertal, pubertal and postpubertal cohorts. We hypothesized that habitual exercise intensity would have a significant effect on body build as well as on body composition, in particular on the amount of body fat. Such effects may be more conspicuous around puberty, because youth of this age are likely to have already acquired a fixed lifestyle inclusive of sport activities and leisure-time passions.

Subjects and Methods

The subsample of the 2nd Hungarian National Growth Study (Bodzsár 2003-2006) discussed in this paper is only representative of the children of Central Hungary aged between 7 and 18 years (Table 1). The sample (N boys= 2502, N girls= 2419) was taken from primary schools and various types of secondary and vocational training schools.

Anthropometric measurements observed the recommendations of IBP (Weiner, Lourie, 1969). Individual somatotypes were estimated by the Heath-Carter anthropometric method (Carter, Heath, 1990) by using the regression formulas of Szmodis et al. (Szmodis et al., 1976).

Body composition was assessed by the Drinkwater-Ross four fraction body mass model (Drinkwater, Ross, 1980).

Quantity of absolute subcutaneous fat was estimated by measuring 5 skinfolds each on the trunk (subscapular, axillary, chest, abdomen, supraspinale) and extremities (triceps, biceps, antebibrachiale, mid-thigh, calf).

Self-reported level of habitual exercise and leisure-time activity was obtained by a questionnaire (Table 2). The sample did not contain any qualified athlete.

In grouping by habitual exercise youngsters with a mean score of 1 to 1.9 were labelled as being physically inactive, 2 to 2.9 as average and 3 to 4 as physically active. In order to assess the effect of physical activity at the various ages, the age range of the sample was contracted into three age intervals as follows: prepuberty (ages 7–10), puberty (ages 11–15) and postpuberty (ages 16–18).

<table>
<thead>
<tr>
<th>N boys</th>
<th>age</th>
<th>N girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>211</td>
<td>8</td>
<td>222</td>
</tr>
<tr>
<td>248</td>
<td>9</td>
<td>194</td>
</tr>
<tr>
<td>217</td>
<td>10</td>
<td>228</td>
</tr>
<tr>
<td>242</td>
<td>11</td>
<td>274</td>
</tr>
<tr>
<td>251</td>
<td>12</td>
<td>233</td>
</tr>
<tr>
<td>211</td>
<td>13</td>
<td>247</td>
</tr>
<tr>
<td>207</td>
<td>14</td>
<td>231</td>
</tr>
<tr>
<td>207</td>
<td>15</td>
<td>202</td>
</tr>
<tr>
<td>223</td>
<td>16</td>
<td>162</td>
</tr>
<tr>
<td>222</td>
<td>17</td>
<td>148</td>
</tr>
<tr>
<td>141</td>
<td>18</td>
<td>131</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2502</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2419</td>
</tr>
</tbody>
</table>

197
INTENSIVE COURSE IN BIOLOGICAL ANTHROPOLOGY
1st Summer School of the European Anthropological Association
16–30 June, 2007, Prague, Czech Republic

Table 2. Questionnaire on habitual activity.

1. In addition to the PE classes at school the activities that make me sweat or get out of breath (sport, work, dance, etc.) usually occur:
   - less than once a week (1 point)
   - once a week (2 points)
   - 2-4 times a week (3 points)
   - day by day (4 points)
2. Remembering the last seven days, the number of days when I exerted myself for at least 60 minutes, was:
   - 0-1 day (1 point)
   - 2-3 days (2 points)
   - 4-5 days (3 points)
   - 6-7 days (4 points)
3. I am engaged in sport(s) in addition to the PE classes at school:
   - no (2 points)
   - yes (4 points)
4. If the answer to the previous question was yes: The weekly hours I do physical training is:
   - 0-4 (1 point)
   - 5-9 (2 points)
   - 10-14 (3 points)
   - 15-25 (4 points)
5. I think my endurance is:
   - poor (1 point)
   - average (2 points)
   - good (3 points)
   - excellent (4 points)
6. The usual number of hours when I watch TV or video on school days:
   - more than 3 hours a day (1 points)
   - about an hour a day (2 points)
   - less than one hour a week (3 points)
   - none at all (4 points)
7. The usual number of hours when I watch TV or video on the weekends:
   - more than 3 hours a day (1 points)
   - about an hour a day (2 points)
   - less than one hour a week (3 points)
   - none at all (4 points)

Results

Habitual physical exercise and leisure-time activity

The occurrence of those living an active life was the lowest in all the three age intervals and in both sexes (Table 3). Patterns of involvement in physical activity across age were found to be similar for the different levels of habitual exercise in boys. In girls the occurrence of active youth reduced while that of the inactive ones increased with advancing age. The level of habitual exercise of the girls lagged behind that of the boys.

In what follows we only report on the comparisons between the groups labelled active respectively inactive.

Table 3. Inactive and active subjects by sex and age.

<table>
<thead>
<tr>
<th>Age</th>
<th>Physical Activity</th>
<th>Boys n</th>
<th>Boys %</th>
<th>Girls n</th>
<th>Girls %</th>
</tr>
</thead>
<tbody>
<tr>
<td>prepuberty inactive</td>
<td>198</td>
<td>24.8</td>
<td>181</td>
<td>22.9</td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>517</td>
<td>64.8</td>
<td>547</td>
<td>69.2</td>
<td></td>
</tr>
<tr>
<td>active</td>
<td>83</td>
<td>10.4</td>
<td>63</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>puberty inactive</td>
<td>303</td>
<td>27.1</td>
<td>345</td>
<td>29.1</td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>669</td>
<td>59.8</td>
<td>726</td>
<td>61.2</td>
<td></td>
</tr>
<tr>
<td>active</td>
<td>146</td>
<td>13.1</td>
<td>116</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>postpuberty inactive</td>
<td>178</td>
<td>30.4</td>
<td>158</td>
<td>35.8</td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>313</td>
<td>53.4</td>
<td>253</td>
<td>57.4</td>
<td></td>
</tr>
<tr>
<td>active</td>
<td>95</td>
<td>16.2</td>
<td>30</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1003</td>
<td>100</td>
<td>893</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Somatotype

The distribution of the individual two-dimensional somatopoints for active and inactive youth among the Carter categories of somatotype differed by physical activity in the group of prepubertal ($\chi^2 = 0.001$, $p<0.05$) and postpubertal boys ($\chi^2 = 0.004$, $p = 0.05$) and pubertal girls ($\chi^2 = 0.025$, $p = 0.05$) (Fig. 1). In comparing the body masses of the three components of the somatotype a marked difference between the activity level subgroups was only found in endomorphy: the body mass of endomorphy of the inactive boys in prepuberty and postpuberty and that of the inactive girls in puberty was significantly higher than in the active ones (Fig. 2).
**Body composition**

In fractionating body mass the shares of all four components differed significantly between prepubertal active and inactive boys, active ones having less relative fat and more muscle and bone. In puberty relative muscle mass only differed in favour of the active boys. In postpuberty active boys had significantly less fat in addition to more relative muscle mass.

In the fractions of the girls the activity groups differed only at puberty: active girls had more relative muscle and less relative fat (Fig. 3).

**Subcutaneous fat layer**

The analysis of underskin fat stores confirmed the results treated above: physically more active ones had thinner fat layers on both the trunk and the extremities in all the three age intervals and in both sexes. The differences were everywhere larger in the boys while in the girls they were more marked on the trunk (Fig. 5).
**Conclusions**

The study showed that differences in lifestyle and physical activity in the examined developmental stages exerted an effect mainly on body fat. Active boys had significantly less fat in prepuberty and postpuberty, but there were no difference in puberty. The reason can be that there might be remarkable differences in the timing of the mobilisation of fat stores that can suppress the effect of physical activity. Active girls had significantly less fat in puberty, but not in pre- and postpuberty. That can be caused by the lower activity level and the weight control after puberty that can be typical for all activity subgroups.

A more active lifestyle squarely braked the accumulation of fat but we got contrary results about the effects on bone and muscle. While the mesomorphy component of the somatotype did not show changes by activity level subgroups, the Drinkwater-Ross body component model showed positive effects on bone and muscle in the active subgroups.
The reason for this fact is, on the one hand, that the groups of physical activity were not distinct enough (the active group did not contain any qualified athlete). On the other hand, there was no basic difference between the dietary regimes of the groups, both had an acceptable nutritional status so the differences in body fatness could be fully attributed to the differences in energy balance, primarily to the extent of calorie intake. Estimating the quantitative effect of physical activity on body composition in respect of energy intake might be an aim of further research.

References


Mailing address: Katalin Tóth
Eötvös Loránd University, Pázmány Péter sétány 1/c, 1117 Budapest, Hungary
kataka1001@yahoo.com