INTRODUCTION

In addition to the metabolic and cardiac diseases, already well documented, the obesity affects the musculoskeletal development and may have long-term implications during adulthood. When compared to normal-weight children obese children have showed poor motor competence [1]. However, it is not clear how overweight and obesity affect the postural balance during childhood and early adolescence. Increased instability and major dependency on vision system have been reported [2,3]. On the other hand, some investigations have found no differences between normal-weight and obese children balance during the quiet standing posture [4,5]. Therefore, the purpose of this study was to verify the association between postural balance and age from 7 to 14 years-old in obese, overweight and normal weight children.

METHODS

The postural balance of 438 subjects from 7 to 14 years-old (201 normal weight, 136 overweight and 101 obese) was assessed. They were divided into four age groups (7-8, 9-10, 11-12 and 13-14) for each three weight status groups (normal weight, overweight and obese) using Cole et al [6]. An AMTI AccuSway Plus force plate at a frequency of 100Hz was used to measure the anterior-posterior amplitude (COPap), medio-lateral amplitude (COPml), mean velocity (COPvel) and 95% area of the ellipse (COParea). The subjects were tested for three trials (30 s) standing in comfortable feet apart and eyes open. The normal data distribution was verified by Kolgomorov-Smirnov test while Pearson correlation coefficient was used to verify association between age and COP parameters for each weight status group. Differences between weight status groups were verified using analysis of variance test. Pairwise comparisons were performed using Tukey post-hoc test (p<0.05).

RESULTS AND DISCUSSION

Figure 1 and Figure 2 provide descriptive statistics for COPvel and COParea. As to be expected, balance becomes better as age increases. Obese group had significant (p<0.01) greater sway for 13-14 years-old than normal weight and overweight groups only for COParea. There is no other significant difference between groups. For COParea the variability is higher than for COPvel mainly for 7-8 years-old group.

Figure 1: COPvel (mean ± sd) by age for weight status groups.

Moderate correlations are found between age and balance variables for normal weight and overweight groups as shown in Table 1 while obese group had poorest correlation with no-significant values for COParea, COPml and COPap. COPvel showed stronger correlation with age than the other measures for all groups. COPml is more associated...
with age than COPap for normal weight and overweight groups.

Figure 2: COParea (mean ± sd) by age for weight status groups.

An increase in body weight has been correlated to a decrease in balance stability [2,3,7]. However, our results did not indicate this same situation. Significant differences were found between obese and normal weight groups and obese and overweight groups only for 13-14 years-old group in COParea. On the same way has not been found any clear underlying sensory organization impairments that may affect standing balance performance in overweight children compared to normal weight peers [4].

Body weight was found to correlate with COPap parameters and not with COPml parameters in adults males and females [7]. However, our results showed better association of age 7 to 14-years with COPml than COPap parameters.

Similar with others studies about the effect of obesity on balance in children, postural balance was measured during quiet double leg stance using natural base of support. This less challenging foot position might explain the absence of BMI group differences. Significantly lower motor coordination in overweight and obese children when compared to normal-weight children on more dynamic situations support this idea [1].

CONCLUSIONS

According our results balance improves from 7 to 14-years-old in a similar way in normal weight, overweight and obese children for quiet standing double leg posture. It seems related more with age than with weight status. COPvel and COPml has stronger association with balance than COPap for normal-weight and overweight children on this age.

REFERENCES


Table 1: Pearson’s coefficient correlation values between age and COP variables.

<table>
<thead>
<tr>
<th></th>
<th>COP_Vel</th>
<th>COP_Area</th>
<th>COP_ML</th>
<th>COP_AP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal-weight</td>
<td>(n=201)</td>
<td>-.40*</td>
<td>-.39*</td>
<td>-.41*</td>
</tr>
<tr>
<td>Overweight</td>
<td>(n=136)</td>
<td>-.51*</td>
<td>-.42*</td>
<td>-.47*</td>
</tr>
<tr>
<td>Obese</td>
<td>(n=101)</td>
<td>-.37*</td>
<td>.12</td>
<td>-.18</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.01 level (2-tailed)