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Introduction

Attention serves as a basic set of mechanisms that underlie our awareness of the world and the voluntary regulation of our thoughts and feelings (Posner & Rothbart 2007). Numerous studies have shown differences in attention and executive functions in overweight children and adolescents. We advanced these findings in overweight adolescents in comparison to healthy controls by studying the functioning of various components of attention using the Attention Network Test (ANT). This test enables us to assess separate attention networks engaged in "alerting," "orienting," and "conflicting." In addition, we investigated the modulating effect of depression on these networks.

Experimental Groups

The sample comprised 19 adolescents with a mean age of 14.9 years (11 girls, 8 boys). The degree of overweight was assessed via body mass index (BMI) at the time of testing. Regarding the percentiles, 9 adolescents reached higher values than 90% (5.5, 6.4, and therefore were overweight, 10 years of a NORMAL WEIGHT (< 90% percentile; 6.7, 4.4).

Methods

In the ANT, a fixation cross remains on the screen the whole time. After 400-1500 ms, a cue appears for 100 ms in most of the trials, followed by the target after 400 ms in which only the fixation cross is visible again. The subject’s task is to indicate the pointing direction of the target arrow with a single button press. The target is either flanked by two black dashed lines or by black arrows (Fig. 2(a)). In addition to these flanker conditions, four different cue conditions are employed (Fig. 2(b)). To gain information about the efficiency of the three attention networks, mean RTs of the different cue conditions are subtracted from each other (Fig. 2(c)). In addition to using the ANT, depression was measured using the depression inventory for children and adolescents (DIKJ, Stiensmeyer-Pelster et al., 2000).

Results

Network Score Results

Whereas no group effect was observed for the orienting network score (p > .10), overweight adolescents exhibited reduced "alerting" and "conflicting" performance, compared to adolescents of normal weight. Overweights also exhibited significantly increased depression ((t(17)=1.771; p<.05 (one-sided)). Additionally, the depression score in the overall sample correlates significantly with an impaired "alerting" function (r=.392; p<.05).

The Alerting Network Score

![Alerting Network Score](image)

<p><sup>.01</sup></p>

The Conflicting Network Score

![Conflicting Network Score](image)

Correlations between depression (DIKJ) and the three network scores

<table>
<thead>
<tr>
<th>Depression</th>
<th>Alerting</th>
<th>Orienting</th>
<th>Conflicting</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIKJ</td>
<td>-.353</td>
<td>-.106</td>
<td>.392*</td>
</tr>
</tbody>
</table>

Discussion

- Overweight adolescents showed severe impairments in attention, especially in the alerting and conflicting network. Overweight subjects displayed a higher alerting network score and a higher conflicting network score, compared to normal weight subjects.

- Previous studies demonstrated that also children with ADHD had specific deficits in the alerting and conflicting attention networks, but normal functioning of the orienting network (Johnson et al., 2008).

- During the past decade, we have become increasingly aware of strong associations between overweight/obesity and symptoms of attention deficit/hyperactivity disorder (ADHD) in children, adolescents, and adults (Davis, 2010).

- Our study demonstrated that both syndromes share deficits in two basic attentional mechanisms which may lead to an overscanning syndrome in an obesogenic food environment.

- Surprisingly, depression scores highly selectively correlated with the alerting network score. This result needs further investigation.

Conclusion

- The study shows associations between the functioning of the attention networks and overweight and depression in adolescence, thereby suggesting new perspectives for research on the interactions between various mechanisms in the development and perpetuation of overweight in adolescence.

References


