

English summary

Background

The prevalence of childhood overweight and obesity has increased markedly in most countries over the past three decades. As of 2013, the prevalence of overweight and obesity in Denmark was estimated as being up to 19.7% in boys and 19.4% in girls. Obesity is not only associated with low-grade inflammation and increased risk of cardiovascular disease (CVD), but also may be associated with poor cognitive function, especially executive function. Furthermore, obese children had an increased risk of obesity and CVD in adulthood. Differing types of camp-based interventions have been used for obesity intervention among children and adolescents. The existing studies of camp-based obesity interventions have demonstrated promising results in improving body composition in children and adolescents. However, previous studies have had some general limitations, such as lack of follow-up and control group. To the best of our knowledge, the effects of camp-based obesity interventions on cognitive function and inflammatory markers have not yet been evaluated.

Brain-derived neurotrophic factor (BDNF) plays an important role in exercise-induced improvements in brain and cognitive function. Few studies have examined the effects of physical activity or obesity intervention programs on BDNF in children.

Purpose

This dissertation consists of a review and an intervention study.

The purpose of the review was to summarize the effects of physical activity and exercise on peripheral BDNF in healthy humans.

The main purpose of the intervention study was to evaluate the effects of a one-year multi-component day camp intervention program on:

- 1) Low-grade inflammation in overweight and obese children;
- 2) Cognitive function in overweight and obese children.

Methods

Review paper

Experimental and observational studies were identified from PubMed, Web of Knowledge, Scopus, and SPORTDiscus. The search terms used to find the studies were variants of (a) physical activity (e.g., physical activity, physical education, training, physical fitness, and exercise) and (b) BDNF.

Intervention study

One hundred and fifteen children aged 12 years were recruited. The participants were randomly allocated to either the Day Camp Intervention Arm (DCIA) or the Standard Intervention Arm (SIA). The intervention for the DCIA comprised two parts: an intensive 6-week day camp intervention and a subsequent 46-week family-based intervention program. Children in the SIA were offered one weekly fun-based physical activity session (approximately two hours) for 6 weeks and one educational meeting. Anthropometrics, cognitive function, and inflammatory makers were measured at baseline, 6 weeks, and 52 weeks.

Results

Review paper

Thirty-two articles were included in the review. Despite inconsistent findings, evidence from interventional studies suggested that peripheral BDNF concentrations were elevated by acute and chronic aerobic exercise. The results from most observational studies suggested an inverse relationship between the peripheral BDNF level and habitual physical activity or cardiorespiratory fitness. The majority of the studies suggested that strength training had no influence on peripheral BDNF.

Intervention study

Low-grade inflammation: Compared with the SIA, the reduction in C-reactive protein (CRP) was larger in the DCIA at 6 weeks. The reduction in leptin was larger in the DCIA at 6 weeks. The intervention effect of the 6-week day camp on leptin, but not CRP, was explained by the changes in body fat mass. No significant between-group differences were found in the changes of adiponectin and monocyte chemoattractant protein-1 (MCP-1) at either 6 weeks or 52 weeks.

Cognitive function: At 6 weeks, the improvement in visuospatial construction skill was larger in the DCIA than the SIA. At 52 weeks, the improvements in emotional control and monitoring were larger in the DCIA than the SIA. No significant between-group differences were found in the changes in visuospatial memory and the Stroop color word test (SCWT) interference score at either 6 weeks or 52 weeks.

Conclusions

The findings of the studies included in the review were not consistent. More research is needed to examine the relationship between physical exercise and peripheral BDNF. The 6-week day camp intervention may improve low-grade inflammation in children, indicated by decreased CRP and leptin, whereas no intervention effects on inflammatory markers were seen at 52 weeks. The multi-component overweight intervention program may benefit cognitive function in children, as indicated by improved visuospatial construction skills at 6 weeks and improved emotional control and monitoring at 52 weeks. More research is needed to provide further support for the beneficial effects on cognitive function and low-grade inflammation as results from participating in physical activity or obesity intervention programs in youth. In

addition, further studies are needed in order to investigate the effects of physical activity and weight-loss on BDNF in children.