

Cardiovascular and metabolic control in obese children and adolescents

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av

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Avhandlingen baseras på följande delarbeten:

- I: **Dangardt F**, Osika W, Volkmann R, Gan LM, Friberg P. Obese Children Show Increased Intimal Wall Thickness and Decreased Pulse Wave Velocity. *Clinical Physiology and Functional Imaging*. doi: 10.1111/j.1475-097X.2008.00806.x
- II: **Dangardt F**, Volkmann R, Osika W, Zafar M, Nilén K, Marild S, Friberg P. Cardiac Autonomic Function in Obese Children. *Submitted*
- III: **Dangardt F**, Osika W, Chen Y, Nilsson U, Gan LM, Gronowitz E, Strandvik B, Friberg P. Supplement with Omega-3 Fatty Acids Improves Endothelial Function in Obese Adolescents. *Manuscript*
- IV: **Dangardt F**, Chen Y, Gronowitz E, Dahlgren J, Friberg P, Strandvik B. Improved Insulin Sensitivity with Omega-3 Fatty Acid Supplementation in Obese Adolescent Girls. *Manuscript*

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Abstract

Childhood obesity is an emerging risk factor for disease and mortality worldwide. The cardiovascular consequences and prevention thereof need to be further investigated. Exercise and weight loss are well examined and effective in the prevention of cardiovascular risk, but warrant well motivated patients with strong social support. The benefits of a diet rich in marine essential (n-3) fatty acids on cardiovascular risk in adults such as prevention of arrhythmias, lowering blood pressure and heart rate, decreasing platelet aggregation and lowering triglyceride levels are well known.

The aims of this thesis were to characterize the vascular changes and cardiac autonomic function in obese children compared to lean subjects and to test whether supplementation with n-3 fatty acids may improve the vascular and metabolic risk profile in obese adolescents.

Very high resolution ultrasound, pulse wave velocity measurements, baroreceptor sensitivity measurements and exercise tests were performed in order to characterize vascular changes and autonomic control in obese compared to lean children and adolescents. Supplementation with 1,2 g/day of n-3 fatty acids was tested in a randomized, placebo-controlled trial with a double-blind, cross-over design. Blood samples and anthropometric measurements were taken before the start of treatment and after each 3 month treatment period. At the end of each treatment period, muscle and adipose tissue biopsies were obtained; insulin sensitivity and vascular function were tested.

Obese children show increased intimal wall thickness in radial artery, increased vascular diameter in peripheral arteries and decreased pulse wave velocity compared to lean subjects. Obese children and adolescents also show cardiac autonomic dysfunction in terms of decreased baroreceptor sensitivity, decreased maximal exercise heart rate and greater heart rate increase during the first minute of exercise, indicating moderate cardiac autonomic dysfunction. After 3 months supplementation with marine fatty acids, n-3 fatty acid content of phospholipids in serum, skeletal muscle and adipose tissue increased. Vascular function measured as vasodilatory response to hyperaemia was improved, and the number of lymphocytes and monocytes was lowered. In females, insulin sensitivity and glucose tolerance improved after n-3 fatty acid supplementation.

In conclusion, obese children show signs of increased risk for cardiovascular disease in terms of increased intimal wall thickness and cardiac autonomic dysfunction. It is possible to modify this increased risk in obese adolescents by supplementing with n-3 fatty acids, which improves vascular function, decreases subclinical inflammation and improves insulin sensitivity.

Key words: Obesity, children, omega-3 fatty acids, atherosclerosis, ultrasound, insulin

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