Early cardiovascular prevention: Does physical fitness and activity affect arterial structure and function in children?

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OBJECTIVES: The main objectives of this study were to investigate, if physical fitness and physical activity are associated to arterial structure and function in children.

METHODS: 119 children (53 girls) aged in the median 12.3 years, IQR 11.9 – 12.9 years and median body mass index standard deviation score (BMI-SDS) of 0.06 (IQR -0.93 - 1.18). All children had ultrasound sonography (ProSound alpha7, Hitachi/Aloka) on carotid intima-media thickness (cIMT), arterial compliance and stiffness. Brachial flow-mediated dilatation (FMD) was measured using a continuous eTRACKING mode, analyzing changes in blood flow velocity and arterial diameter at baseline, ischemia and vasodilatation (Prosound alpha 6, Hitachi/Aloka). Physical fitness was tested via a symptom limited pulmonary exercise test on a bicycle ergometer (Geratherm Respiratory, Ganshorn Medical, Germany). Physical activity was assessed using GT3x accelerometers (Actigraph, USA).

RESULTS: No significant relations between cIMT and physical fitness as well as physical activity revealed. However, physical fitness was inversely correlated to carotid (r=-0.246; p=0.012) and brachial (r=-0.208; p=0.036) stiffness indices. Time in sedentary lifestyle was inversely correlated to carotid arterial compliance (r=-0.210; p=0.034), whereas time in high intensive activity level was negatively correlated with the brachialis stiffness (r=-0.286; p=0.004). Furthermore sex differences revealed. Girls demonstrated higher arterial stiffness and lower arterial compliance than boys.

CONCLUSIONS: This research is suggestive of the fact that physical fitness as well as physical activity have an affect on arterial function but not on arterial structure. Girls seem to be at higher atherosclerotic risk than boys due to less physical activity, demonstrating higher arterial stiffness and lower compliance. Further research need to clarify the mechanisms of early endothelial (dys)-function and the impact of physical fitness on them.