

# Physical activity in school may not just improve metabolic health but also cognitive function

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Well designed school based physical activity interventions have proven successful in improving health (1). Many studies have found substantial changes in cardiovascular (CVD) risk factors (2), and it seems that greater improvements are found in the children who need it most (3). It is therefore surprising that most countries only have two compulsory physical education lessons per week (4). One reason for politicians to be reluctant in increasing physical education could be a fear of using more school time on PE and less on theoretical subjects. This is despite the fact that no interventions have shown decreased grades in theoretical subjects in the intervention group even if number of theoretical lessons decreased. It is therefore necessary to increase the knowledge of the association between physical activity and cognitive function (1).

Recently, a study including 1.3 million Swedish military conscripts born 1950-76 analyzed the association between cardiorespiratory fitness (CRF) and four different types of cognitive function as well as the job and salary they got later in life (5). Among the conscripts 268,496 were siblings, 3,147 were twins, and 1,432 monozygotic twins. The authors found a positive cross sectional association between CRF and cognitive function at the age of 18 years, and an increase in CRF from age 15-18 years was associated with higher intelligence. The CRF as 18 year old was associated with better job and higher salary later in life. These associations were found even in monozygotic twins, and there was a close relationship between the difference in CRF and difference in cognitive function in monozygotic twins. Others have shown that increased physical activity has both an acute (6) and more lasting (7) effect on cognitive parameters.

The mechanism behind the observed improvement in cognitive function is still unclear. Results from a study of Coras et al indicate the ability to remember new impressions is related to the regenerative capacity in hippocampus and improves synaptic plasticity (8;9). A study of Erickson et al found an association between serum brain derived neurotrophic factor (BDNF), the size of hippocampus and memory (7), and exercise training increased the size of anterior hippocampus. BDNF is a member of the neurotrophic factor family that plays a key role in regulating synaptic plasticity, neuronal survival, differentiation, and learning and memory (10). The effect of physical activity on BDNF has also been shown in several human studies (11-13).

Of interest is that BDNF is associated with inflammatory markers and insulin sensitivity, and lower levels of BDNF have been found in obese subjects compared to normal weight (14). Many studies have been conducted in children where metabolic health parameters have been measured in order to study health effects of physical activity. Cardiovascular risk factors are important and they are the primary health outcomes used in studies of children. It has been shown that CVD risk factors cluster in children with low physical activity level, low CRF or obesity (15;16). However, if good evidence existed showing that physical activity interventions could improve BDNF and cognitive function in children, this would further strengthen the importance of children being physically active.

BDNF can be measured in serum with conventional methods and it is suggested that this protein is analyzed in future studies or in existing blood samples from better designed physical activity interventions as a biological marker of cognitive function. If evidence of improved cognitive function and this biological marker is gathered in school based interventions, politicians may eventually recognize the importance of increasing physical education and other physical activity in school.

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