Annotated bibliography: effect of exercise on motor skills and cognition of pre-a...

Annotated Bibliography

(Updated/Edited)PICO: In pre-adolescent children, how does exercise affect the development of motor skills and cognitive function compared to being sedentary?

Introduction:

Pre-adolescence is a crucial time for growth and development. Throughout childhood, motor, cognitive, and social skills are continuously developing. Advancements in these areas occur with play, socializing, exercise, and classroom work. It is well known that physical activity has positive effects on physical and mental health. With the advancements in technology over the past few years, children have become increasingly sedentary. Campaigns have been started throughout the country to get children active again, such as “ NFL Play 60” and Michelle Obama’s “ Let’s Move”. These campaigns aim to improve overall health and decrease obesity risk in children. Could exercise and activity levels of children affect not only obesity risk and general health, but also development of motor skills and cognitive function?

1. Ferrer-Uris B, Busquets A, Angulo-Barroso R. Adaptation and Retention of a Perceptual-Motor Task in Children: Effects of a Single Bout of Intense Endurance Exercise. *Journal of Sport & Exercise Psychology* . 2018; 40(1): 1-9. http://search. ebscohost. com/login. aspx? direct= true&db= s3h&AN= 128866572&site= ehost-live. Accessed October 18, 2019.

This study looked at how acute intense exercise affects adaptation and retention of a perceptual-motor task in children around the age of 9. They also assessed if the order of exercise and learning task affects consolidation. Consolidation occurs when the acquired information becomes long-term memory. It has been found there is greater cognitive performance in children with higher fitness levels. High-intensity exercise doesn't affect the adaptation of a tracking task, possibly due to fatigue. They also found that low-intensity exercise has little effect on cognitive performance, moderate-intensity causes the greatest benefits, and excessive-intensity has a negative effect. The improvement in cognitive performance following moderate-intensity exercise may be due to increased arousal and elevation of catecholamine secretion. The maximal amount of motor-memory consolidation was achieved when exercise was performed before motor adaptation. Stimulating motor-memory consolidation through acute exercise can strengthen motor learning in children.

2. Lambrick D, Stoner L, Grigg R, Faulkner J. Effects of continuous and intermittent exercise on executive function in children aged 8-10 years. *Psychophysiology* . 2016; 53(9): 1335-1342. doi: 10. 1111/psyp. 12688.

This study examined how acute exercise affects executive function causing enhancement of school performance in prepubescent children. The effects of acute continuous and acute intermittent, moderate-intensity treadmill exercise were examined. The relationship between cognitive performance and exercise intensity is represented as an inverted U, meaning optimal cognitive performance is during moderate-intensity exercise. One group ran

continuously for 15 minutes, while the other group ran 2. 5 minutes at a time for a total of 15 minutes. They found that an acute bout of exercise, whether it is continuous or intermittent, improves executive function in children. The effects of exercise are maintained for ≤ 30 minutes after exercise stopped. It's highly recommended that children be active during school recess.

3. Lundbye-Jensen J, Skriver K, Nielsen JB, Roig M. Acute exercise improves motor memory consolidation in preadolescent children. *Frontiers in Human Neuroscience* . 2017; 11. https://search. ebscohost. com/login. aspx? direct= true&db= psyh&AN= 2017-17997-001&site= ehost-live. Accessed October 18, 2019.

This study investigated motor memory consolidation in preadolescent children, specifically ethnically diverse children from 3 rd and 4 th grade. They looked into if exercising after practicing motor skills in school could improve motor memory retention long-term. They also wanted to see if the types of acute exercise make a difference on amount of motor memory and skill learning. For this study, the children practiced a novel motor task and followed it with either resting, playing floorball, or running for 20 minutes. They made the intensity of the exercise performed after the motor task relatively high, since some studies have shown that high intensity after learning leads to a larger effect. They also chose floorball and running because they are common in school-settings. They gathered the children's average heart rate and peak heart rate during the high intensity exercise. Retention was tested 1 hour, 24 hours, and 7 days following the child's first practice of the motor task. The results showed that 20 minutes of exercise performed after practicing a motor task improves long-term motor memory.

Exercise helps retention after skill learning with motor memory consolidation. Long-term memory was enhanced in both the floorball and running exercise groups, indicating how the type of exercise most likely doesn't matter as much as timing, intensity, and duration of exercise. In this study, there was a short delay between motor practice and exercise, which is important for consolidation. The motor memory improvements can appear long after the performance and exercise. Motor performance was most enhanced in the exercise groups 7 days later. There was a negative effect on the running group one hour after the motor practice, but all of the other retention tests showed the exercise groups to have better effects. These positive effects of motor learning and memory consolidation can be accomplished in schools.

4. Mavilidi MF, Ruiter M, Schmidt M, et al. A narrative review of school-based physical activity for enhancing cognition and learning: The importance of relevancy and integration. *Frontiers in Psychology* . 2018; 9. doi: 10. 3389/fpsyg. 2018. 02079.

This narrative review looks into the enhancement of cognition and learning through physical activity. Chronic exercise causes changes in the brain structures that are important for learning and memory. Acute exercise enhances cognitive performance by activation of neurochemical responses. It's been found that activity breaks in the classroom between lessons either have positive effects or have no adverse effects on cognitive function and academic performance. In one study, preadolescents performed better on attention and control after 20 minutes of walking compared to those who remained seated.

5. Bidzan-Bluma I, Lipowska M. Physical Activity and Cognitive Functioning of Children: A Systematic Review. Int J Environ Res Public Health. 2018; 15(4): 800. Published 2018 Apr 19. doi: 10.3390/ijerph15040800

This article presented studies demonstrating the influence between physical activity and health, especially involving sports and cognitive functions. The goal of the research was to raise awareness of the significance of the problem of children becoming more sedentary and neglecting the physical activity needed for development. Limited physical activity leads to posture problems, somatic conditions, obesity, and even premature death. Research also suggests that lack of physical activity is associated with mental health risks, such as suicide attempts and alcohol addiction. Guidelines suggest children should have 60 minutes of physical activity each day. It has been argued that those who don't get activity won't fully develop their motor skills to the best of their genetic ability. The cognitive functions are memory, attention, visual-spatial, and executive functions. Complex cognitive processes are thinking and language functions. Regular physical activity has positive effects on attention span. This was noticed after three hours of class, when focus started to deteriorate. Those who do sports are calmer during classroom lessons as well. With more computer screen and game use, there is an associated decrease in attention span. They found that physical activity has a positive role in speech development. There was a positive correlation between physical activity and working memory in children aged 3-12. Research suggests that children who are more physically fit have a greater basal ganglia and hippocampus, which are associated with cognitive

control and memory. Their results suggested that engaging in sports in late childhood is related to changes to certain brain structures, which has a positive influence on cognitive and emotional functions. Increased physical activity improves cognitive function, especially working memory, visual-spatial memory, and cognitive flexibility. Physical activity is desirable for childhood because it positively influences development.

Conclusion:

Physical activity plays an important role in pre-adolescent development. Cognitive function and motor learning are greatly impacted by physical activity. Moderate-intensity aerobic exercise is associated with increased motor consolidation compared to individuals who are sedentary. Regular physical activity has a positive influence on attention span, working memory, visual-spatial memory, emotional functions, speech development, and cognitive flexibility. It is highly recommended that children live active lifestyles in order to improve physical and mental health, as well as cognitive function and motor learning.