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Role of physical exercise in attention deficit hyperactivity disorder

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Abstract

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by excessive amounts of inattention, carelessness, hyperactivity, and impulsivity that are pervasive, impairing in multiple contexts, and otherwise age-inappropriate. It is known that people with ADHD have specific strengths, as a result of their brain functioning difference. By using the positive effect of ADHD, many great persons with ADHD have excelled their life later. Though the exact cause of it is unknown but some factors like genetics, brain structure and function and problem during birth and other are thought to be responsible. After diagnosing ADHD via psychological and or physiological process, the management process should start immediately to counter this problem. Behavioral therapy, medications, diet, exercise etc. may boost up the treatment of ADHD. Exercise has been suggested as a safe and low-cost adjunctive therapy for ADHD and is reported to be accompanied by positive effects on several aspects of cognitive functions in the general child population. After analyzing the existing preliminary evidence it may be suggested that exercise can improve cognitive performance intimately linked to ADHD presentations in children with and without an ADHD diagnosis.

Keywords: ADHD, physical exercise, cognition, executive functions, physical activity

Introduction

ADHD is not a medical condition or a disorder, but a dysregulation of the biological functioning of the brain. The main signs of hyperactivity and impulsiveness are: being unable to sit still, especially in calm or quiet surroundings, constantly fidgeting, being unable to concentrate on tasks, excessive physical movement, excessive talking, being unable to wait their turn, acting without thinking, interrupting conversations, little or no sense of danger, These symptoms can cause significant problems in a child's life, such as underachievement at school, poor social interaction with other children and adults, and problems with discipline. The other side of ADHD people is that they have specific strengths, as a result of their brain functioning difference. They are more spontaneous, creative, energetic, intuitive, imaginative, and inventive. Some successful people with ADHD are Michael Phelps (the legendary swimmer), Olympic gymnast Simone Biles, Harry Potter star, Emma Watson, Leonardo da Vinci, John F Kennedy, the 35th President of the United States, Bill Gates, the founder of Microsoft.

Cause of ADHD: The exact cause of attention deficit hyperactivity disorder (ADHD) is not fully understood, although a combination of factors is thought to be responsible.

Genetics: ADHD tends to run in families and, in most cases, it's thought the genes you inherit from your parents are a significant factor in developing the condition.

Brain function and structure: Studies involving brain scans have suggested that certain areas of the brain may be smaller in people with ADHD, whereas other areas may be larger. Other studies have suggested that people with ADHD may have an imbalance in the level of neurotransmitters in the brain, or that these chemicals may not work properly. The human brain is a complex communication network, whereby messages are relayed between neurons.

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In order for messages to be relayed, the brain requires two key neurotransmitters, also known as chemical messengers. They are called dopamine and noradrenaline. In an ADHD brain, there is an irregularity of these neurotransmitters resulting in a variety of symptoms, both positive and negative, that can impact on education, work, and relationships. Evidence suggests that dopamine can be boosted up by balanced diet, getting enough sleep, exercising, listening to music, meditating, and spending time in the sun.

Groups at risk: Children born with a low birth weight, born premature, or whose mothers had difficult pregnancies have a higher risk of having ADHD. The same is true for children with head injuries to the frontal lobe of the brain, the area that controls impulses and emotions.

ADHD Diagnosis and Testing: Health care professionals such as pediatricians, psychiatrists, and child psychologists can diagnose ADHD with the help of standard guidelines like DSM-IV criteria, ICD-10 criteria etc. ADHD diagnosis often takes into account feedback from parents and teachers. To diagnose ADHD in your child aged 6 to 17 years a full physical exam, including vision and hearing tests to be done. Also, the FDA has approved the use of the Neuropsychiatric EEG-Based Assessment Aid (NEBA) System, a noninvasive scan that measures theta and beta brain waves. The theta/beta ratio has been shown to be higher in children and adolescents with ADHD than in children without it.

Management: The management of ADHD is a multitask oriented process which needs the cooperation of all the persons who are with the child in his daily life activities. Behaviour therapy, medication, diet and exercise may play a vital role in managing the ADHD in children.

Behaviour Therapy: There is good evidence for the use of behavioural therapies in ADHD. They are the recommended first-line treatment in those who have mild symptoms or who are preschool-aged. Psychological therapies used include: psychoeducational input, behaviour therapy, cognitive behavioural therapy, interpersonal psychotherapy, family therapy, school-based interventions, social skills training, behavioural peer intervention, organization training, and parent management training.

Medication: Many stimulant and non-stimulant medications are used for treating ADHD but the methylphenidate and amphetamine or its derivatives are first-line treatments for ADHD.

Diet: A growing body of research suggests that diet, both the elimination of certain additives and/or allergens (Candy, Honey, Sugar, Artificial colour food etc), and the consumption of nutrient-rich foods (High protein food- Fish, egg, chicken, beans, seasonal vegetables and fruits, sea fish for omega 3 fatty acid etc.), plays a role in ADHD.

Exercise Role: Analyses on various researches suggest beneficial effects of exercise on cognitive functions in children with ADHD. A growing body of literature suggests beneficial effects of exercise on symptoms of attention deficit hyperactivity disorder (ADHD).

Wigal SB *et al.* (2003) [9] tested the effects of a single session of cycling on plasma catecholamine levels in boys with

ADHD and without ADHD and found epinephrine and norepinephrine increases after exercise. The increases were; however, smaller in the ADHD group than in the healthy control group. Moreover, dopamine levels only increased in healthy participants, but not in those with ADHD.

Pontifex MB *et al.* (2013) [7] worked on exercise improves behavioral, neurocognitive, and scholastic performance in children with attention-deficit/hyperactivity disorder and found that single bouts of moderately intense aerobic exercise may have positive implications for aspects of neurocognitive function and inhibitory control in children with ADHD.

Caterina P, *et al.* (2013) [1] suggested that long-term interventions appear to have largest effects when they entail both cardiovascular and coordinative elements. Such playful but exerting activities are likely to be more practical feasible and associated with higher compliance. Importantly, the physiological and cognitive load associated with different activities is inherently individual. This feeds into the idea of individualizing physical activities to match the physical and cognitive level of the involved children, so that each individual is optimally stimulated and engaged by the employed interventions. Furthermore.

Cook BG *et al.* (2015) [5] suggested that the deficits in executive functions associated with ADHD might decrease adherence to an exercise regime in young individuals underlining the importance of motivational activities.

Lee SK *et al.* (2015) [4] assessed peripheral epinephrine and serotonin levels after a long-term exercise intervention in a small group of boys with ADHD and found significant increases in epinephrine concentration, whereas serotonin levels did not increase significantly.

Piepmeyer AT *et al.* (2015) [6] did a study on the effect of acute exercise on cognitive performance in children with and without ADHD and found that the children with and without ADHD realize benefits in speed of processing and inhibitory control in response to a session of acute exercise, but do not experience benefits in planning or set shifting.

Hung CL *et al.* (2016) [3] studied on Neuroelectric and behavioral effects of acute exercise on task switching in children with attention-deficit/ hyperactivity disorder.

Ludyga S *et al.* (2017) [5] worked on the acute effects of aerobic and coordinative exercise on inhibitory control in children with ADHD and found that a single exercise bout improves inhibitory control and the allocation of attentional resources. There were some indications that an aerobic exercise session seems to be more efficient than coordinative exercise in reducing the inhibitory control deficits that persist in children with ADHD.

Santonastaso, O. *et al.* (2020, Sep) [8]. Showed that mindfulness-oriented meditation (MOM) training has an effect on the brain and behavior. The authors suggested that it could be a useful tool for relieving ADHD symptoms. In this trial, 25 children aged 7–11 years received three MOM sessions per week for 8 weeks, gradually increasing in duration from 6 minutes to 30 minutes.

Conclusion

Exercise has been suggested as a safe and low-cost adjunctive therapy for ADHD and is reported to be accompanied by positive effects on several aspects of cognitive functions in the general child population. After analyzing the existing preliminary evidence it may be suggested that with or without use of other therapies, exercise can be used effectively for the treatment of ADHD people.

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