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Potential for Aerobic Exercise to Release Growth Factors to Induce Cognitive Changes in Children with Autism Spectrum Disorder

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Introduction

Autism Spectrum Disorder (ASD) is becoming increasingly prevalent among adolescents, and while the number of individuals diagnosed with the disorder grows, there continues to be no cure or even a clear treatment plan for ASD. This study analyzes the biological stimulations that create cognitive changes—which are induced by intensive aerobic exercise—within the brains of individuals ages 8-18 diagnosed with autism. Aerobic exercise stimulates the release of growth factors such as BDNF, which target primarily the cerebral cortex and the hippocampal regions of the brain, which tend to be affected in individuals with autism, essential for learning and memory processes along with synaptic plasticity. Because there is no current cure or even a clear treatment plan for Autism Spectrum Disorder (ASD), and because the number of people who are diagnosed with ASD are consistently rising in the United States, it is essential to find ways to mediate this disorder.

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is serious developmental disorder which has no known cure. ASD can be characterized by three categories of symptoms:
1. Abnormalities of social interaction
2. Abnormalities in communication
3. Stereotypical/repetitive behaviors

The proportion of children with ASD characteristics has increased consistently: “From 32% in 2002...to 46% in 2010”

Effects of Exercise

“Aerobic exercise” will be defined as any form of physical activity that engages the cardio and stimulates a significant increase in the consumption of oxygen. Aerobic activity has the following cognitive effects:
• Stimulates activation of processes in the brain
• Produces larger volumes of prefrontal, temporal grey matter, and anterior white matter
• Sets into motion an interactive cascade of growth factor signaling that has the net effect of stimulating plasticity, enhancing cognitive function, attenuating the mechanisms driving depression, stimulating neurogenesis and improving cerebrovascular perfusion
• Increased neurogenesis in the hippocampal regions (area for learning and memory)
• Growth of blood vessels in the hippocampus, cortex, and cerebellum while suppressing apoptosis (programmed cell death)

Growth Factors—BDNF

Brain-derived neurotrophic factor (BDNF) is one of the main growth factors that are released during aerobic exercise, with a high prevalence in the hippocampus and cerebral cortex. BDNF plays a key role in:
• Regulation of neuronal survival
• Formation of functional synapse
• Plasticity of synaptic connections
• Regulation of differentiation
• Maintenance of phenotype in mature neurons
• Hippocampal function (i.e. learning)
• Modulation of depression
• Neuronal differentiation and survival

Methods

This study analyzes the biological stimulations that create cognitive changes—which are induced by intensive aerobic exercise—within the brains of individuals ages 8-18 diagnosed with autism. I studied journal articles on the current treatments available for ASD, the increasing prevalence of the disease, the cognitive alterations of the autistic brain relative to the brains of individuals without the disease, the release of growth factors due to aerobic exercise, and the benefits of brain derived neurotrophic factors (BDNF) on the hippocampus and cerebral cortex. The journals provided that aerobic exercise stimulates the release of growth factors such as BDNF, which target primarily the cerebral cortex and the hippocampal regions of the brain essential for learning and memory processes along with synaptic plasticity.

Conclusion

Since there is evidence of reduced hippocampus and amygdala in the autistic brain, growth factors can have a significant impact on these two areas of the autistic brain. BDNF, which is released in higher levels during aerobic exercise, targets both the hippocampus and the cerebral cortex; therefore, the hippocampus, an area for learning and memory, is a key area in the brain which sees an overlap in which it is both highly altered in individuals with ASD and is significantly affected by aerobic exercise with an influx of BDNF.

References

Some studies claim that the hyperactivity of BDNF in the hippocampus could possibly be a cause of ASD, which means the increased levels of BDNF due to exercise could possibly be counterproductive. However, other studies support that the release of BDNF from aerobic exercise has only positive or no effect.

Acknowledgements

Professor Mary C. Boyce and the Honors College at Virginia Commonwealth University