An Association of Iron Deficiency Anemia (IDA) with Attention Deficit Hyperactivity Disorder (ADHD) in children and young adults

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Abstract— The objective of this short report is to find out the association between Iron Deficiency Anemia (IDA) and young patients of Attention Deficit Hyperactivity Disorder (ADHD). Micronutrients are essential for neurotransmitters and cognitive development including iron which is an important trace element required for brain function. Its deficiency may cause alteration in dopamine activity. Other than macronutrients, micronutrients (vitamins and minerals) are also required by the body in an adequate amount and their inadequacy can cause malnutrition (under-nutrition/over-nutrition). Children in Asian countries are considered as more malnorished, however deficiency of single micronutrient is less as compared to multiple micronutrients. The main aim of this study is to find out association between iron deficiency anemia and attention deficit hyperactivity disorder and the effects and role of iron to improve cognitive functioning. Supplementation can also be used to maintain an adequate amount of nutrients in the body.

Key words --- Iron Deficiency Anemia, Attention Deficit Hyperactivity Disorder, Risk factor, Metabolism, Energy requirements, Trace Elements.

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INTRODUCTION

Micronutrients are trace elements required by the body to sustain its physiological function, they include Vitamins and Minerals. These nutrients contrary to Macronutrients are required by body in small amount and help in normal metabolism, cognitive function, energy production and cell differentiation. They are readily available in all food groups and are fortified in food enough to avoid their deficiency among populations. Supplementation is also a way to meet the required daily amounts of micronutrients for individuals following a special lifestyle.

MALNUTRITION

According to WHO, Malnutrition is defined as the deficiency, imbalance or excess of dietary nutrients. Malnutrition includes under nutrition, (wasting, stunting and underweight) obesity, over weight and vitamin and minerals inadequacy.

Nutrient deficiency is a thorough indicator of how a country might be on a risk of malnutrition and how well the health system is working to prevent it. Asian countries have the highest rate of malnourished children. Among the increasing population, vulnerable groups like infants, elderly and pregnant women are at a risk of developing multiple diseases and infections by consuming low nutrient dense food. Apart from the risk factors involved with the deficiencies, another problem is the knowledge regarding these micronutrients. Though some people consume macronutrients rather sufficiently, their lack of knowledge about micronutrients leads them to develop certain ailments.

According to World Health Organization (WHO) developing countries commonly suffer from deficiencies of Folate, Iodine, Iron, Zinc, Vitamin A, D, and B-complex that lead to vulnerability and disease burden and further causing increased mortality and morbidity rates.

Single micronutrient deficiencies are uncommon but multiple micronutrient deficiencies exist among populations. Researches have shown that the detrimental effects of under nutrition mainly include mental retardation and reduced cognitive function (2) which in turn lead to lower economic status.

Iron is an important component of micronutrients that helps in formation of red blood cells. Iron along with other nutrients help in normal functioning of brain too. ADHD is a common psychological disorder that effects children and may persist to adulthood as well. There is a significant possibility that micronutrient deficiency especially iron deficiency can lead to development of ADHD. (1)

ANEMIA

Anemia is caused by insufficient hemoglobin in the blood. The hemoglobin is an oxygen carrying protein produced by the bone marrow and is an important part of red blood cell. With low levels of hemoglobin, hypoxia occurs. It is one of the five causes of years lived in disability burden. (Global Burden of Disease Study 2016) (2)

IRON DEFICIENCY ANEMIA (IDA) is caused due to the insufficient iron in the body required to produce normal red blood cells. According to few researches iron deficiency can also cause certain neurotransmitter imbalances that may lead to cognitive impairments (3) (4) like autism spectrum disorder, bipolar mood disorder, attention deficit hyperactivity disorder and anxiety disorder. Symptoms of IDA include tiredness, lack of energy, heart palpitations, pale skin and shortness of breath. Usually in a healthy fetus, iron reservoirs are present for up to 6 months after birth. Iron stores are di-

rectly proportional to body weight, so low birth weight can lead to low iron levels in the blood. Around 300 million children in 2011 were reported to have suffered from Iron- deficiency Anemia. Globally Anemia deficiency affects 40% of children under five years of age.

ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

It is one of the most common mental disorder that effects 5.9–7.1% children and young adults. ADHD is usually caused by structural problem in brain and its neurotransmitters. Environmental factors can also develop ADHD among children. (5) Symptoms of ADHD are mostly hyperactivity and impulsiveness which further include signs like not being able to sit properly, excessive physical movements, fidgeting, being impatient, interrupting, excessive talking and decreased concentration on assigned tasks. (6) (7)

According to Centers for Disease Control and Prevention study, 6.1 million children aged between 2-17 years from United States are diagnosed with ADHD.

DISCUSSION:

The reviews of different published articles have established a possibility that deficiency of iron may result in possible appearance of ADHD symptoms. Iron helps in formation of myelin sheath in brain.(8) Ferritin is a protein that stores Iron and usually ferritin levels are an indicator of how much iron is present in the body. According to some researches it was observed that ferritin levels were lower in children with ADHD as opposed to healthy children. (9) However there are also few researches that show no such effect of low ferritin level in ADHD patients. Symptoms of ADHD also appear with dopamine dysfunction. Iron being a coenzyme in dopamine synthesis might cause its dysfunction at lower levels.(10) A control group comparison study done in 2004 with children aged between 4-14 years does suggest that low levels of serum ferritin were present in children with severe ADHD. Serum ferritin levels were an indicator of how much iron stores are present in the child belonging to control as well as experiment group. Moreover, Conner's Parents Rating Scale was used to identify the severity of ADHD. The results suggested that since hematocrit and hemoglobin levels were normal in both groups, it concluded that anemia is not the reason behind ADHD symptoms, only low ferritin levels cause ADHD to develop. (11)

METHODS

A systemic search was done using published literature about Iron deficiency and ADHD. Articles about ADHD and its symptoms as well as iron deficiency and its symptoms were referred. However, they were narrowed down to school going children and young adults age group only. International researches were analyzed more than regional researches because there was very limited published data in regards to our topic from South Asian region. All articles were searched through PubMed and Google Scholar.

CONCLUSION

Although there are relatively few studies that suggest that there could be an association of IDA and ADHD symptoms but our findings from the published literature were not enough to support the idea that only low levels of Iron in body can lead to development of ADHD. IDA is not the only cause that may result in ADHD in children and young adults, evidence suggests that genetic and environmental factors are more likely to cause ADHD. However, there is no uncertainty in the fact that low iron levels in the body do cause decreased working capacity and cognitive decline in adults as well as children. But in order to counter this problem, iron supplementations are used in many countries.

DISCLAIMER

None

CONFLICT OF INTEREST

None

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