Research Article

The effect of Iron Deficiency Anemia on Intelligence Quotient in children

Effat A. Zaky; Zainab Kh. Mahmoud; Marwa M. Abd El Wahab and Shimaa Kh. Kamel
Department of E.N.T, El-Minia Faculty of Medicine

Abstract
Obgective: to evaluate the The effect of Iron Deficiency Anemia on Intelligence in children. **Patients and Methods:** This study was carried out on fifty children who were classified into 2 groups: The (study group) included 25 children who diagnosed with iron deficiency anemia (collected from pediatric blood disease clinic at Minia University Hospital). The result from the study group were compared to another group (control group), which included 25 not diagnosed with iron deficiency anemia" children. (Collected from children coming with their relatives to ENT (Ear, Nose and Throat) clinic at Minia University Hospital. **Results:** Children with IDA had lower scores in inteligence quotient indicating impaired neurocognitive function .
Key Words: Iron Deficiency Anemia, inteligence quotient, Neurocognitive functions,.

Introduction
Iron deficiency is the most common micronutrient deficiency worldwide and one of the most important public health problems, affecting approximately 25% of the world's population according to the World Health Organization (WHO). It is the most common in preschool children and women in childbearing age, particularly in regions of Asia and Africa with poor access to iron-rich foods (De Benoist et al., 2008).

The first years of life are considered the most important for the development of auditory and cognitive abilities, since it corresponds to the period of neural system maturation with larger growth of brain and establishment of new neuron synapses. This stage also coincides to the period of highest prevalence of iron-deficiency anemia (IDA), which affects more than 50% of children between six months and five-years old in developed countries. The principal consequence of IDA is the impairment of the neuro-psychomotor development. Studies in children suffering from IDA have shown iron-deficiency associated with psychomotor and cognitive abnormalities in children (Santos et al., 2008).

Methods
Subjects and Study Design
The present study was carried out at Minia University hospital (ENT department, honiatric unit), during period from February 2019 to November 2020, and included 50 children aged between 3 to 7 years. They were 28 males (56%) and 22 females (44%). This study was approved by the ethics committee in the Faculty of medicine, Minia university hospital, and concents were obtained from subjects.

Methods:
All children will be assessed according to the language and speech assessment protocol in the Phoniatrics Unit, Minia University Hospital.

I- Preliminary Diagnostic Procedures:

1. Parents interview and history including complaint, personal data, personal history, searching for etiological factors during pregnancy, natal, neonatal, and postnatal periods, developmental milestones and illness of early childhood.
2. Examination including neurological and ENT including ear, nose and throat examination.
3. Subjective auditory perceptual assessment "APA" of both language and speech.

II- Clinical Diagnostic Aids:

1. **Audiological evaluation:**included middle ear assessment through immitancemetry (Tympanometry and Acoustic Reflex threshold recording) and hearing assessment. According to the age of child, hearing assessment was performed through one of the following methods:
   - Free field audiometry and Behavioral Observational Audiomety (BOA).
   - Pure tone audiometry (Conditioned play or conventional audiometry).
   - Auditory Brainstem Response "ABR".
2. **Psychometric evaluation:** by Intelligence Quotient "IQ" using Stanford Binet Intelligence test 5th edition (Hanoura and Hamid 2002).

Results

(1) Demographic data:

Table (1): Comparison between the study and control group regarding the demographic data:

		Patients (group I)	Control (group II)	P value
		N=25	N=25	
Age (months)	Iqr Median	(36-55.5) 42	(39.5-64) 52	**0.156**
Sex	Male Female	15 (60%) 10 (40%)	13 (52%) 12 (48%)	**0.569**

The children in the study group were 15(60%) males and 10(40%) females and median of the age (42 months), the children in control group were 13(52%) males and 12 (48%) females and median of the age (52 month).

Table (2): Comparison between the study and control group regarding IQ grades:

		Patients (group I)	Control (group II)	P value
		N=25	N=25	
IQ	MR Below average Average	2 (8%) 18 (72%) 5 (20%)	0 (0%) 5 (20%) 20 (80%)	**0.0001***

There was a statistical significant difference between the two groups as regarding the IQ grades.

Table (3): Comparison between the study and control group regarding **the audiological evaluation**

		Patients (group I)	Control (group II)	P value
		N=25	N=25	
Audiological evaluation	Bilateral normal CHL SNHL	24 (96%) 0 (0%) 1 (4%)	22 (88%) 3 (12%) 0 (0%)	**0.130**

There was a Non statistical significant difference between the two groups as regarding the audiological evaluation.

Discussion

Several micronutrients affect the functional performance of children. These effects could begin as early as the period of fetal development. Furthermore, sub-clinical deficiencies could also potentially lead to functional impairment; the functional domains that are important and have been studied in some detail include cognitive and physical performance. For example, in follow-up studies of formerly iron-deficient anemic or chronically iron-deficient individuals from the period of infancy, poorer outcomes were evident in terms of IQ, motor and cognitive scores and poor academic

performance in spite of iron therapy during infancy (Swaminathan et al., 2013). Iron deficiency is most prevalent during the first 2 y of life when the infant brain is still developing. Severe iron deficiency anemia during this period may cause permanent neurologic damage (Hurtado et al., 1999). Iron is an essential nutrient not only for the normal growth, health, and survival of children, but also for their normal mental and motor development and cognitive functioning. Iron deficiency with anemia (IDA) is associated with significantly poorer performance on psycho-motor and mental development scales and behavioral ratings in infants, lower scores on cognitive function tests in preschool children, and lower scores on cognitive function tests and educational achievement tests in school-age children (Nokes et al., 1998).

The purpose of the present study to evaluate the Intelligence Quotient in children with Iron Deficiency Anemia (IDA). A statistical significant differences between the two groups as regarding the IQ grade. In the study group, (20%) children had average mentality in comparison to (80%) children of the control group. In the study group, (72%) children had below average mentality in comparison to (20%) of the control group In the study group, (8%) children had Mental retardation mentality in comparison to (0%) of the control group.

Iron-deficient anemic or chronically iron-deficient individuals from the period of infancy, were evident to have poorer outcomes in terms of IQ, motor and cognitive scores and poor academic performance. This result was in agreement with Hurtado et al., (1999) who showed that children younger than 10 years with IDA had increased risk of moderate mental retardation. this study also was in agreement with Pala et al., (2010) who reported that children who had severe chronic iron deficiency in infancy had score lower on measures of mental and motor functioning and are at risk for long-lasting developmental disadvantages.

Conclusion

There is evident that children with Iron Deficiency Anemia had lower scores in inteligence quotient The need for diagnosis and treatment of children with IDA as soon as possible, preferably no later.

References

1. Beltrán-Navarro, B., E. Matute, E. Vásquez-Garibay and D. Zarabozo (2012). "Effect of chronic iron deficiency on neuropsychological domains in infants." Journal of child neurology 27(3): 297-303.
2. De Benoist, B., M. Cogswell, I. Egli and E. McLean (2008). "Worldwide prevalence of anaemia 1993-2005; WHO Global Database of anaemia.
3. Hurtado, E. K., A. H. Claussen and K. G. Scott (1999). "Early childhood anemia and mild or moderate mental retardation." The American journal of clinical nutrition 69(1): 115-119
4. Nokes, C., C. van den Bosch and D. A. Bundy (1998). "The effects of iron deficiency and anemia on mental and motor performance, educational achievement, and behavior in children." A report of the INACG. Washington, DC: International Life Sciences Institute.
5. Pala, E., M. Erguven, S. Guven, M. Erdogan and T. Balta (2010). "Psychomotor development in children with iron deficiency and iron-deficiency anemia." Food and Nutrition Bulletin 31(3):431-435.
6. Santos, J., S. Lemos, S. Rates and J. Lamounier (2008). "Hearing abilities and language development in anemic children of a public daycare center." Pro-fono: revista de atualizacao cientifica 20(4): 255-260.
7. Swaminathan, S., B. S. Edward and A. V. Kurpad (2013). "Micronutrient deficiency and cognitive and physical performance in Indian children." Eur J Clin Nutr 67(5): 467-474.