Department of Medical Studies for Children

Study of Behavioral Disorders in Children and its Relation with Iron Deficiency Anemia in UAE

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(Child Health and Nutrition)

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"قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ"

﴿ صدق الله العظيم ﴾

﴿ سورة البقرة الآية 32 ﴾

Acknowledgement

Thanks to Allah, the Merciful, the compassionate

DEDICATION

I would happily dedicate my whole life, not only this thesis, to people stood by me, believed in me and always gave me strength to carry on

Parents, no words can contain my thankful and grateful feelings to you; I would not have been who I am without your guideness and dedication

Brothers, Dr. Aymen, Eng. Ashraf and my sister Miss. EMAN, I sincerely hope you ever know how much I love you. I always appreciate your help, love and encouragement

Einas Jubarah
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ABSTRACT

BACKGROUND: Anemia and iron deficiency anemia in particular are important problems of childhood worldwide. This is a concern since evidence is accumulating that iron deficiency anemia has detrimental effects on the normal growth and psychomotor development of children. Over the past three decades, there have been a considerable number of studies on the relation-ship between iron status and cognition and behavior, but the topic remains controversial.

OBJCTIVE: The aim of the present study was meant to study the relation between behavioral disorders in children and iron deficiency anemia in UAE, in the age group 5-10 years old of both sex from different nationalities.

SUBJECTS & METHODS: A follow-up prospective study was conducted on a sample of 126 child diagnosed to have IDA. They all were obtained from the pediatrics out- patient clinic of Abu-Dhabi Police Medical Services in UAE, in the period from January 2010 to October 2010. It consisted of 64 females (50.8%) and 62 males (49.2%), the mean age was 7.42 years. Exclusion criteria were symptoms and signs suggestive of other causes of anemia other than IDA, history of chronic illnesses that might affect cognition, history of prematurity or twins, history of neurological or psychiatric diseases, current acute illnesses that might affect the investigations and abnormal clinical examination.

All patients were subjected to full detailed history, complete medical examination and laboratory diagnosis of IDA by complete blood picture, serum iron, serum ferritin, TIBC and stool analysis.

IQ assessment (using Good-enough Harris test) applied for all patients, and SES (using AL-SHAKHS) scoring system also done for all patients, but both assessment were kept fixed (IQ between 80-110 and SES of low & middle levels of the scoring system).

All patients were also subjected to CBCL, (Quay and Paterson revised child behavior check list, 2001) the Arabic version, according to which they are diagnosed for presence of motor excess, conduct disorder, attention problems, anxiety withdrawal, socialized aggression or psychotic behavior, were done before and after treatment in order to assess the effect of IDA on the behavior of children in the studied group.

RESULTS: IDA is reported to cause several behavioral disturbances in children. Children with behavioral disorders in this study showed clinical improvement with iron therapy. A significant correlation found between laboratory findings of IDA and CBCL reveals that; motor excess was significantly associated with decreased Hb, serum iron and ferritin. Attention deficit was reported to be significantly associated with low Hb, serum iron, ferritin & MCV. Anxiety Withdrawal showed negative correlation with low serum iron & MCV. Also conduct disorders noticed to be associated with low Hb level.

CONCLUSIONS: It was concluded that IDA is a systemic disease affecting multiple systems rather than exclusively a hematological condition associated with anemia. This study proved that IDA in children of the studied age group has a significant negative impact on intellectual, cognitive functions and behavior that justify the necessity for early detection, treatment and prevention of IDA among infancy and childhood.

Keywords: Behavioral disorders, children, iron deficiency anemia, child behavioral check list.

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List of Abbreviations

Abbreviation	Meaning
AAP	American Academy of Pediatrics
ADHD	Attention deficit hyperactivity disorders
ANW	Anxiety withdrawal
AP	Attention problems immaturity
BMI	Body mass index
CBC	Complete blood count
CBCL	Child behavioral chick list
CD	Conduct disorder
CNS	central nervous system
DA	Dopamine
DMT1	Divalent metal transporter 1
E/G ratio	Ratio of erythroid to granulocytic precursors
Fe+2	Ferrous Iron
Fe+3	Ferric Iron
FEB	Free Erythrocyte Protoporphyrin
GIT	Gastro intestinal tract
Hb	Hemoglobin
Hct	Hematocrit
ID	Iron deficiency
IDA	Iron deficiency anemia

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Abbreviation	Meaning
IQ	Intelligence Quotient
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
ME	Motor excess
NE	Norepinephrine
NHANES	National Health And Nutrition Examination Survey
NSAIDs	Nonsteroidal anti- inflammatory drugs
ODD	oppositional defiant disorder
PB	Psychotic behavior
PEM	Protein energy malnutrition
RBCs	Red blood cells
RDW	Red cell distribution width
RLS	Restless Leg Syndrome
SA	Social aggression
SD	Standard deviation
SES	Socio-economic status
SPSS	Statistical package of social science
TfR	Transferrin receptor
TIBC	Total iron binding capacity
WHO	World Health Organization

Introduction and Importance of the Study

Introduction

Iron deficiency anemia (IDA) is the most common and widespread nutritional disorder in the world. As well as affecting a large number of children and women in developing countries, it is the only nutrient deficiency which is also significantly prevalent in industrialized countries. The numbers are staggering 2 billion people over 30% of the world`s population- are anemic **(WHO, 2013).**

In susceptible population groups, such as infants and pregnant women, the global prevalence exceeds 50% **(*Cook, 1994*).** And 43% of the world`s children aged up to 4 years, and 37% of the world`s children aged 5 to 12 years, according to WHO are anemic **(*WHO, 1998*).**

Iron is an essential component of brain growth and is required not only for cell differentiation but also protein synthesis, hormone production, and fundamental aspects of cellular energy metabolism and functioning (***Wrigglesworth and Baum, 1988 & Beard et al., 1993***).

Oski and Honig, in 1978 made a study suggesting that iron deficient infants have behavioral abnormalities. Since then, there

is increasingly convincing evidence to suggest that iron tendency impairs psychomotor development and cognitive function (***Lozoff, 1988***).

Iron deficiency in early life is associated with delayed development as assessed by a number of clinical trials using similar global scales of development; this poor development

during infancy persists in most cases after iron therapy has corrected iron status. If iron deficiency occurs in preschool and older children, the consequences appear reversible with treatment (***Beard and Conner, 2003***).

Iron deficiency may occur as a result of chronic blood loss, inadequate dietary iron intake, and malabsorption of iron, diversion of iron to fetal and infant erythropoiesis during pregnancy and lactation**,** intravascular hemolysis with hemoglobinuria, or a combination of these factors (**Fairbanks and Butler, 2001**).

Iron deficiency is a major health problem in developing countries manifesting not only as overt anemia but also involving the central nervous system (CNS), resulting in cognitive and behavioral deficits. Iron is involved in myelin formation and neurotransmitter synthesis and thus contributes to normal neurological activity. Hypomyelination has been reported in iron