PSYCHOLOGICAL ASPECTS OF IRON DEFICIENCY IN CHILDREN

THESIS

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BY

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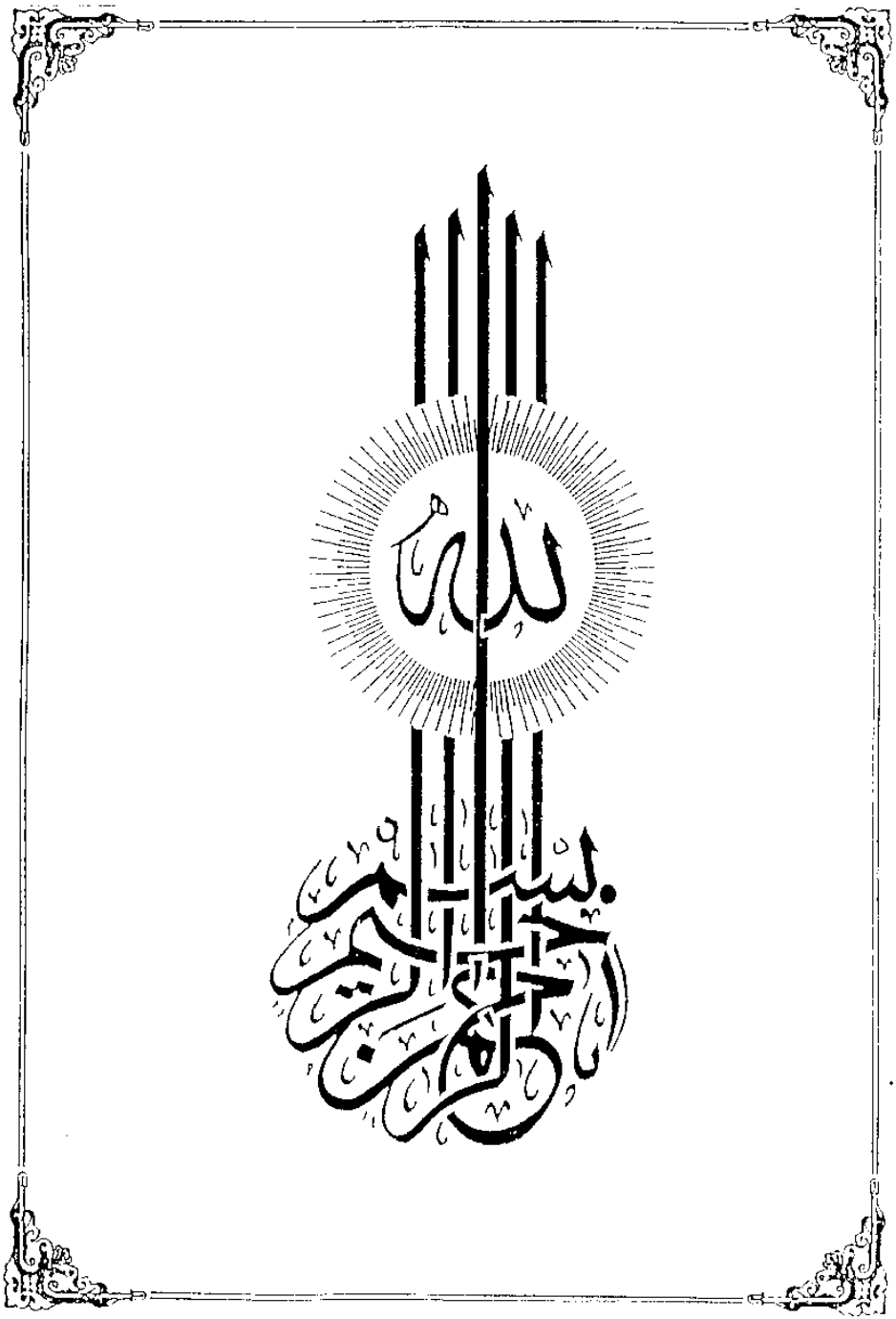

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ABBREVIATIONS AND SYMBOLS

$	Dollar
%	Percentage
BNF	British National Formulary
CNS	Central nervous system
CVIQ	Computed Verbal IQ
dL	Deciliter [10^{-1} x liter]
DNA	Deoxyribonucleic acid
e.g.	[L *exempli gratia*] For example
FEP	Free erythrocyte protoporphyrin
Fig	Figure
fl	Femtoliter [10^{-12} x liter]
g	Gravity
GIT	Gastrointestinal tract
gm	Gram [10^{-3} x kilo]
Hb	Hemoglobin
Hct	Hematocrit
HD	Hard disc
i.e.	[L *id est*] That is
INACG	International Nutritional Anemia Consultative Group
IQ	Intelligence quotient
KB	Kilogbyte [10^{3} x byte]
Kg	Kilogram [10^{3} x gram]
MAO	Monoamine oxidase enzyme
MB	Megabyte [10^{6} x byte]
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
mg	Milligram [10^{-3} x gram]
ml	Milliliter [10^{-3} x liter]

N	Number of children
ng	Nanogram [10^{-9} x gram]
NHANES	National Health and Nutrition Examination Survey
p	Probability
per se	As such
pg	Picogram [10^{-15} x gram]
r	Correlation coefficient
RBCs	Red blood cells
RDA	Recommended daily allowance
RDW	Red cell distribution width
RNA	Ribonucleic acid
TIBC	Total iron binding capacity
USA	United States of America
USAID	United States Agency for International Development
WISC	Wechsler Intelligence Scale for children

INTRODUCTION
AND
AIM OF THE WORK

Introduction and Aim of the Work

Although most of the fundamental work on iron metabolism and iron deficiency has been carried out during this century, yet the use of iron compounds to cure a variety of illnesses dates far back in history. The clinical manifestations of iron deficiency anemia appear to have been recognized in earliest times.

A disease characterized by pallor, dyspnea, and oedema was described in about 1500 B.C. in the *Papyrus Ebers*, an Egyptian manual of therapeutics believed to be the oldest complete manuscript extant. Medical historians have attributed this ancient disease to ancylostomal anemia, a form of iron deficiency anemia.

Chlorosis or "green sickness" was well known to European physicians after the middle of the seventeenth century. In France, iron salts were used along with many other remedies in the treatment of chlorosis. By the begining of the twentieth century, it had been established that chlorosis was characterized by a decrease in the iron content of the blood

and by the presence of hypochromic erythrocytes *(Williams et al, 1990)*.

Iron deficiency is the most common nutritional disorder and it is the most common cause of anemia worldwide. The iron status of infants and children is especially precarious because of exaggerated needs imposed by growth *(Oski, 1985)*.

Evidence that iron deficiency has important behavioral effects has steadily accumulated in the past two decades. The resulting picture of behavioral alterations due to iron deficiency reflects the convergence of two independent but complementary investigational approaches: studies of central nervous system biochemical changes, primarily in the laboratory animal, and studies of behavior in relation to body iron status, primarily in the young human. The research in this field is largely at the stage of generating rather than testing, hypotheses *(Lozoff, 1988)*.

If these behavioral changes are related to tissue iron rather than hemoglobin concentration, they could be conceivably present in iron deficiency before the drop of hemoglobin to

below the limit of normal *(Oski, 1985)*.

The aim of this study is to investigate the possible effects of iron deficiency (with or without anrmia) and the child's cognitive functions and behavior. If these effects are confirmed, the societal implications are obvious and enormous for many members of our community. By laying a spot of light on this relationship, we might call attention to the idea that iron deficiency is more than just a blood disorder. The consequences of behavioral alterations in iron deficiency may thus become powerful consideration in public health policy as decisions are made about the promotion of child's health.

REVIEW OF LITERATURE

IRON METABOLISM

Body Iron Pools

Body iron is distributed so that about 60-65% is in hemoglobin. About 4.5% is in myoglobin, about 10% in nonheme enzyme iron, and about 20% in storage iron (ferritin, hemosiderin) and in cytochrome and other heme enzymes (0.2%) *(Alpers, 1988)*.

In living tissues iron does not exist, except transiently, as a free cation; instead it is bound by or incorporated into various proteins.

The iron proteins which occur in man may be broadly grouped as heme proteins, iron flavoproteins, and a heterogenous group of proteins which contain iron in a variety of molecular configurations. Among the heme proteins are hemoglobin, myoglobin, the cytochromes, cytochrome oxidase, homoginistic oxidase, peroxidase, and catalase. Iron flavoproteins include cytochrome reductase, succinate dehydrogenase, reduced nicotinamide adenine dinucleotide (NADH) dehydrogenase, acyl coenzyme A dehydrogenase, xanthine oxidase, and aconitase *(Fairbanks & Beutler, 1990)*.