Relationship between Obesity and Iron Deficiency

Thesis

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By

Maha Hassan Mohamed Hamdy
M.B.,B.Ch - Cairo University

Supervised by

Prof. Dr. Tahany Ali El-kerdany
Professor of Clinical Pathology
Faculty of Medicine - Ain Shams University

Prof. Dr. Wafaa Ahmed Fahmy
Professor of Public Health and Nutrition
Head of Nutritional Requirements & Growth Department
National Nutrition Institute

Dr. Doaa Ahmed Gamal Eissa
Assistant Professor of Clinical Pathology
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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List of Abbreviations

(BMI) : Body mass index

(CBC) : Complete blood count

(CHD) : Coronary Heart Disease

(CHr) : Reticulocyte Hemoglobin Content

(CRP) : C-reactive protein

(EDHS) : Egypt Demographic and Health Survey

(EDTA) : Ethylenediaminetetraacetic Acid

(EHIS) : Egypt Health Issues Survey

(EHIS) : Egypt Health Issues Survey

(ELISA) : Enzyme-Linked Immunosorbent Assay

(FAO) : Food and Agriculture Organization

(FDA) : Food and Drug Administration

(Hb) : Hemoglobin

(hs-CRP) : High Sensitive C-reactive protein

(ID) : Iron Deficiency

(IDA) : Iron Deficiency Anemia

(MCV) : Mean Corpuscular Volume

(NHANES) : National Health and Examination Survey

(NNI) : National Nutrition Institute

(RBCs) : Red Blood Cells

(RDW) : Red blood cell distribution width

(SACN) : Scientific Advisory Committee on Nutrition

(sTfR) : Transferrin Receptor Concentration

(TIBC) : Total Iron Binding Capacity

(TSI) : Transferrin Saturation Index

(UIBC) : Unsaturated iron binding capacity

(WFP) : World Food Programe

(WHO) : World Health Organization

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Introduction

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle **(WHO, 2008a)**.The most significant contributor to the onset of anemia is iron deficiency **(Aggett, 2012)**.

Iron is a nutritionally essential trace element that is critical for optimal physical and cognitive performance. The development of iron deficiency occurs in stages and the consequences of iron deficiency anemia include fatigue and diminished work capacity **(Aggett, 2012)**.

The main risk factors for IDA include a low dietary intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds, and period of life when iron requirements are especially high i.e. growth and pregnancy **(Wessling-Resnick, 2014)**.

Obesity is one of the most visible, yet most neglected, public-health problems that threatens to overwhelm both more and less developed countries **(WHO, 2000a)**.

Worldwide obesity has nearly doubled since 1980. Overweight and obesity are leading risks for global deaths. Around 3.4 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity **(WHO, 2014b)**.

Egypt Health Issues Survey **(EHIS, 2015)** showed that 26% of women in reproductive age (15-59 years old) were considered overweight and 50% of them were considered obese.

It has become clear that iron deficiency and obesity do not merely represent the coincidence of two frequent conditions but are molecularly linked and mutually affect each other **(Aigner et al., 2014)**.

Obese individuals who develop ID have an increased health burden. Initially presenting with iron depletion, ID can progress to iron-deficient erythropoiesis, eventually leading to iron deficiency anemia (IDA) **(Cook , 2005)**.

The mechanism explaining the relationship between iron status and obesity remains unclear; this may be due to lower iron intakes and/or increased iron requirements in

overweight individuals. In addition, the chronic inflammation and increased leptin production characteristic of obesity increase hepcidin secretion from the liver, which, along with hepcidin produced by adipose tissue, could reduce dietary iron absorption **(Tussing-Humphreys et al., 2012)**.

Aim of the Work

To evaluate the iron status in obese Egyptian females in comparison to normal weight females.

Chapter (1)

Iron Deficiency Anemia

Definition of Iron Deficiency Anemia:

The word "Anemia" comes from the Ancient Greek meaning "lack of blood." It is a decrease in the normal number of red blood cells (RBCs), or less than the normal quantity of hemoglobin (Hb) (the protein in RBCs that transports oxygen to tissues) in the blood **(Klemm et al., 2011).**

Nutritional anemias are caused when there is an inadequate body store of specific nutrient needed for Hb synthesis **(WHO, 2012)**.

This state of insufficient iron interferes with normal physiologic functions **(Baker and Greer, 2010).** It is defined as a condition in which there are no mobilizable iron stores, and in which signs of a compromised supply of iron to tissue are noted (**Desalegn et al., 2014)**.

The severity of iron deficiency is classified to three stages of increasing severity: depletion of iron stores (stage 1), iron deficiency without anemia (ID) (stage 2), and iron

deficiency anemia (IDA) (stage 3) **(Scholl, 2011).** The most sever stages of iron deficiency is associated with anemia **(Perignon et al., 2014)**.

Dietary factors play a role in the development of iron deficiency and subsequent development of iron deficiency anemia **(Beck et al., 2014).**

Prevalence of Iron Deficiency Anemia:

Iron deficiency is still a big problem today. In fact, the WHO lists iron deficiency as one of the" top ten risk factors contributing to death". About 4-5 billion people, 66-80% of the world's population, may be iron deficient. Two billion people about 40% of the world's population are anemic, mainly due to iron deficiency **(Aggett, 2012).**

WHO estimates that worldwide, 42% of pregnant women, 30% of non-pregnant women (aged 15 to 50 years), 47% of preschool children (aged 0 to 5 years) are anemic. Africa has the highest prevalence of anemia for all three population groups, but the greatest numbers of people affected are in Asia **(McLean et al., 2009).**

iron deficiency anemia (IDA) resulted in 273 000 deaths: 45% in Southeast Asia, 31% in Africa, 9% in the Eastern Mediterranean, 7% in the Americas, 4% in the

Western Pacific, and 3% in Europe, with 97% occurring in low-and middle-income countries **(Pasricha et al., 2013)**.

Many studies were carried out in **Egypt** during the second half of the past century. Some of these studies were at the national or sub-national level. These local studies revealed the high prevalence of anemia especially among women in reproductive age period (17-71%) among preschool children (23-90%) and school children, (22-45%) **(World Bank, Human Development Group and Micronutrient Status in Egypt over the Last Decade, 1999).**

According to Egypt Demographic and Health Survey **(EDHS)**, the level of anemia among the ever-married women aged 15-49 was severe in 1% of the women, 7% were moderately anemic and around 33% were mildly anemic **(EDHS, 2014).**

Epidemiology of Iron Deficiency Anemia:

The prevalence of iron deficiency varies greatly according to host factors: age, gender, physiological, pathological, dietary, and socioeconomic conditions **(WHO, 2008a).**