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Evaluation of Molasses In The Treatment of Patients with Iron Deficiency Anaemia

THESIS

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BY

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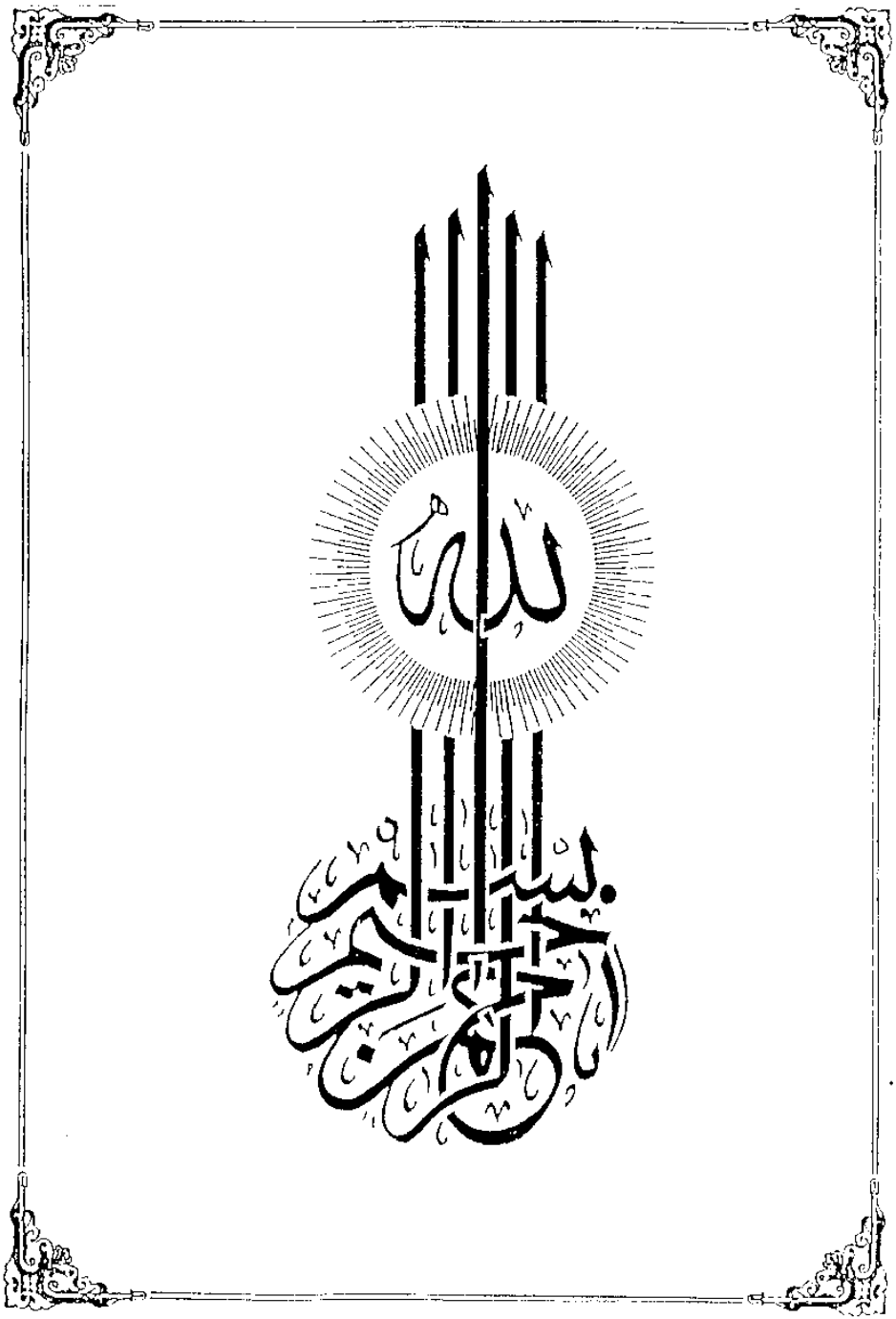

CONTENTS

INTRODUCTION & AIM OF WORK

INTRODUCTION

Egyptian molasses is manufactured by prolonged boiling of sugar -cane juice in iron tanks . It is thought that the process of manufacturing leads to dissolution of a good amount of iron in the final product , Molasses .

It was a popular idea that molasses protects poor class people from anaemia .

However , there is no available scientific works to prove this idea . If it is proved to be true , it will be a good , cheap , safe and palatable source of iron

AIM OF WORK :

This work is a practical trial to prove or disprove the value of Molasses in the treatment of patients with iron deficiency anaemia .

REVIEW OF LITERATURE

ROLE OF IRON

Iron not only plays an essential role in hematology as regards haemoglobin synthesis and the problems concerning the anaemias , but also in tissues , where it participates in numerous enzymatic systems owing to its ability to oxido-reduction mechanisms . A large number of enzymes are known to contain iron or require it as a co-factor , including cytochrome oxidase , succinate dehydrogenase , aconitase , catalase , myeloperoxidase , cytochrome C reductase , ribonucleotide reductase , tyrosine hydroxylase , and xanthine oxidase . (Cook and Lynch , 1986).

One of the most important biological role played by iron is its role in regulation of cellular respiration because it controls the activity of several mitochondrial iron-containing enzymes as cytochrome oxidase , catalase , and peroxidase . Also , it controls mitochondrial electron transport . This alongside its role in oxygen transport and storage . (Skikne et al.,1984 , Cook and Lynch , 1986).

IRON BODY CONTENT :

The total body iron content of adult man with adequate intake in about 4 - 5 gm. (Skikne etal., 1984) , which is distributed as follows :

About 65 % is found in circulating blood cells incorporated in haemoglobin , each millilitre of blood containing approximately 0.5 mg of iron . (Skikne etal. , 1984).

Another 10 % is present in muscles in the form of myoglobin (Skikne etal., 1984) . The storage iron compartment accounts for most of the remaining iron , varying from 400 to 1000 mg depending on age and diet . Small but physiologically important quantities of iron are also present in tissue enzymes and in the circulation bound to transferrin (Skikne etal. , 1984) .

Menstruating women have considerable less total body iron , approximately 2 - 3 gm. and iron stores average only about 300 mg. After menopause iron stores rise progressively and soon approach those levels found in men (Skikne etal. , 1984) . Although menstruation is the factor that is chiefly responsible for lower iron reserves in women , iron intake , which is closely related to caloric intake , is also lower .

A newly borne child has a total body iron content of approximately 250 mg. (Sturgeon , 1956) .

IRON DISTRIBUTION IN MAN :

The iron is present in various compartments in man and is distributed in several physiologically and chemically distinct forms as haemoglobin iron, tissue "which include storage tissue

iron and essential tissue iron " , and plasma iron compartment (Fairbanks , 1983) .

Haemoglobin Iron :

It is the largest iron compartment constituting about 65 % of the total body iron , each millilitre "ml" of blood containing about 0.5 mg of iron (Skikne etal. , 1984).

The amount of haemoglobin iron changes with anaemia and polycythaemia . A fall in haemoglobin concentration is a late manifestation in the development of iron deficiency and is a sign of storage iron depletion .

Since the greater part of the body's iron is contained in the haemoglobin of the red cells , it is obvious that any major blood loss will significantly lower the total iron content . The iron derived from the breakdown of haemoglobin released by the destruction of the effete red cells is conserved by the body and is reutilized for haemoglobin sythesis .

Tissue Iron :

Tissue iron is represented by two components ; essential (non-available) tissue iron and storage (available) tissue iron .

Essential (Non-available) tissue iron :

This represents the iron in muscle , myoglobin , the iron in the enzymes of cellular respiration , and the iron present as a constituent of the cell .

The amount of essential tissue iron about 300 mg , formed mainly by myogobin , remains constant although it may be slightly reduced in severe iron deficiency anaemia (Fairbanks , 1983) .

Myoglobin :

Is structurally similar to haemoglobin , but it is monomeric. It is present in all skeletal and cardiac muscle cells in which it serves as an oxygen reservoir to protect against cellular injury during oxygen deprivation (Fairbanks , 1983) .

Iron of tissue enzymes :

It is of extreme vital importance in tissue respiration and in a variety of essential metabolic processes (Fairbanks , 1983) as in catecholamine metabolism and DNA synthesis (Cook and Lynch, 1986) .

Storage (available) tissue iron :

Storage tissue iron comprises 28 % of the total human iron . It occurs in two forms ,Ferritin and Haemosiderin, normally present in approximately equal amounts .

About one third of the storage iron is in the bone marrow , one third in the liver , in the hepatocytes and to a lesser extent in the nonparenchymal cells of the liver , namely kupffer and endothelial cells (Munro etal. , 1978) . And the remaining one third is distributed in spleen , muscles and other tissues .

The uptake of iron into the storage site is mediated through the presence of a specific saturable binding site , the receptor for transferrin . The histochemical demonstration of transferrin receptors on both parenchymal and nonparenchymal cells in the human liver tissue supports this finding . (Gatter etal. , 1983 ; Vogel etal. , 1987) .

Ferritin :

Is a protein shell with a molecular weight of about 500,000 made up of 24 subunits . The multiple forms , or isoferritins , that occur in most human tissues appear to originate by the presence of different subunits . (Worwood , 1982 ; Arosio etal., 1984) .

Three subunit types have been described L" light , mol wt 19,000" , H" heavy , 2100 " and G" glycosylated , 23,000 " (Bellotti etal. , 198) .

Tissue ferritins consist of variable proportion of H and L subunit types . The H and L subunits have large immunological differences (Luzzage etal. , 1986) .

The major known function of ferritin is to store and sequester iron intracellularly and plays a significant role in iron metabolism (Munro etal. , 1978) .

To perform its regulatory activity ferritin should interact with a specific binding sites on the surface of target cells . (Fargion etal. , 198) . The presence of ferritin-binding sites has been described on human placenta (Takami etal., 1986). A ferritin receptor has been identified on rat hepatocyte (Mack etal. , 1985) and on guinea pig reticulocyte (Blight and Morgan , 1983) . Resent studies showed that erythroid K562 cell line have specific binding site of acidic isoferritin to human cell (Covell etal. , 1987) .

Red cell ferritin as a diagnostic tool :

Many investigations showed that the ferritin content of red cells is a reflection of body iron status (Peters etal. , 1983; Cazzola etal. ,1983 a) and appears to be only slightly

influenced by those factors which falsely elevate the serum ferritin concentration to a degree disproportionate to that of iron stores (Cazzola etal. ,1984) .

The first diagnostic use of the red cell ferritin is based on the concept that red cell ferritin reflects the balance between iron supply to the erythroid marrow and the need for haemoglobin synthesis . Poor iron supply to the erythron results in low red cell basic ferritin , as is typically found in iron deficiency anaemia and iron deficiency erythropoiesis (Cazzola etal. , 1983 b).

The red cell ferritin content can be used as an indicator for diagnosis of iron deficiency anaemia before a typical microcytic hypochromic anaemia appears . Bodemann etal. (1984) found this measurement clinically useful in monitoring blood donnors. Normal values of basic red cell ferritin range from 8 to 40 ag / cell (ag = attogram , 1 ag = 10^{-18}g) (Cazzola , 1986).

The second diagnostic use of red cell ferritin is its use in assessing tissue iron content in patients with idiopathic haemochromatosis . (Weyden etal. , 1983 b) .

The third diagnostic value is the use of red cell ferritin to monitor suppression of erythropoiesis during transfusion therapy in thalassaemia major (Cazzola etal. , 1983 b) .

Haemosiderin :

Found predominantly in cells of monocytes and macrophage system (marrow , kupffer cells of liver and spleen) .

It is a water insoluble and its iron content is higher than that of ferritin . Under pathological conditions , it may

accumulate in almost every tissue of the body .

Plasma iron :

About 3 - 4 mg of iron are present in the plasma , where it is bound to a specific protein , B-globulin , known as transferrin and the term serum iron denotes this fraction . The normal value of serum iron is about 120 ug / dl (about 20 umol / l) (Skikne etal., 1984) .

Once iron stores are depleted , there is a fall in iron supply to circulation and ultimately to the erythroid marrow . This stage of iron deficiency is signalled by a decline in serum iron to less than 40 ug / dl and a fall in transferrin saturation to below 16 % . Since the transferrin concentration increases in the face of lack of iron , transferrin saturation is a more sensitive measure of defective plasma iron supply than serum iron alone . (Skikne etal. , 1984) .

The plasma protein transferrin mediates iron exchange between body tissues . Cell surface transferrin receptors provide the major mechanism of iron supply to tissues and growing cells (Huebers and Finch , 1987) .
The transferrin- cell interaction is a multistep process starting with the binding of the iron transport protein to specific membrane receptors . The binding is followed by the internalization of the receptor- ligand complexes into endosomes. Iron is released from transferrin in the endosomes ,