CHANGES IN PLASMA PROTEINS AND AMINO ACIDS IN BLOOD AND URINE IN HELMINTHIC INFESTATIONS IN CHILDREN

Thesis

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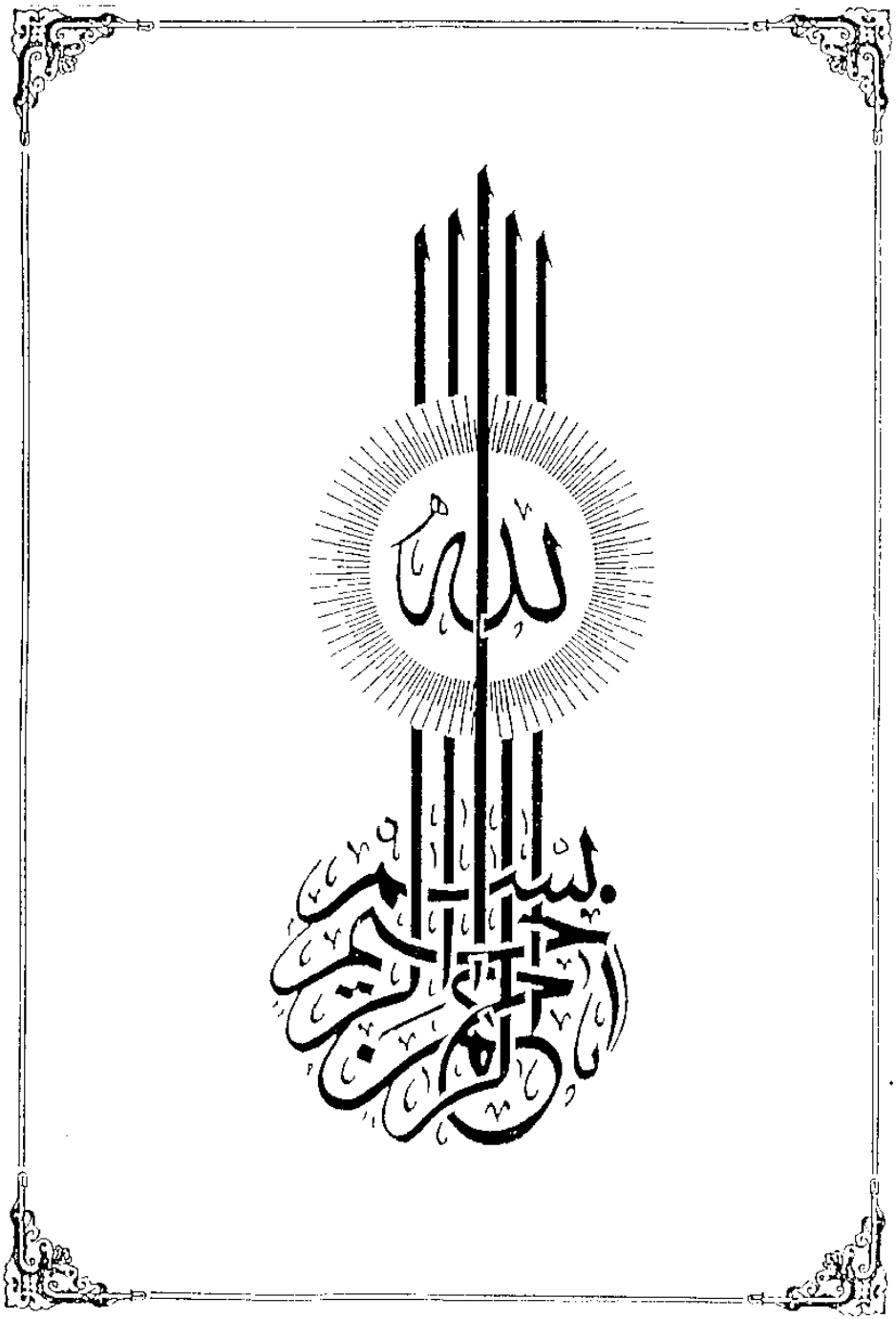

C O N T E N T S

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PART I

INTRODUCTION

INTRODUCTION

Parasitic infestations are widely distributed all over the world especially in temperate zones and in the tropics. In Egypt, the parasitic infections are common particularly in the younger age group.

Ascaris, Hymenolepis nana and Enterobius vermicularis are among the most important worms prevalent in children in U.A.R. Rifaat et al. (1958)(1)

The diagnosis of these ailments had been tacled in the past from various angles. Nowadays with the adoption of new techniques, this subject is quite tempting and appealing for reconsideration and opening new fields in research. Thus some electrophoretic studies on the changes of blood proteins in certain parasites Staaber(1954)(2) as malaria, Leishmania, Trypanosoma, Trichinella, Ankylostoma, Bilharzia and Ascaris, were carried out. These studies are, however, still inadequate to cover all the intestinal parasites.

Moreover, no attention had been given to the changes in the aminoacid distribution in blood or urine in helminthic infestations.

A comprehensive picture of the aminoacid metabolism is not complete without simultaneous studies of both blood

and urine aminogram patterns, since most of the different aminoacids of the blood are exposed to the continuous clearing mechanism of the kidneys. They are actively transported through the proximal tubular epithelium removing them from the glomerular filterate and returning them to the blood.

Rogers in (1955)[3], however found that Nematodes especially Ascaris excrete different variaties of amino-acids.

Gerbasio et al (1959)[4] after studying blood proteins in children infected with Ascaris attributed the deficiency of serum proteins to interference with food absorption and utilization in infected cases.

These findings have drawn attention to carry out this study with the aim of investigating changes in blood proteins and aminoacids in children infected with Ascaris, Hymenolepis nana and Enterobius vermicularis owing to the strong connection between the parasitic infestations and the nutrition of the host.

Ascaris has been chosen as an example of large worm inhabiting the small intestine. H. nana is a small worm which lives also in the small gut, while Enterobius vermicularis represents a kind of a thread worm that affects mainly the large gut and anal canal.

REVIEW OF LITERATURE

stated that all antibodies are present in the gamma globulin fraction.

Since 1937, the development of electrophoresis by Tiselius[9], allowed the study of plasma protein fractions, and its use in the diagnosis of some diseases. An example of this is the elevation of the alpha globulin fraction in acute inflammatory lesions with tissue breakdown. Powell, (1959)[10], while, on the other hand, gamma globulin was found to be increased in chronic infections (Flynn, 1954)[11], Jencks et al., 1956)[12]. Beta globulin was also found to rise in cases whenever there are high levels of phospholipids and cholesterol in the blood. Albumin usually decreases in hepatic dysfunction, while plasma fibrinogen is increased in acute infections, nephrosis, cirrhosis and after X ray irradiation (Ham and Curtis, 1938)[13].

Formation of Plasma Proteins :

Most of the plasma proteins namely albumin, fibrinogen, transferrin (iron binding), ceruloplasmin (copper binding), and probably alpha and beta globulin are synthesised in the liver. Gamma globulin, including the immunoglobulin, is therefore an exception.

Most disorders affecting either the liver, the intake of essential amino acids or the excretion of protein will affect the concentration of various components of plasma proteins.

Miller and Bale (1954)[14] using lysine C 14 and zone electrophoresis, found that the normal perfused rat liver produced all plasma proteins except gamma globulin. The total circulating albumin decreases in chronic liver failure or cirrhosis of the liver due to diminished formation of albumin by the damaged liver parenchyma.

The immunoglobulins consisting mainly although not wholly of 7 s globulin are formed in the plasma cells and lymphocytes of the reticuloendothelial system,(Enders, 1944)[15], Dougherty et al, 1944)[16] and (Martin,1947)[17]. In chronic liver failure, Martin (1949)[18] showed that there was an increase of the gamma globulin, thus indicating that this fraction is not formed by the liver, but the liver plays a role in the removal of gamma globulin.

Good (1955)[19] demonstrated that in a gamma-globulinaemia plasma cells were absent from the bone marrow and lymph nodes.

Classification of Plasma proteins :

The plasma proteins were first named and defined according to the solubility in water and in salt solution.

Tiselius (1937)[9] developed the moving boundary electrophoretic apparatus and could separate the plasma proteins into albumin, alpha, beta and gamma globulin.

Longsworth (1942)[20] and Svenson (1946)[21] on further study were able to identify a further subdivisions of the globulin into α_1, α_2, B_1, B_2, γ_1 and γ_2 globulins. Thereafter the serum rather than the plasma was generally chosen for electrophoretic analysis, because the presence of fibrinogen obscures the resolution of the beta and gamma globulin.

Hermans (1960)[22] pointed out that the classic gamma globulin of tiselius electrophoresis was functionally and antigenically related to protein extending through the beta globulin and even into the alpha globulin.

In immuno-electrophoresis the immuno-globulin separated as 3 precipitin lines.

[illegible] components were designated [illegible] by [illegible] (19[illegible])[illegible] but was called [illegible] or [illegible] by Deutsch et al. (19[illegible])[illegible]. The [illegible] molecular weight globulin called β_1 macroglobulin (γ_1 [illegible]) by [illegible] et al (19[illegible])[illegible] was later designated [illegible] by [illegible] and Burtin (19[illegible])[20].

The ultracentrifugal heterogeneity of the globulin related proteins complicated the picture, since components with a common antigenic determents might have an S_{20} of 7 s, 10 s, 1[illegible] s and even higher.

Yet two distinct gamma globulin precipitin lines were sometimes seen in immuno-electrophoresis.

The B_2 A (γ_1 , A) and B_2 M (γ_1 M) globulins were classified into the same two antigenic groups on the basis of common determents with 7 - s γ (Bence Jones proteins).

Thus, there are three immunoelectrophoresis classes each with two subtypes. Yet non of these six subdivisions of the immunoglobulin is homogenous.

Factors affecting changes in the Plasma Protein :

Changes in the plasma proteins were known to be affected by several factors. The most important of these are discussed below :

Effect of age on the Plasma Proteins :

Stewart et al in (1961)[7] noted that the serum albumin level declined with age while the gamma globulin level rose with an almost constant level for the total serum protein.

The Effect of Dietary Protein Intake :

Among variables that could possibly explain the difference in the serum protein levels that were dependant upon race and age was the dietary proteins.

Cox and Mueller (1944)[28] suggested that various food proteins differ qualitatively in their ability to promote synthesis of plasma proteins.

By means of the plasmapheresis technique, Madden et al (1938)[29] demonstrated that some dietary proteins may favour the production of plasma albumin while others may favour the production of plasma globulins.

Stewart (1961)[27] found that in subject with low protein intake, the serum albumin was low. In subject with high protein intake, the serum albumin was high. With increased levels of protein intake the serum albumin level rose to a maximum and failed to increase thereafter. On the other hand the gamma globulin fraction took the opposite direction.

Steiner and Holmes (1954)[30] noted a rise in the serum albumin level when malnourished adults were fed a high protein diet, but they reported that the high gamma globulin level did not invariably fall. So it seems obvious that factors other than the dietary protein intake influence the gamma globulin level when one noted that, at the higher level of animal protein intake, the mean serum albumin levels of Bantu and European subjects were alike, but highly significant differences existed with respect to the mean gamma globulin levels. These factors might be genetic or environmental such as long continued or repeated exposure to chronic infections.

Effect of race on the Plasma Proteins :

Stewart and Antonis (1961)[27] found similarity of the serum albumin and globulin levels in the new born infants of white and black races in Africa.

differences could however, be seen following the first year of age. It was also noted that there was increased concentration in the gamma globulin in normal healthy Nigerians (Mozin 1958)[34]. This was also noticed in New Guinea natives (Knarke and Kirkley 1961)[35], and in normal healthy U.S. Negroes, (Comens 1957)[33] and Cawnaley et al 1956)[34].

These variations might reflect the genetic differences in gamma globulin concentration with different population.

Changes of Plasma Proteins in Different Diseases :

Changes of plasma proteins are either congenital or acquired. Congenital changes appear in many conditions among which are the following :

Agammaglobulinaemia (Bruton 1952)[35] in children with repeated attacks of infection. The subject of congenital idiopathic hypogammaglobulinaemia was further studied by Elphinstone (1956)[36].

Analbuminaemia which is total absence of serum albumin owing to genetic defects was reported by Bennhold (1956)[37].