BIOCHEMICAL STUDIES ON LENTIL

By

ABD ALLAH MOHAMED ABD EL-RAHMAN MOUSSA

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APPROVAL SHEET

This Thesis for the M. Sc. Degree has been Approved by :

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Committee In Charge

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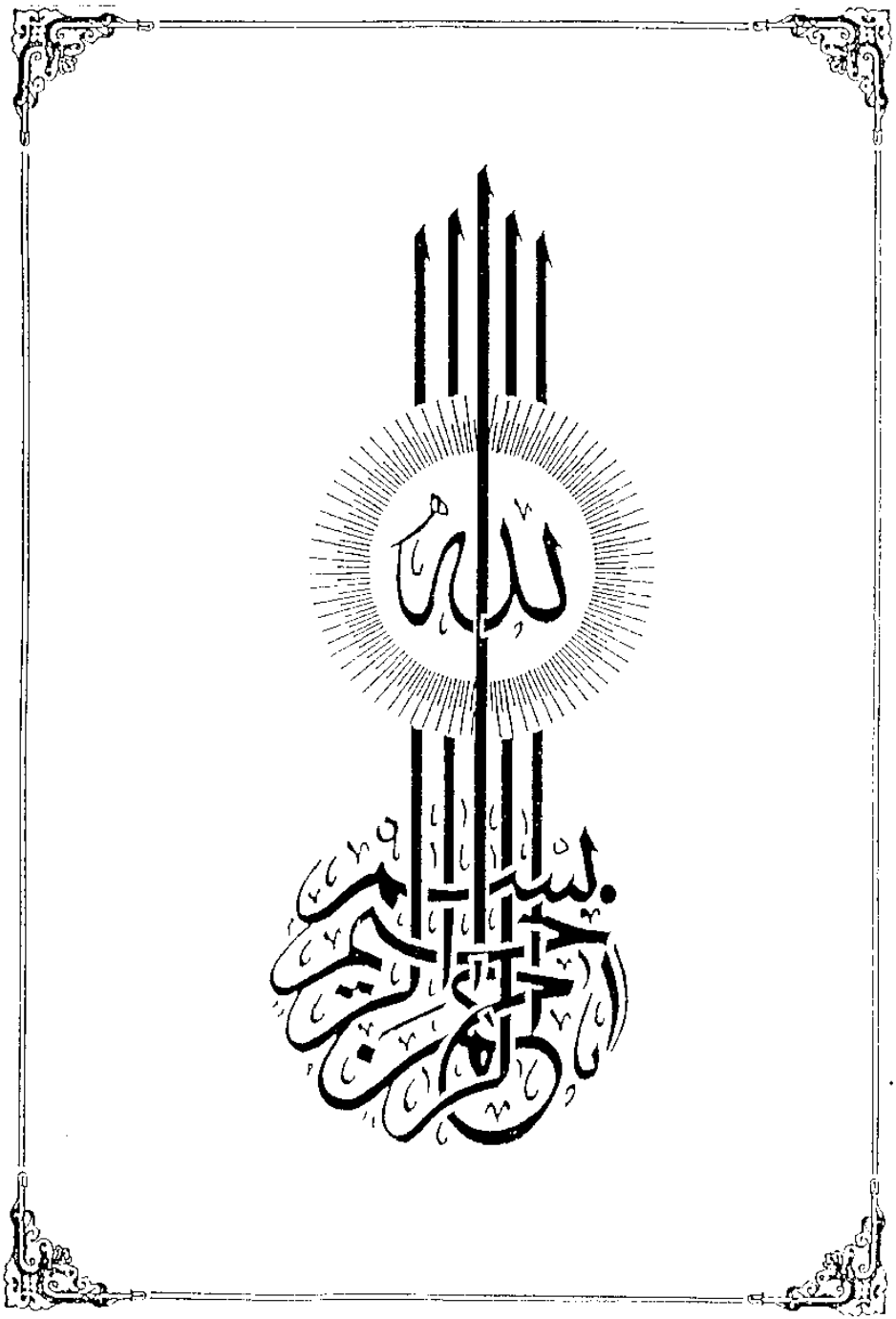

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INTRODUCTION

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Egypt is one of the developing countries where protein malnutrition remains the major problem of nutrition. Egypt has a total area of nearly one million square kilometres of which 3.3 % is cultivated. According to the 1960 Census, the population was 26,059,000,- of which 98.8 % inhabit the Nile Valley. The population grows at a rate of 2.8 % per year and is expected to become 45 millions in 1982 (c.f., statistical pocket Book of the U.A.R. 1952-1961).

As far as food production is concerned, Egypt is more fortunate than many other developing countries. A study of the food balance sheet (1968), shows that the energy value of the total food supplies is about 2806 cal/head/day and the protein intake is about 80 g of which only 10.8 come from animal origin.

The main agricultural products are Cereals, Legumes, different varieties of vegetable and fruits. Cereals, mainly wheat are the staple food. Legumes, especially beans and Lentils are most widely consumed. Fresh vegetables are available all the year round at reasonable prices. Different varieties of fruits are cultivated. Their prices are within the reach of all (Morcos, 1966).

Animal foods include meat, poultry, eggs, fish, and dairy products. Meat goes to those who can afford it. In

rural areas, the farmers sell their own produce (i.e. milk, butter, cheese, eggs and poultry in order to buy larger quantities of cheap foods like bread and beans to feed a large number of children.

The amount of food as officially declared, will meet the requirements of the population, but the high death rate, the prevalence of anaemia, rickets, protein-calorie deficiency diseases among infants and children all point out that the food of the people being deficient (Morcos 1969).

From the nutritional point of view, two important problems face the nutritionist in our part of the world that is the adequacy of protein and the problem of parasites. For economic reason, the protein intake of the population can not be increased by the increase of animal proteins. The obvious alternative is to augment the diet with legumes, which as a class, are relatively rich in protein.

Studies of diet and nutrition in the developing countries confirm the possibility of increasing the consumption of legumes and indicate its necessity from the economic and nutritional standpoints (Aykroyd 1969).

Legumes occupy a prominent position in our national dietary. Broad beans (Vicia faba), lentils (lens esculenta) and kidney beans (phoseolus vulgaris) come first in order to legumes consumption.

The aim of this thesis is therefore :

To demonstrate the importance of legumes in the Egyptian diet and to see to what extent our needs for amino acids are catered for lentils. A systematic study of the protein and its essential amino acid contents of the new variety seeds of lens esculenta (Giza 9) being produced by the plant Breeding section, Ministry of Agriculture, and two of the most commonly imported vareities (Abyssinian and Pakistanian) are to be undertaken in two cases whole and split (without seed coat).

PART I

REVIEW OF LITERATURE

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Proteins :

Proteins have the function of building up new tissues in the growing animals as well as repairing the wear and tear of tissues in both the young and adult. Proteins are also sources of many catalysts such as enzymes and hormones which are outstandingly essential in making the chemical reactions of the body run smooth and fast enough to meet the needs of life processes and in so regulating the conditions within the body that the process of living may proceed efiiciently. Still other proteins act as antibodies of the blood, which defend the organism against viruses, which are themselves proteins and it seems that Braconnat (1820) (c. f. Gortner & Gortner, 1950) was the first to expose proteins to acid hydrolysis. He isolated what was later identified as glycine by hydrolysing gelatin with dilute sulphuric acid. The discoveries and isolations of amino acids continued untill the ones identified reached more than 22 in number.

The amino acids isolated from the protein hydrolysates are alpha amino acids.

At this function one may draw attention to the facts that proteins differ in nutritive value and that animal proteins are superior to plant proteins in that respect. According to Henry and Kon (1958), however, the strict division of the harmful substances produced by pathogenic organism. Finally the nucleoproteins found in the genes are believed to represent the basic unit of heredity.

Where there is such diversity of functions, there must be a corresponding diversity is due to the simple compounds, the amino acids which join together to make up the protein molecule.

When proteins are subjected to hydrolysis either by acids, alkalies or enzymes, the resulting hydrolystate is found to contain a variable number of compounds which have many characters in common.

Proteins into those of the first class and those of the second class is no longer tenable, for with increasing knowledge it became evident that the differences between the two classes of proteins were reflecting differences in amino acid composition and availability. According to these investigators the distinction between

animal and vegetable proteins is neither rigid nor justified. Thus, it is possible to upgrade "second class" or vegetable protein in physiological value.

The human body has certain limited powers of converting one amino acid into another. There are several amino acids which the body cannot make for itself in sufficient quantities from other products of the metabolic pool in order to satisfy normal needs, and so must obtain them from the diet. These are termed "Essential Amino Acids".

Rose (1938) has defined an essential or indispensable dietary component as "one which cannot be synthesized by the animal organism, out of the materials ordinarily available at a speed commensurate with the demands for normal growth.

The adult human body can maintain nitrogen equilibrium on a mixture of eight pure amino acids as its sole source of nitrogen apart from the vitamins. These are threonine, valine, leucine, isoleucine, lysine, tryptophan , phenylolanine and methionine. To maintain growth in infants, histidine and arginine are also needed (Rose, 1949). The presence of low or inadequate amounts of even

one of the essential amino acids may be the limiting factor in the nutritive value of a protein.

Protein requirements :

In order that protein can fulfil the needs of growth, repair and maintenance there must be a proper balance between energy and nitrogen metabolism (Van Itallie, 1955); Abbott, Krieger, Babb, Levey and Holden (1953); Keys et al.(1950). The body draws upon protein reserves to correct any deficiency in calories in the metabolic pool for energy (Rosenthal and Allison, 1951; Rosenthal 1952; Allison, 1955. Conversely food energy conserves body nitrogen (Bosshardt et al., 1948; Lathe and Peters, 1949 ; Leverton, Gram and Chaloupka, 1951; Munro, 1951; Calloway and Spector, 1955. Studies involving human subjects by cuthbertson and Munro (1939) and those involving animals by Cuthbertson, Mc Cutcheon and Munro (1940); by Lathe and Peters (1949); by Munro (1951); by Thomson and Munro (1955) and by others, all demonestrate the improvement of nitrogen retention by feeding carbohydrate and protein, simultaneously. On the other hand, Rosenthal (1952) reported that variation in the fat content of the diet did not alter the nitrogen balance indeces of casein fed to normal dogs.

Similarly, Calloway and Spector (1955) found that restriction in calories in normal rats resulted in a negative balance that was independent on the fat content of the diet.

When the total food is properly adjusted to the size, and activity of the subject so that there is sufficient, but not excessive fuel to meet all the energy requirements, the problem of protein requirements can be discussed.

For almost any nutrient we might mention that there is most likely a minimal intake necessary for life, an optimum intake compatible with excellent health, and finally an excessive level of intake that is injurious. It is comparatively easy to define minimum intake and the level that will cause injury but it is usually very difficult to define an optimum intake. This is because we are not clear about what constitutes optimum health or how to measure it.

Chittendon (1907) estimated the protein requirements of a man average weight of 70 kg to be 44 - 53 g. Sherman (1920) mentioned that the daily protein requirements of an adult of 70 kg. body weight ranged from