BIOCHEMICAL STUDIES ON SOME NEW SOURCES OF PROTEINS WITH SPECIAL REFERENCE TO THEIR NUTRITIVE VALUE AND THEIR CONSTITUENTS OF AMINO ACIDS

A THESIS

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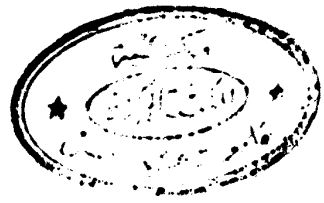

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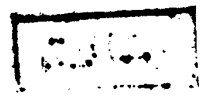

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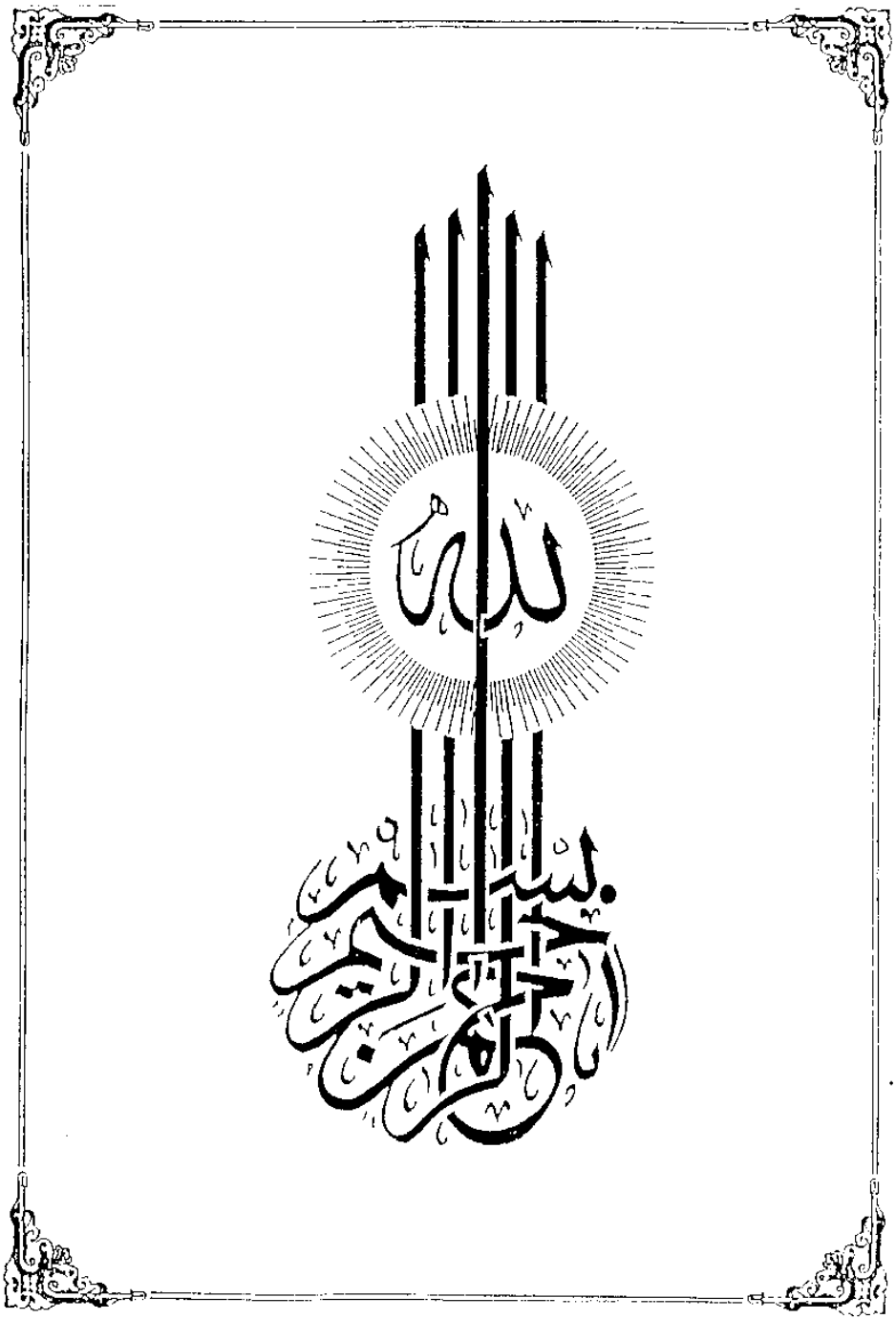

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CHAPTER - I

THEORETICAL ILLUSTRATIONS

Part 1 :

General Introduction.

Part 2 :

Biological Evaluation of Protein Quality.

Part 3 :

Chemical Evaluation of Protein Quality by Amino Acid Chromatographic Analysis.

1. The problem of protein requirements :

The problem of protein needs is the most complex in the field of nutrition and biochemistry. However, it is equally the most interesting from the scientific and practical aspects not only for nutritionists, biochemists and clinicians, but also for a multitude of national and international health agencies.

The total food protein sources in the world as reported in the WHO (1968), amount to approximately 79.5 million tons a year, representing an average annual intake of 25.18 kg per person.

Cereals constitute 49 % of the total protein intake and thus form the main source of dietary protein.

The protein intake of animal origin is approximately 25 million tons a year representing 31 % of the total. This supply is unevenly distributed, 70 % being consumed by less than one third of the world's population, those living in the developed countries.

By the turn of this century, the world food supplies must be trebeled, if the world population, which is expected

to double [illegible] to exceed [illegible] millions by then, [illegible] have enough to eat.

At present it is estimated that one tenth to one sixth out of 3.000 millions in the world are under fed and that up to one half of the world population - perhaps even more - suffer from hunger or malnutrition.

2)Protein sources :

The conventional sources of protein now available are :

1- Protein of animal origin :

In general, all proteins from animal sources, such as milk and milk products, poultry and eggs, meat and meat meals, fish and fish products, are of high quality. The production of animal proteins expands slowly and the cost remains high so that consumption will continue to be uneven.

2- Protein of vegetable origin :

a) Cereals :

Wheat, rice, corn and other grains have been used from time immemorial as main foods in many areas of the world. Although their protein content is only between 7 % and 15 %, cereals contribute almost 50 % of the total protein intake of the world population. Also the quality

of the protein is not high, however it is also one of [illegible] now possible to improve it by genetic manipulation.

b) Legumes :

Legumes have a high protein content than most cereals ranging from 20 to 28 % .

They are traditional foods in developing areas and the present production represents about 8 millions tons of proteins per year. The quality of the protein is usually from fair to good. Whenever possible, the increase in their production would be highly desirable. The biological quality of plant proteins are now improved by their intermixing in a manner as to counteract their missing amino acids.

Non-conventional sources of proteins :

Additional sources of proteins are now being developed. They are known as non-conventional sources because they have been little used in human feeding or because they are entirely new.

1- Oleaginous seeds :

After extraction of the oil, such seeds as soya been, pea nuts, cotton seeds, sesame, sun flower and coconut, have a cake residue rich in proteins.

So far, these cakes have been used primarily for animal feeding or as fertilizers and in some cases they have been used as fuel. The food industry in certain developed countries has also promoted their use for human consumption.

The world production of oil seeds represents about 20 million tons of protein annually, if processed under suitable conditions, at least part of the cakes could be used for human food and thus increasing the available protein supply.

2- Food yeasts:

Although both Torula and Brewers' yeast contain approximately 50 % protein of relatively good quality and can improve the protein quality of cereals, they are not yet widely used as protein source for human diets. The limiting factors are primarily their greater cost compared with the oil-seed meals and the limited amounts that can be tolerated in diets.

There is evidence, that yeast can be useful both as vitamin and a protein source in vegetable mixtures for human consumption in underdeveloped areas.

3- Algal and leaf proteins :

Considerable publicity has been given to the processes for making concentrates from grass and other leaf proteins, and also for culturing algae as a protein-rich food. All such products are of low palatability, a relatively high cost and their protein quality is not impressive. It is unlikely that algal and leaf proteins will be of immediate help in solving the problem of hunger.

Traditionally, the need for more proteins results in attempts to produce more of the conventional sources of proteins like meat, fish, eggs, milk and other dairy products.

Unfortunately, the production of these foods in the more developed countries could only keep in pace with the population growth and leave no surplus for international trade and for the various aid programs required by the under developing districts.

In these countries, the production of such traditional, conventional, sources of high protein quality lags far behind the needs for covering even minimum protein requirements.

[illegible] consumption is nearly [illegible], [illegible] population is almost increasing, this discrepancy between nutritional needs and available supplies become larger and progressively more critical. For this reason, a solution to the world protein problem from conventional protein sources alone cannot be expected and if the world is to have a realistic chance of meeting its future food needs, the conventional sources of protein must be supplemented by new and unconventional ones.

Aim of Work

The aim of this work is to investigate some of the local non popular protein sources in order to test their possible abilities as protein supplements in the diets of the limitted income class people.

The protein sources chosen were taken from both animal and plant origin. The first was undertaken by studying the defatty muscular residue of the desert locust and the cotton leaf worm, while the second origin was represented by some defatty legume seeds usually wildly grown in Upper Egypt and around the nile shores. These were those of Dolichos lablab (Hyacinth bean), Lathyrus sativus (Blue vetch), Stizolobium deeringianum (Velvet bean) and Glycine max. (Soya bean).

These sources are not habitually used in food consumption, their characteristic feature and morphological structure are summarised in the following few words.

The Desert locust :

The Desert locust, Schistocerca gregaria (F), (Family Acrididae, Order ORTHOPTERA), is the most widely distributed of locusts. Its distribution area occurs over a vast area of about 11 million square miles in Africa, Asia and includes 61 countries.

The Desert locust prefers to live permanently or semi-permanently in desert area, and breads there on desert vegetation during years of favourable rainfall. The large swarms thus produced from the desert breeding grounds, then invade the adjoining cropped areas.

The adult desert locusts have fully developed wings and when sexually immature they are pink in colour and become yellow after maturation. The males are smaller than females, the adult life ranges from one month to three months but it may be longer.

Locusts have been known to cause great crop damage and devastation from the beginnings of civilization. There are legends of invasions from many lands and they have the capacity to thrive on a very wide range of food plants. They have also high mobility enabling them to travel even along thousands of kilometers to more favourable habitats.

Defoliation by eating is the most common form of locust damage and caused by eating of flowers, seeds, stems, bark and growing points.

The cotton leaf worm :

The cotton leaf worm, Spodoptera littoralis (Prodenia litura (F), Family Noctuidae, Order LEPIDOPTERA), is a major pest on cotton and many other crops in U.A.R.

The pest is a widely distributed cosmopolation insect causing highly damage each year for many crops. The larvae are very destructive to cotton, clover, corn and vegetables in many parts of the world. The larva has six instars, the larval stage period varies greatly according to the time of the year. It may be two weeks in summer and over three months in winter.

The last instar (sixth instar) feeds voraciously for some days until maximum size has been attained, then feeding decreases rapidly.

The general colour is variable, dark brown, dark grey or almost black, mottled with irregular spots and lines. There are two black spots with yellow edges on dorsum of mesathorax and two similar ones on metathorax,

two big black areas on first and eighth segments of abdomen.

Approximately [illegible] plant species belonging to 44 families are reported as hosts of the cotton leaf worm in tropical and temperate zones of the old world. These plants include 73 species recorded from Egypt of which 16 hosts are preferred for oviposition, 45 for food only, and 12 for food and oviposition.

<u>Dry legume seeds</u> :

The seeds of the leguminous plants, which belong to the family of Leguminosae are cultivated in various parts of the world.

The family Leguminosae is the second largest family of seed plants and contains about 600 genera with 13.000 species.

They vary in size from the tiny wild vetches of the temperate zone to great trees.

The importance of different kinds of legumes as human foods varies widely, some are produced and eaten in many parts of the world, while others have a much smaller range of use. The leaves of some leguminous