BIOCHEMICAL STUDIES ON SOME EGYPTIAN FEEDSTUFFS

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A C K N O W L E D G M E N T

The present investigation was suggested and directly supervised by Professor Dr. Mohamed Abdel-Moneim Kamal, Chairman Professor of Agricultural Biochemistry, Faculty of Agriculture, Ain Shams University, Cairo, to whom the author is greatly indebted for his inspiration, guidance and encouragement throughout the whole course of research.

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This dissertation has not previously been submitted for a degree at this or at any other university.

The references in the text will show the extent to which I have availed myself of the work of the other authors.

Signed

Hatem Mohamed Ali

C O N T E N T S

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A B S T R A C T

The present study was planned to study the nutritive value of feedstuffs through their biochemical constituents, i.e. nitrogen fractions essential and semi-essential amino acids, carbohydrate fractions and mineral content. On the other hand the effects of different treatments carried out on feedstuffs of plant origin such as water and acid soakings for different periods of time was tried. The feedstuffs of animal origin were exposed to three different heat treatments for six different periods of time, which might improve the protein quality.

The results can be summarized as follows :.

The determinations of the various nitrogen fractions of feedstuffs of plant origin, revealed that its total nitrogen varied considerably according to plant species, When the protein nitrogen was calculated as percentage of total nitrogen, it was found that this fraction comprised a high value, i.e., 92.38%, 82.68%, 81.27%, 67.10%, 73.66%, 75.09%, 32.66%, 62.16%, 57.58 and 69.32% of total nitrogen for decorticated cottonseed meal, extracted cottonseed meal, protein, radicle, undecorticated cottonseed meal, corn germ meal, malt, rice bran, corn and barley.

When the nutritive value of the feedstuffs under investigation were determined according to their essential amino acids contents, it was found that they were deficient

in their tryptophane ,lysine and methionine contents. Methionine was the amino acid which limits the nutritive value of barley, malt and radicle while lysine was also corresponding limiting for the nutritive values of corn. rice bran, the three types of cottonseed meals and protelan. The nutritive qvality of corn germ meal proteins was limited to 28.7% only because its tryptophane was found to this extent. Generally, the essential amino acids comprised 25%-30% of the total nitrogen content of plant feedstuffs.

With reference to the semi-essential amino acids contents of the feedtsuffs of plant origin, the results revealed that all feedstuffs contained sufficient amounts of arginine required by animals.

The determination of carbohydrates and its fractions showed that the feedstuffs of plant origin varied considerably in their total carbohydrates contents, i.e. corn, protelan, corn germ meal, barley, undecorticated cottonseed meal, malt, rice bran, extracted cottonseed meal, decorticated cottonseed meal and radicle contained 69.37%, 64.29%, 50.39, 44.22%, 37.47%, 35.60%, 31.7%, 29.75%, 28.54% and 25.05% of total carbohydrate, respectively. It was clear that polysaccharides comprised the major component of carbohydrate contents, i.e., 81.08% , 94.77%, 89.31%, 91.43%, 90.93%, 88.31%, 80.64%, 81.79%, 88.07% and 74.45% of total carbohydrates for decorticated,

extracted cotton seed meal, radicle, undecorticated cotton seed meal, corn germ meal, malt, rice bran, corn, and barley respectively. The non reducing sugars was the major component of total sugars in the above feedstuffs.

From a nutritional point of view corn and barley were the only feedstuffs which can not cover the animal requirements of calcium and phosphorus, while the magnesium contents in all feedstuffs tested were quite enough to cover animal requirements. Sodium and potassium contents in the different feedstuffs were quite enough to cover the animal needs

The investigation of the various nitrogen fraction of blood meal, fish meal, meat meal and skim milk showed that they contained 11.094%, 10.136%, 9.242% and 4.511% gm. nitrogen per 100 gm. dry matter, respectively. The protein nitrogen fraction occupied 97.68%, 83.01%, 74.57%, and 92.48% of total nitrogen for blood meal, fish meal. meat meal and skim milk, respectively.

The nutritional evaluation of the feedstuffs under investigation on the basis of its essential amino acids content showed that the amounts of tryptophane, lysine,

[illegible] valine, [illegible], phenylalanine and threonine were sufficient for the animal requirements. But the blood meal was deficient in histidine and isoleucine content. Fish meal and skim milk were comparatively deficient in methionine contents, while meat meal was deficient in its valine content. About 50%, of the total nitrogen was in the form of essential amino acids

The investigation of the semi-essential amino acids revealed that feedstuffs of animal origin tested contained sufficient amounts of cystine and tyrosine. The determination of carbohydrates and its fractions amounts, showed that feedstuffs of animal origin contained comparatively small amounts of carbohydrates. The total sugarss was the major fraction of such feedstuffs as it represents 93.00%, 97.40%, 60.44% and 87.46% of total carbohydrates content of blood-, fish-, meat meals and skim milk, respectively. Non reducing sugars comprised the largest portion of total sugars Skim milk was the only feedstuffs under investigation which contained comparatively a high value for its total carbohydrates.

Feedstuffs of animal origin contained a Ca/P ratio which is sufficient to cover the animal requirements. The ratio was 0.38 : 1, 1.6 : 1, 2.3 : 1 and 1.1 : 1 for blood meal, meat meal and skim milk respectively.

It was found that both water and acid soaking treatments used, affected the biochemical structure of such feedstuffs, i.e. the soluble nitrogen was increased together with the carbohydrate contents, while the essential amino acids content was not remarkably affected. Such analytical data are considered vital base for the preparation of rations for animal consumption.

Feedstuffs of animal origin subjected to heat treatments showed that their amino acids, lysine , phenylalanine, threonine, cystine and the available lysine value were significantly affected by high temperatures during processing. Heat processing for long periods of time caused a significant decrease in these amino acids content. So it is quite advisable to use mild heating treatments during processing of such feedstuffs.

Statistical analysis of data obtained for the effect of heat treatments on the distruction of amino acids contents of the feedstuffs, revealed that heating at 95°C. even up to 300 minutes produced comparatively the most superior quality of the processed feedstuffs. On the contrary, the heating of feedstuffs at 120°C. at

15 lb./pressure caused a highly significant decrease in the amino acids content at any period of time.

INTRODUCTION

The progressive jump achieved in the United Arab Republic to raise the standard of living caused a revolutionary trend in all aspects concerning the average consumer. Biochemists and nutritionists together must cooperate to solve the problem resulting from the great increase in the consumption of animal and plant proteins.

To solve this problem, two major plans were taken into consideration, carefully studied and put fourth in practice. The first plan is a short-term plicy by increasing the imports of animal products such as meat, fish and chicekn. The other plan for a long-term plicy dealing with the increase of animal products at a more rapid rate than that of the demand.

In the United Arab Republic, feedstuffs of livestock are rather inadequate, due to the fact that the cultivated area for the time being is very limited and occupied by various crops. It is necessary to use and utilize the by-products of food processing and all different kinds of feedstuffs not used for human consumption.

It is also of importance to use high efficiency rations for livestock as a successful plan for increasing