THE NUTRITIONAL VALUE OF PROTEINS WITH SPECIAL REFERENCE TO:

A) THE AVAILABILITY OF AMINO ACIDS IN MEAT MEALS TC CHICKS, AND

B) THE CHEMICAL CHANGES WITH HEAT-DAMAGE OF PURE PROTEINS

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ABSTRACT

Meat meals are highly variable in protein quality and this may be due in part to heat-damage. This possibility was investigated by estimating the available lysine content of meat meals by chick growth assay. In addition, the combined urinary and faecal excretion of dietary amino acids by chicks, fed a meat meal as the sole source of protein, was determined, and by subtraction from the amount consumed, values for the apparent retention of dietary amino acids were obtained.

In a second part of the study, the mechanism of heat-damage to pure proteins was investigated. Since cross-linkages may form during heat-damage of proteins, enzymatic digests were examined for the presence of peptides with enzyme-resistant linkages. Samples of unheated and heat-damaged haemoglobin or globin were digested with either trypsin, or exhaustively, using several proteolytic enzymes.

Chick growth assay for lysine. A chick growth assay for lysine was developed using wheat gluten as the protein source in a semi-purified diet. The meat meals were added to the basal diet either at the expense of starch or by isonitrogenous substitution of wheat gluten.

Estimated potencies based on weight gain varied with the method of meat meal addition to the basal diet. This variation was probably due to an effect on the appetite of the chicks as estimates based on food conversion efficiency did not differ significantly with the method of meat meal inclusion.

The percentage of lysine biologically available in eight meat meals ranged from 61 to 105%, suggesting that some meals had been heat-damaged.

Apparent retention of dietary amino acids. Estimates of the apparent retention of essential amino acids in six meat meals ranged from 79 to 100%. The apparent retention of lysine was generally much higher than

the estimated potencies by chick growth assay. The difference in the two biological estimates indicated that other factors, apart from digestibility, and absorption and urinary excretion of peptides and amino acids, must be responsible for the reduced availability of lysine in heat-damaged proteins.

Tryptic digests of unheated and heated haemoglobin and globin. Several large fragments were isolated from digests of heated globin which were not present in digests of unheated globin. The fragments had more than one amino-terminal but individual peptides could not be separated. It was not possible to determine if cross-linkages were present.

Exhaustive enzyme digests of unheated and heated globin. A peptide was isolated from digests of heated globin which was not present in unheated globin digests. Results obtained indicated that the peptide was a cyclic tetrapeptide composed of equal quantities of lysine and aspartic acid. It was suggested that the peptide was the result of cross-linkages formed during heat-damage of globin, between the β-carboxyl groups of aspartic acid and the ε-amino groups of lysine.

It is considered that the formation of covalent bonds with the ε-amino groups would account for an appreciable proportion of the decreased availability of lysine in heat-damaged proteins.

PREFACE

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