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The protein nutritive value of proteolan, a by-product of starch industry

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With 4 tables

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Although the production of starch is the main goal of the starch industry, several by-products are also produced during the several processes of its manufacture.

The utilization of the aqueous by-products produced from the steeping and sorting processes in isolation of protein precipitates for feeding and industrial purposes were investigated (1, 2, 3, 4, 5).

The present investigation was initiated by the desire to evaluate the proteolan by-product produced from the starch industry from corn which consists from mixing the brands by-product with the protein concentrates from the aqueous by-products in the proportion 2:1, and used as animal feed. Attention is being paid to study such an important by-product with special reference of its nutritional aspects.

Experimental

Source of sample

Samples of the proteolan by-product recovered during the starch industry from corn were obtained from the Egyptian Company of starch and glucose (Mostorod, Egypt). The samples are produced in dry form as a powder.

All samples were finely ground and well mixed, then subjected to the chemical analysis. The moisture, fat, nitrogen, ash, iron and phosphorous contents were determined by the methods adopted by the A.O.A.C. (6) and *Stuffins* (7).

The amino acid contents were determined as described by *Hegazi* and *Salem* (8).

The net protein utilization was determined on weanling hooded rats according to the method of *Miller* and *Bender* (9).

The digestibility coefficient and the biological value were calculated.

Mixtures of proteolan and barley rootlets, a by-product of malting (protein content 27 %) in the ratio 1:1, both the proteolan diet and the mixture were compared with the standard casein diet.

Results and discussion

From the results given in tab. 1, it is seen that the proteolan by-product contains a relatively high protein content (27.4 %). The amino acid contents of its protein hydrolysate showed the presence of at least 18 amino acids (tab. 2). Glutamic acid arginine tyrosine as well as aspartic acid are

Tab. 1. Chemical composition of the proteolan by-product of starch industry from corn.

Constituents	g/100 g (on dry basis)
Protein content	27.4
Fat	7.5
Total hydrolysable carbohydrate	47.76
Ash	1.54
Crude fibre	5.8
Phosphorus mg/100 g	171
Iron mg/100 g	3.1
Moisture %	8.7

Tab. 2. Amino acid pattern of the proteolan protein hydrolysates.

Amino acid	mg/g Nitrogen*)	Amino acid	mg/g Nitrogen*)
Lysine	183	Cystine and	
Histidine	345	Cystein	217
Arginine	643	Tryptophan	102
Threonine	192	Methionine	–
Valine	300	Serine	293
Tyrosine	630	Glycine	306
Phenylalanine	310	Alanine	401
Leucine and		Aspartic acid	561
Isoleucine	420	Glutamic acid	920

*) mean of 5 samples on dry basis

found in the largest amounts whereas the tryptophan content is found in the smallest percent compared to the other amino acids. Tab. 2 also shows that the proteolan is rich in most of the essential amino acids with exception of cystine leucine and isoleucine and lysine while the other amino acids are existing in optimal amounts.

Out of the 18 amino acids detected in the proteolan hydrolysate, four amino acids are existing in more increasing amounts than that of the recommended allowance given by the F.A.O. (10) (tab. 4). These amino acids are phenylalanine, valine, threonine and lysine.

The poor nutritional quality of the proteolan diets as shown in tab. 3, compared to the ideal casein diet, could be attributed to its deficiency in the sulfur-containing amino acids such as cystine, methionine and lysine, which are considered as the important factors determining the biological value of proteins. However, mixing the proteolan diets with the barley rootlets lead to a noticeable increase in the N.P.U. value of the proteolan diet from 41.5 to 49.2 (tab. 3). The synergetic effect could be attributed to the amino-acid composition or the vitamin contents of barley rootlets which might complement the amino acids and vitamin in the proteolan forming a more suitable diet for animal feeding purposes.

Tab. 3. Net protein utilization (N.P.U.), digestibility coefficient (D) and biological value (B.V.) of the proteolan by-product, and its mixture with barley rootlets, the by-product of malting as compared with casein diet.

Diets	Digestibility coefficient	Biological value	Net protein utilization*)
Proteolan	91.2	45.9	41.5
Proteolan and rootlets	86.65	67.92	49.2
Casein	85.9	84.6	72.24

*) mean of 3 assays

Tab. 4. The essential amino acids of the proteolan and the amino-acids pattern designed by Food and Agriculture Organization (10).

Amino acid	mg/g Nitrogen Proteolan*)	FAO	Amino acid	mg/g Nitrogen Proteolan*)	FAO
Leucine and Isoleucine	420	576	Threonine	192	180
Lysine	183	270	Valine	300	270
Phenylalanine	310	180	Tryptophan	102	90
Total sulfur-amino acids	217	270	Tyrosine Methionine	630 –	180 144

*) on dry basis

The suitability of the proteolan by-product for nutritional purpose can be well appreciated when this diet is compared to the other meals of plant origin. *Miller* and *Bender* (9) determined the N.P.U. values of wheat gluten, rice gluten and broad beans; they showed the values 37, 36 and 41.7, consequently. However, our work gave increasing value for the N.P.U. in comparison to wheat and rice glutens.

It has a comparable N.P.U. value to the broad beans.

Summary

The nutrient contents as well as the amino-acid pattern of the proteolan by-product were determined. The results showed the presence of 18 amino acids. Most of the essential amino acids are existing in optimal concentration with exception of the sulfur-containing amino acids which showed deficiencies. The animal experiments indicated high figures for the digestibility coefficient and low figures for both the biological and net protein-utilization values. Mixing the proteolan in equal proportion with barley rootlets, a by-product of malting, leads to a noticeable increase in the biological value.

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