INVESTIGATION ON THE AVAILABILITY OF AMINO ACIDS FROM DIFFERENT ANIMAL PROTEIN SOURCES IN GOLDEN COCKERELS

Saima, M. Akhter*, M. Z. U. Khan, M.I. Anjum, S. Ahmed, M. Rizwan and M. Ijaz

Department of Food and Nutrition, University of Veterinary and Animal Sciences Lahore
*Pir Mehr Ali Shah University of Arid Agriculture, Rawalpindi

ABSTRACT

The direct relationship exists between the quality of an animal protein source and its available amino acids. A number of samples of each of the fish meal, feather meal, meat meal and blood meal were analyzed for their proximate composition. Then two samples of each ingredient one having the highest (grade A) other with lowest crude protein (grade B) were selected. They were analyzed for their available amino acids. The average availability of fifteen amino acids in high grade fish meal, feather meal, meat meal and blood meal were 85.68, 80.36, 85.53 and 77.62 percent, respectively. Whereas average availability of fifteen amino acids in low grade fish meal, feather meal, meat meal and blood meal were 78.12, 76.60, 67.10 and 69.46 percent, respectively. All protein sources were force fed to the birds and excreta samples were collected during the trial. Feed and excreta samples were analyzed for amino acid. The available amino acid contents of a feed protein were assayed by measuring the live weight gain, feed conversion efficiency, nitrogen retention of the chicks given the intact protein as a supplement to a diet deficient in a particular amino acid under investigation. It was clear after the determination of availability of each amino acid that more amino acids are available in high grade animal protein sources as compared to low grade animal protein source. Thus it was concluded that quality of feed ingredients impose direct effect on their available amino acids profile.

Key words: Animal protein, quality, available amino acids, cockerels

INTRODUCTION

In feed formulation, considerable attention is paid to the protein and energy content of the feed. Meeting the protein needs of birds contribute significantly to the feed cost (Skinner *et al*., 1992). Vegetable and animal protein sources are two major sources of protein in poultry rations. Poultry nutritionists focus more attention in the use of animal protein sources because vegetable protein sources are deficient in certain essential amino acids. Moreover, vegetable protein sources also have low biological values and anti nutritional factors. Due to this animal protein sources such as meat meal, blood meal, feather meal and fish meal are extensively used in poultry rations (Johnston and Coon, 1979). The future of animal protein in poultry diets in reality lies within the decisions made by the industry itself and for the consumer products. There are no scientifically based reasons for the exclusion of animal protein ingredients from poultry diets. Without the recycling and processing services of renderers, massive problems of disposal from farms/feedlots, slaughter facilities, food processors, restaurants and institutions would result, contributing to serious challenges for disease transmission, disease prevention, control, environmental and public health. In recent feed formulation, considerable attention has been focused on the true metabolizable energy and available amino acids content of feed ingredients. Although the animal protein sources have high values of available amino acids and the availability of amino acids can vary greatly with the quality (Johnson and Parsons, 1997). In general, the quality of animal protein sources is mainly dependent upon the composition of the raw material used. There are many methods for the determination of available amino acids. Indirect assays for determination of availability include physical and chemical analysis method. In case of direct method, considerable attention has been, focused on the precision for determination of digestibility of amino acids (Kessler *et al*., 1981). There is need to determine the relationship between the quality of feed ingredients and their available amino acids. Present project was planned to analyze the different sources of animal protein for proximate composition and available amino acids and study the relation between the quality of animal protein sources and their available amino acids.

MATERIALS AND METHODS

Four animal protein sources (fishmeal, feather meal, meat meal and blood meal) with two levels of crude protein were used in this study. Proximate analysis was done to investigate their nutrient profile. Animal protein source containing higher crude protein content was termed as high grade whereas animal protein source with lower crude protein content was termed as low grade. The composition of all protein sources used in the experiment revealed that the moisture contents of all

sources ranged from 5-10 percent. The crude protein content of high quality feather meal was 56.88% and that of low quality feather meal was 54.69%. Similarly, the crude protein content of high quality fish meal was estimated to be 53.59% and that of low quality fish meal was 47.03%, the crude protein content of high and low quality meat meal was 45.94% and 27.34%, respectively. The crude protein content of high and low grade blood meal was 82.03% and 77.50%, respectively. The whole proximate composition of all protein sources is given in Table 1.

For the determination of availability of amino acids of each animal protein source, forty golden cockerels of same age and weight were kept in individual cages. About 3 inch thick layer of saw dust was spread under the cages to counteract the problems of ammonia production from droppings during the experimental period. In a completely randomized design, 40 experimental birds were divided into 10 groups in such a way that there were four birds in each group and each bird was considered a replicate. Out of 10 groups 4 groups were fed with low grade animal protein sources and 4 with high protein sources. Whereas for the estimation of urinary losses for endogenous amino acid secretion, 2 groups were kept as negative control, one for low grade animal protein sources and other for high grade animal protein sources. After an adjustment period of 7 days, the birds were kept without feed for 24 hours fasting period to empty their alimentary canal. After that thirty grams of coarsely ground feed ingredient was forced fed into the crop of each bird with a 30 cm long glass funnel. A plunger was used to push the feed into the crop of the bird. The excreta collection tray was placed under the cage. The excreta were collected over a period of 48 hours in 2% H_2SO_4 solution in individual trays attached at the bottom of the cages. Collection of excreta in H_2SO_4 solution helped in reduction of losses of volatile nitrogenous substances during oven drying. Feed samples were analyzed for proximate composition (AOAC, 1990) and amino acid content (Spackiman *et al*., 1958). But faecal samples were only analyzed for amino acid contents. The available amino acid contents of a food protein were assayed by measuring the live weight gain, food conversion efficiency, nitrogen retention of the chicks given the intact protein as a supplement to a diet deficient in a particular amino acid under investigation (Mc Donald, 2008). Data were statistically analyzed through one way analysis of variance technique (Steel, *et al*. 1997).

Table 1. Proximate composition of high grade and low grade feed ingredients

Ingredients	Moisture %	Crude protein %	Ether extract %	Crude fiber %	Ash %
Feather meal (A grade)	7	56.88	12.3	9.8	17.3
Feather meal (B grade)	10	54.69	13.9	11.5	19.5
Fish meal (A grade)	5	53.59	10.5	1.0	24.5
Fish meal (B grade)	8	47.03	9.00	0.9	24.5
Meat meal (A grade)	4	45.94	6.5	2.4	10.3
Meat meal (B grade)	6	27.94	7.5	2.35	17.0
Blood meal (A grade)	3	82.03	1.5	1.5	5.7
Blood meal (B grade)	4	77.50	1.0	1.0	8.0

RESULTS AND DISCUSSION

Amino acid availability: The average availability of all the fifteen amino acids in high (A) and low grades (B) fish meal was 85.68% and 78.12%, respectively. The availability of all amino acids in high grade fish meal was higher than the low grade (Table 2). Johnson and Coon (1979) determined that the poor processing conditions could adversely affect the protein digestibility and cause reduction in availability of amino acids. Wortheimer (1989) noted that average availability of amino acids in fish meal was 82.5%. The better availability of amino acid determined by Wertheimer may be due to better processing technique and better storage conditions in their country.

The average availability of all the amino acids in high grade and low grade feather meal was 80.36% and 76.60%, respectively. The percent availability of all amino acids in high grade feather meal was higher than the low grade feather meal. Payne (1972) stated that processing conditions could affect the quality of meal. The low availability of amino acids in low grade feather meal might be due to its poor processing because during processing of feather meal the temperature is increased very high in order to extract the extra fat which may cause loss of amino acids.

The average availability of all fifteen amino acids in high and low grade meat meal was 85.53% and 67.10%, respectively. The percent availability of other amino acids has been given in Table 2. High grade meat meal has more available amino acids than low grade meal. The reason for this low availability of amino acid in low grade meal might be due to adulteration. Green and Kiener (1989) determined the availability of amino

acids in meat meal by using same technique. The results of present study revealed (Table 2) that the availability of all amino acids in high grade meat meal except cysteine, isoleucine and phenylalanine was comparable with their results. But the apparent digestibilities of indispensable amino acids of fish meal, with the exception of methionine and threonine were significantly higher in caecectomized than in intact birds. Whereas the apparent digestibilities of methionine, cysteine, threonine, valine and serine of meat cum bone meal were higher in intact birds in comparison to their caecectomized counterparts. The true digestibilities of all the amino acids of fish meal were similar between caecectomized and intact birds.

The average availability of all the fifteen amino acids in high and low grade blood meal was 77.62% and 69.46%, respectively.

Thus it is revealed that the quality of feed ingredients has direct bearing on the availability of amino acids. Table 2 shows the comparison between high grade and low grade animal protein sources with availability of amino acids. Feather meal is relatively low in methionine, lysine, histidine, and tryptophan compared to other protein sources**.** Feather meal contains high levels of the amino acid cysteine. The amino acid L- cysteine can inhibit the uptake of both D- and L-methionine in the chick mucosal epithelial membrane. It is important to note that lysine, methionine, histidine, and tryptophan have lower digestibility in feather meal than in other protein sources.

Table 2. Comparison between high and low grade protein sources for their % available amino acids

Amino acids	Fish meal (A)	Fish meal (B)	Feather meal (A)	Feather meal (B)	Meat meal (A)	Meat meal (B)	Blood meal (A)	Blood meal (B)
Aspartic acid	81.5	78.1	61.7	59.5	82.7	64.1	74.1	70.8
Threonine	84.9	75.4	75.3	71.8	89.4	70.8	78.6	72.5
Serine	83.7	73.4	84.3	78.4	84.8	71.2	79.6	70.1
Glutamic acid	86.2	77.5	75.3	70.7	85.1	71.6	80.7	68.9
Alanine	87.7	80.2	85.5	82.8	85.8	69.3	82.1	77.5
Cysteine	82.1	68.8	64.8	62.4	73.5	62.5	77.8	59.1
Valine	84.2	80.3	87.7	86.5	88.2	64.9	81.0	71.5
Methionine	89.9	82.5	79.6	64.3	89.3	71.4	75.4	64.9
Iso-leucine	85.1	80.7	88.2	87.5	81.9	70.1	79.8	72.2
Leucine	87.0	83.4	87.3	84.1	85.1	61.5	80.2	65.9
Tyrosine	86.6	75.0	84.1	78.8	87.6	67.2	69.1	58.8
Phenylalanine	87.5	80.2	87.7	87.6	71.2	62.6	70.5	64.2
Histidine	83.3	76.9	84.6	70.9	87.7	59.3	81.3	75.5
Lysine	86.8	80.9	71.8	83.3	85.4	66.7	78.7	71.6
Arginine	88.8	78.5	81.8	80.5	85.3	73.4	75.4	68.5

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