Reprinted from Indian Journal of Poultry Science, 1976, XI (2) 102-107

Studies on Growth Response of Broiler Chicken to Frog Meal as a substitute to Fish Meal

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ABSTRACT

Frog meal was prepared from the frog waste material such as delegged frog carcasses and its proximate analysis including amino cid composition was determined.

One hundred and twenty day old Shaver Starbro broil r chicks were divided into three groups of 40 each. Three diets were prepared by substituting fish meal with frog meal. The average gain in body weight at 10 weeks age for group I (fish meal was completely replaced by frog meal); group II ($\frac{1}{3}$ fish meal+$\frac{1}{3}$ frog meal) and control group (contain only fish meal but no frog meal) was 1923 g, 1972 g and 1835 g respectively. The feed consumption during the same period for the 3 groups was 6225 g 6325 g, and 6175 g, respectively. The growth rate of the group II ($\frac{1}{3}$fish meal+$\frac{1}{3}$ frog meal) was significantly high when compared with other two groups fed fish meal or frog meal alone.

India exports about 2,500 tonnes of frog legs annually and this Industry has made available about 10,000 tonnes of delegged frog carcasses annually, which is now being wasted. If it can be converted into edible protein, it offers an excellent opportunity for the growing poultry industry.

Several attempts have been made to include by-products of both plant and animal origin in poultry feeds by earlier workers in order to produce economic poultry rations. But no attention has been paid for utilization of frog meal in poultry feed so far. Good quality fish meal, an important constituent of poultry mash, is not available in quantities sufficient to meet the requirements of a growing poultry industry. In the present investigation, frog meal has been prepared from delegged frog carcasses, its chemical analysis including amino acid composition is determined and feeding trials are conducted by complete and partial replacement of fish meal in broiler chicken.

MATERIALS AND METHODS

Preparation of frog meal

Delegged frog carcasses were obtained from a local exporter of frog legs. The salted frog carcasses (containing head,

thorax, empty of contents and forelimbs) were washed free of salt in water. The material was then autoclaved at 15psi for 20 minutes. This was stored overnight prior to further processing in a preservative solution. The material was then pressed free of water in a mechanical screw press and dried at 60°C for 12 hours. The processed product was ground in Willy mill to a coarse powder. The yield was 25% based on wet weight.

Analytical methods

Proximate analysis of the frog meal were done for the following parameters: Moisture was estimated using infrared moisture meter. Total ash and nonvolatile petroleum ether extract contents were determined by the methods of Associaton of Official Analytical Chemists (1950). The protein content of the meal was calculated from Kjeldahl nitrogen values. Calcium was esitmated as calcium oxalate by titrating against potassium permanganate. Collagen content was determined by estimating the hydroxyproline by Newman and Logan (1950) method. Tryptophan and tyrosine were estimated spectrophotometrically by Goodwin and Morton method (1946) after alkaline hydrolysis of the meal. Amino acid analysis was carried out on a Beckman Spinco 120-C automatic amino acid analyzer. The frog meal had a high calcium content arising out of high bone content. The modified method of Tong-Yun Ho (1960) was followed for demineralising. The meal was then hydrolyzed and subjected to amino acid analysis.

Feeding trials in chicken

One Hundred and twenty, 1—day old broiler Shaver Starbro chickens were wing

Table 1. Composition and calculated analysis of broiler starter and finisher rations

Ingredient	Starter mash (0-6 week)%	Finisher mash (7-10 weeks) %
Maize	39.5	46.0
Groundnut cake	17 0	13.5
Sesame oil cake	4.0	3.0
Wheat bran	5.5	6.0
Rice polish	11.0	13.0
Fish meal	9.5	7.5
Meat meal	7.5	6.0
Groundnut oil	3.0	2.0
*Mineral Mixture	3.0	3.0
**Vitablend	0.02	0.02
Neftin	0.10	0.10
Crude protein (calculated)	24.0	20.50
Metabolizable energy Kcal/kg (calculated)	3020	3030
Energy : protein ratio	126.0	148.0

* Composition of mineral mixture : Phosphorus, 5%; calcium, 28%; sodium chloride, 18%; Iron, 3500 PPM, Iodine, 33 PPM; Copper, 130 PPM; Manganese, 2500 PPM; Cobalt, 50 PPM; Zinc, 1100 PPM; Magnesium, 800 PPM.

** Each gram of vitablend contains Vitamin A, 40.000 IU vitamin B_2, 25 mg. and vitamin D_3, 600. i, c, u.

banded, divided into three groups of 40 each and grown in deep litter (6" depthsaw dust) system. Three types of chicken feed were computed as per the formulae shown in Table I (control group). In the experimental group I, fish meal was completely substituted by frog meal, and in the experimental group II, $\frac{1}{2}$ fish meal was substituted by $\frac{1}{2}$ frog meal. Other feed ingredients are common in all the three groups as shown in the Table I. The chicks were fed the test rations i. e. starter and finisher rations from 0 to 6 weeks, and 7-10 weeks of age respectively. Initial weight at zero week and at the end of every 2 weeks thereafter was recorded individually till 10 weeks of age for all the three groups. The quantity of feed consumed during the same period was also recorded separately for each group to calculate the feed efficiency.

Usual preventive measures were taken for all the birds. The birds were supplied *ad libitum* feed and clean water at all times.

Results

Proximate analysis and amino acid composition of the frog meal is recorded in

Table 2. Proximate and essential amino acid composition of frog meal and fish meal and the essential amino acid requirements for chicks (N R C 1971) (Percent).

Nutrient	Frog meal[1]	*Fish meal[2] (Titus 1961)	Essential amino acid requirements for chicks NRC (1971)[3]
Moisture	6.4	10.0	—
Ash	34.5	20.0	—
Fat	3.0	6.8	—
Protein	55.0	60.0	22.0
Calcium	10.7	5.75	—
Methionine	0.62	1.80	0.44
Cystine	—	0.63	0.39
Arginine	1.54	3.80	1.32
Glycine	8.41	3.30	1.10
Histidine	0.50	1.50	0.44
Isoleucine	1.82	3.20	0.83
Leucine	3.94	4.90	1.54
Lysine	2.57	4.0	1.21
Phenylalanine	1.41	2.70	0.77
Tyrosine	3.50	2.0	0.66
Threonine	1.65	2.60	0.77
Tryptophan	2.20	0.69	0.22
Valine	1.62	3.10	0.94

* Other amino acids of frog meal are hydroxyproline (1.63%); Aspartic acid (5.89%); serine (7.63%); (Proline 2.53%); glutamic acid (1.24%); alanine (4.08%) and traces of hydroxylysine, allohydroxylysine and L- amino butyric acid.

(1) Uncorrected for the losses during hydrolysis.

(2) Values of typical fish meal are included for comparison.

(3) Adjusted to a dietary protein level of 22%.

Table 2. Values of typical fish meal along with the essential amino acids requirement of chicks (N R C 1971) are included for comparison. The analysis data reveal a high calcium content for frogmeal. Due to high calcium value, difficulty was also experienced in preparing pure protein hydrolysate for amino acid analysis. The results of the amino acid analysis of the frog meal show that all the essential amino acids except cystine are present in the meal and the rare amino acids like hydroxylysine, allohydroxlysine and L- amiuobutyric acid are present in traces. A comparative study of the amino acid content of meal with that of the fish meal shows that the contents of threonine, leucine, isoleucine, valine, methionine, phenylalanine, lysine, histidine, and arginine are little lower than in the standard fish meal while glycine, tyrosine and tryptophan are little higher than in fish meal. The high content of glycine and serine may be due to high bone content in the meal.

The average body weights of the three upto 10th week are recorded in Table 3. The maximum weight recorded is 2430 g; 2670 g; and 2400 g in groups I, group II and control group respectively. The average feed consumption data of the three groups of chicken with their feed efficiency upto 10th week are presented in Table 4. It is apparent that to attain a weight of 2022 g, the group II chicken had consumed 6325 g of feed as against 6175 g. eonsumed by the control group to attain a body weight of 1883 g. The group I chicken consumed 6225 g. of feed to attain a weight of 1972 g. There was no mortality among the three groups throughout the period of experiment.

Discussion

It is observed (Table 3) that the body weights of the chicken receiving frog meal (group I) and the chicken receiving $\frac{1}{2}$ frog meal + $\frac{1}{2}$ fish meal (group II) are higher than the chicken in control group from 2nd to 10th week. There was no marked difference in the bodyweight of the two groups I and II upto 4th week. But from 6th week, the body weight of the group II chicken fed with $\frac{1}{2}$ frog meal + $\frac{1}{2}$ fish meal was significantly higher than the chicken (group I) fed with frog meal alone. There was a difference of 50 grams in favour to the group II chicken at 10th week than that of the group I chicken.

The difference in the weight at 10th week between the Group I and control group was 89 g. and that between the control and the group II was 139 g. Though fish meal is an important constituent of poultry mash, a good quality fish meal is not available and such substandard samples are found deficient in essential amino acids such as lysine, methionine and cystine (Mathur and Ahmed 1971). In the present investigation also, it may be attributed that due to poor quality of fish meal,

Table 3. Average body weights (gm) of broiler chicks fed varying combtinaions of frog and fish meal.

Treatment	2nd week	4th week	6th week	8th week	10th week
Control	254	638	1039	1506	1883
Group I (fish meal completely replaced by frog meal)	282	649	1091	1600	1972
Group II ($\frac{1}{2}$ fish meal + $\frac{1}{2}$ frog meal)	286	651	1126	1625	2022

Table 4. Average feed consumption and feed efficiency in broiler chicken fed varying combinations of frog and fish meal

Treatment		4th week	6th week	8th week	10th week
1 Control	Feed consumption, gm.	1600	2475	4250	6175
Group	FER	2.71	2.49	2.91	3.36
2 Group I	Feed consumption, gm.	1575	2400	4350	6225
(Frog meal)	FER	2.62	2.30	2.80	3.23
3 Group II	Feed consumption, gm.	1575	2450	4400	6325
(Frog meal : Fish meal 50 : 50)	FER	2.62	2.27	2.79	3.20

the group fed with fishmeal has given less growth rate than the group fed with frogmeal. But the group II chicken fed with a ration containing equal proportions (4.75% each in starter mash and 3.75% each in finisher mash) of fish meal and frog meal has yielded maximum body weight when compared with the chickens fed frog meal (9.5% in starter mash and 7.5% in finisher mash) alone. It can be assumed that equal proportions of frog meal and fish meal in the diet might have produced balance of essential amino acids which have resulted in maimum growth rate in chicken. Studies reviewed by Davis 1959, Forbes, 1960; Sathe and McClymont, 1965, indicate that high content of calcium is detrimental to the growth of chicks. As frog meal contains high calcium content (10.7%), it can also be attributed that the growth rate of chicken fed with higher levels of frog meal (7.5 to 9.5%) was less than that of chicken fed with lower levels of frog meal (3.75 to 4.75%).

The group II birds consumed 1.0 g. more feed than the control group to produce 139 g. of extra body weight. Similarly the group I birds consumed 50 g. more feed than the control group to produce 89 g. of extra body weight. It is seen from table 4, the groups I and II converted feed more efficiently into body weight than the control group. There was difference of 0.16 units in feed efficiency between control group chicks and group II chicks.

Acknowledgements

This research has been financed in part by a grant made by the U. S. Department of Agriculture, Agricultural Research Service, under P L 480.

REFERENCES

Association of Official Analytical Chemists 1950 "Methods of Analysis". (Ass. Offic. Analyt. Chemists; Washington, D. C.)

Davis, G. K.; 1959. Effects of high calcium intakes on the absorption of other nutrients Federation Proc. 18 : 1119.

Forbes, R. M. 1960 - Nutrition intractions of zinc and calcium. Federation Proc. 19 . 643.

Goodwin, T. W. and Morton, R. A. 1946. The spectrophotometric determination of tyrosine and tryptophan in proteins. Biochem. Jour. 40 : 628.

Mathur, C. R. and Ahmed, M. T. 1971. Improvement in the protein efficiency of practical chick rations using two sources each of vegetable and animal protein suppliments. Ind. Vet. Journ. 48 : 609.

Neuman, R. F., and Logan, M. A. 1950. The determination of hydroxyproline. Journ. Biol. Chem. 184 : 299.

National Research Council (U. S.) 1971. "Nutritional requirements of domestic animals. No. I. Nutritional requirements of Poultry," p. 15. (Natn. Acad. Sci. Washington D. C.).

Sathe, B. S. and McClymont, G. L. 1965. Nutritional evaluation of meat meals for poultry. III. Association of chick growth with the bone, calcium and protein contributed by meat meals to diets and the effect of mineral and vitamin plus antibiotic supplementation- Austr. Journ. Agri. Res. 16 : 243.

Tong-Yun Ho. 1966. The isolation and amino acid composition of the bone collagen in Pleistocene mammals - Comp. Biochem. Physiol. 18 : 353.