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# Amino Acid Digestibility in Broiler Birds Fed with Fish Meal and Rumen Epithelial Scrap Based Meal

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## ABSTRACT

The amino acid digestibility in broiler birds fed with rumen epithelial scrap based finisher meal was investigated and compared with those of standard Fish Meal (FM) and other meals in poultry use. This was in a quest to search for an alternative and local source of protein in broiler-chick meal due to adulteration and high cost of fish meal. Three groups of eighteen 4-week-old broiler chickens in each group were fed with three isocaloric finisher diets: basal diet, Rumen Epithelial Scrap based Meal (RESM) and Fish Meal (FM) containing 0% Crude Protein (CP), 19.5 and 19.5% CP, respectively. The broiler birds, in their starter phase, were fed a nutritionally sound starter mash (23% CP and 2.8 Kcal $g^{-1}$ ME). At day 14 of the experiment the birds were sacrificed and feed remnants in their crops and faecal deposits in their rectum were extracted for amino acid analyses. The consumption of the RESM and FM by the broiler birds were not significantly ($p<0.05$) different. The amino acid digestibility co-efficient obtained for lysine, methionine, cystine and other amino acids in broiler birds fed with RESM compared favourably with values obtained by earlier researchers for meat meal, blood and feather meal but the lysine digestibility coefficient was significantly ($p<0.05$) lower than the value obtained in the broiler birds fed FM. We inferred that rumen epithelial scraps, an abattoir by-product which constitutes an environmental waste, could be utilized as a source of protein in broiler feed production with appropriate supplementation with lysine.

**Key words:** Amino acids digestibility, poultry, rumen epithelial scraps, meal, supplementation

## INTRODUCTION

One of the main problems confronting mankind in the 21st century is the supply of high quality proteins in the diets (Olimpia, 2006). The situation is not different in poultry production. The growing need for an efficient and low-cost poultry production in the tropics leads to the selection of alternative raw materials, with acceptable bio-availability and do not compete with human feeding (Savon, 2005). Ghadge *et al.* (2009) reported that cheaper protein sources like groundnut cake and fish meal are used as major protein sources in poultry feed formulation in India. Amongst the other protein sources soybean meal has emerged as the most promising one because of its better protein quality and fairly consistent nutrient content. The utilization of legumes for animal feeding constitutes one of the most accurate alternatives. The foliage of *Stizlobium* sp. (mucuna) is an outstanding resource due to its crude protein content (CP: 18.79%) (Leal *et al.*, 2008) and also to the mineral (Diaz *et al.*, 2002) levels, which makes it attractive for inclusion in poultry diets. However, as a non-conventional feed, it also contains an important amount of neutral detergent fibre (NDF: 46.85%) and anti-nutrient factors (Scull, 2004), which diminish the apparent

digestibility of the nitrogenous compounds (Savon, 2005). Olimpia (2006) submitted that feeding growing animals on diets containing raw legumes as major sources of protein brings about a number of undesirable physiological and biochemical effects. They have sulphur containing amino acid deficiency and a variety of antinutritive factors (Phytics acids, trypsin inhibitors, soine, ascorbidase, allergic factors, lizanalanine, un-useful methionine, nitril-glycosizis). The wide variation in quality due to presence of anti-nutrients in legumes and adulteration in fish meal as well as high prices of U.S. meat meal and U.S. poultry by-product meal has necessitated a search for other potential protein sources. Rumen epithelial scrap is an abattoir by-product which is rich in protein (about 53% CP) and has amino acids profile which in most cases is similar with those of fish meal. There is however, paucity of information on its apparent amino acid digestibility. The purpose of the present study is to evaluate the amino acid digestibility of broiler-birds fed rumen epithelial scrap based meal and fish meal with a view to demonstrating the feasibility and effectiveness of substituting imported and expensive fish meal, U.S. meat meal or U.S. poultry by-product meal with rumen epithelial scrap based meal.

## MATERIALS AND METHODS

A total of 54 day old Anak 2000 broiler chicks were obtained from Animal Science Research farm, University of Ibadan, Nigeria and used for this study between March and July, 2006. These chicks were fed ad libitum with commercial broiler starter mash for 4 weeks so that no other variable was introduced by the method of feeding. The birds were brooded in a pen that was electrically heated at 37°C. The 54 day old broilers were divided into three groups in their finisher phase and were placed on a nitrogen-free basal diet, Rumen Epithelial Scrap based Meal (RESM) and Fish Meal (FM), respectively. The RESM and FM were iso-nitrogenous with 19.5% Crude Protein (CP). The feed intake and the live weight gain were measured. A 7 day adjustment period was allowed followed by a 4 day total faecal collection. The faeces were oven dried and stored till required for analysis. At day 14 of the experiment the birds were sacrificed and feed remnants in their crops and faecal deposits in their rectum were extracted for amino acid analysis.

**Experimented protein source:** The rumen epithelial scrapings used in this study were obtained from the Bodija abattoir in Ibadan, Nigeria. It was sun dried, milled and sieved.

Table 1: Composition of experimental diets

| Ingredients | Basal diet | RESM | FM |
|---|---|---|---|
| RES (53% CP) | - | 36.60 | - |
| FM (65% CP) | - | - | 30.00 |
| Cassava flour | 50.00 | 30.20 | 36.80 |
| Palm oil | 10.00 | 5.00 | 5.00 |
| Glucose | 10.00 | 3.20 | 3.20 |
| Sucrose | 25.00 | 20.00 | 20.00 |
| Cellulose | 0.35 | 0.35 | 0.35 |
| Bone meal | 2.00 | 2.00 | 2.00 |
| Oyster shell | 1.00 | 1.00 | 1.00 |
| Vit./Min pre-mix | 0.65 | 0.65 | 0.65 |
| Salt | 1.00 | 1.00 | 1.00 |
| Total | 100.00 | 100.00 | 100.00 |
| ME (Kcal $g^{-1}$) | 3.03 | 2.85 | 2.84 |
| Crude protein | 0.00 | 19.50 | 19.50 |
| Calorie: Protein | - | 146.15 | 145.64 |

**Feed formulation:** Formulation of the experimental feed was carried out in accordance to BIS (1992). The processed rumen epithelial scraps were used to replace fish meal (used in the first diet) 100% as the source of dietary protein in the RESM. The diets were made iso-caloric and iso-nitrogenous by adjusting the other ingredients (Table 1).

**Proximate analysis:** The proximate composition of the feeds ingredients were carried out in accordance to AOAC (1990). Amino acids assay was carried out using the method of Merck and Darmstadt (1979).

**Statistical analysis:** Data are presented as mean of 10 replicates±Standard Error of Mean (SEM). Analysis of variance was carried out. Level of statistical significance was taken at $p<0.05$ (Adamu and Johnson, 1997).

## RESULTS AND DISCUSSION

The RESM and fish meal showed no significant ($p<0.05$) difference in the crude fibre, crude fat and ether extract (Table 2). The ash contents of both the fish meal and rumen epithelial scrap based meal were also similar. Ravindran *et al.* (2002) showed that the ash content was the only chemical parameter that was consistently correlated with amino acid digestibility. He further reported that digestibility of amino acids, with the exception of aspartic acid, threonine, serine, tyrosine, histidine and cystine, were negatively correlated with ash content while samples with high ash levels had lower digestibility. The much correlation in the amino acid digestibility of the fish meal and the rumen epithelial scrap based meal in this study may therefore be due to apparent sameness in the ash content of the two meals.

The results of amino acid composition (Table 3) of the RESM compared favourably with those of FM except for lysine and arginine that were significantly ($p<0.05$) lower in RESM. The use of RESM in broiler bird diet may therefore require lysine supplementation.

Table 4 showed that the digestibility coefficients of amino acids in birds fed RESM compared favourably with the values obtained for those of FM and other meals in poultry use. However the values were significantly ($p<0.05$) lower in lysine and cystine (0.72 and 0.62, respectively) compared to those of FM [lysine (0.88) and cystine (0.73)]. The digestibility of the amino acids for the broiler-birds in this study was also comparable with the values obtained by Kluth and Rodehutscord (2006) for broiler-birds fed soy bean meal. The amino acids with the highest digestibility observed by Kluth and Rodehutscord (2006) was methionine (87%) which conformed well the value obtained in this study. However, they obtained higher digestibility (84%) for lysine in comparison with the 27% digestibility obtained for lysine in this study. The dietary requirement

Table 2: Proximate composition (g/100 g DM)

| Parameters | Basal diet | RESM | FM |
|---|---|---|---|
| Dry Matter (DM) | 90.01 | 92.40 | 92.64 |
| Proteins (Crude) | 1.05 | 19.21 | 19.82 |
| Crude fibre | 10.85 | 9.56 | 9.28 |
| Crude fat | 10.78 | 7.45 | 7.21 |
| Ash | 8.66 | 8.54 | 8.57 |
| Nitrogen per extract | 86.66 | 55.24 | 55.12 |

Table 3: Amino acid composition (mg $g^{-1}$) of the RESM, FM and meat meal

| Essential amino acids | RESM | [a]FM | [a]Meat meal |
|---|---|---|---|
| Lysine | 0.87±0.02 | 4.43 | 2.37 |
| Methionine | 1.36±0.01 | 1.94 | 0.68 |
| Threonine | 2.85±0.04 | 2.79 | 1.55 |
| Tryptophan | 3.03±0.02 | - | - |
| Isoleucine | 4.38±0.02 | 2.59 | 1.37 |
| Leucine | 7.89±0.03 | 4.41 | 2.90 |
| Valine | 2.38±0.02 | 2.79 | 2.11 |
| Arginine | 1.67±0.02 | 4.31 | 3.48 |
| Phenylalanine | 2.55±0.01 | 2.37 | 1.58 |
| Histidine | 2.43±0.01 | 1.27 | 0.73 |

Sources: [a]Eka in 1987

Table 4: Apparent amino acid digestibility in broiler birds fed RESM, FM and some standard values

| Amino acids | RESM | FM | *FM | *Blood meal | *Meat meal | *Feather meal |
|---|---|---|---|---|---|---|
| Arginine | 0.93 | 0.52 | | | | |
| Histidine | 0.98 | 0.91 | | | | |
| Lysine | 0.27 | 0.83 | 0.88 | 0.86 | 0.79 | 0.66 |
| Phenylalanine | 0.82 | 0.89 | | | | |
| Tyrosine | 0.81 | 0.93 | | | | |
| Leucine | 0.79 | 0.92 | | | | |
| Isoleucine | 0.79 | 0.92 | | | | |
| Methionine | 0.87 | 0.95 | 0.92 | 0.91 | 0.85 | 0.76 |
| Valine | 0.88 | 0.89 | | | | |
| Cystine | 0.62 | 0.84 | 0.73 | 0.76 | 0.58 | 0.59 |
| Alanine | 0.87 | 0.93 | | | | |
| Glycine | 0.88 | 0.86 | | | | |
| Glutamic acid | 0.77 | 0.75 | | | | |
| Serine | 0.88 | 0.86 | | | | |
| Threonine | 0.79 | 0.60 | | | | |
| Aspartic acid | 0.87 | 0.83 | | | | |
| Proline | 0.95 | 0.84 | | | | |
| Tryptophan | 0.95 | 0.95 | | | | |

*Leeson and Zubair (2002)

Table 5: Mean Feed Intake (FI), Live Weight Gain (LWG) and Feed Conversion Ratio (FCR) for broiler birds fed RESM, FM and basal diet

| Dietary treatment | FI | LWG | FCR ($^{FI}/_{LWG}$) |
|---|---|---|---|
| | ---------- (g $birds^{-1}$) ---------- | | |
| Basal diet | 253.3 | 122.0 | 2.08 |
| RESM | 300.7 | 158.0 | 1.90 |
| FM | 305.2 | 165.5 | 1.84 |

for protein is actually a requirement for the amino acids contained in the diet and the efficiency of protein utilization depends to a large extent on the amino acid composition of the diet. However, Ayu (2006) demonstrated that formulation of poultry diets on a digestible amino acid basis was superior to formulation of diets on the total amino acid basis. Lysine is a very important amino acid in poultry feed. Ghadge *et al.* (2009) reported that superior performance of broiler birds fed soybean meal was due to higher content of lysine and methionine in soybean meal.

It was observed in Table 5 that the feed consumption by the broiler birds was not significantly ($p<0.05$) different in RESM and FM. The apparent sameness of the feed intake in the broiler birds fed RESM and FM may be due to an apparent equality in the crude fibre in both meals. The basal diet with higher crude fibre was consumed much lesser than RESM and FM. This lend credence to the earlier submission of Ghadge *et al.* (2009) that higher fibre content in poultry feed may induce low feed intake.

## CONCLUSIONS

Fish meal has long been regarded as the standard protein for broiler bird diets. The present trial clearly demonstrated that with application of proper formulation technology the use of RESM, of which the source of protein is available locally, can perform well without fish meal, meat meal and feather meal, especially when supplemented with lysine.

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