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Response of Broilers to Improved and Local Fishmeal

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Target Audience: Animal Nutritionist, farmers, scientist

Abstract

A 42 day experiment with 204 one day old Marshal broilers was conducted to assess the nutritional quality of two imported- and two local-fishmeal using the biological response of broilers as a measure of performance. These birds were randomly distributed into four dietary treatments namely two commercially available imported fishmeal (A, B) and a commercially available local fishmeal (C). Finally, a manually prepared fishmeal from African Butter Catfish (Schible mystus) [D] was the last one. A completely randomised design was adopted for the study. The results of the proximate composition the fishmeal showed that local manually prepared fishmeal D (African Butter Catfish, Schible mystus) had the highest crude protein (47.6% CP) while the local commercially available fishmeal C had the lowest CP (15.95%). The imported fishmeal A and B have 34.3 and 28.06%CP, respectively. Dietary treatment significantly influenced the final body weight FBW (P=0.0002), weight gain WG (P=0.0002), feed intake (P=0.010) and feed conversion FC (P0.006) of broiler chicks. Broiler starters fed African Butter Catfish, Schible mystus (D) had the heaviest FBW and WG with the best FC. Those fed commercially available local fishmeal C had the lowest FBW and WG. Starters fed manually prepared fishmeal D had significantly better FBW and WG than those fed imported fishmeal B. At finishing phase, broilers fed imported fishmeal A and B as well as those fed manually prepared fishmeal D had significantly better FBW than those fed local available fishmeal C. Broiler chickens fed fishmeal C had the heaviest kidney with elevated serum alkaline phosphatase. In conclusion, the poor quality of local commercially available fishmeal C and the consequential poor biological response of broilers in this study revealed that a number of feedstuff particularly fishmeal were often being adulterated. Hence, the regulatory institutions such Nigeria Institute of Animal Science need to regulate the quality of the feeding ingredients being sold in the markets because of its economic and health related effect on the consumers of broiler products.

Keywords: Broiler, body weight, kidney, alkaline phosphatase, African butter catfish, imported and local fishmeal

Description of Problem

Proteins are organic nitrogen containing compounds and they are an important component in the feed of livestock particularly in monogastric animals. Proteins sources for animal feeding are generally more expensive than energy source [1] such that their reduced

inclusion level in diets can lead to saving cost in feed and in production in the long run [2]. Fishmeal is an exceptionally good source of high quality protein and its price usually reflects this [3]. It is also rich in minerals, B-vitamins and essential fatty acids. The presence of unidentified growth factors is another feature of fishmeal. The amino acid profile of fishmeal makes it attractive as a protein supplement. High quality fishmeal normally contains 60-72% crude protein by weight [42006].

Most commercially available fishmeals in Nigeria are usually imported from Denmark, America and some other European countries [5]. However, locally produced fishmeal is also available in the markets. Local fishmeal is generally of low quality owing to lack of control over raw fish quality, processing and storage conditions. They are often adulterated with cheap diluents including poor-quality protein sources (dried poultry manure, oilseed meals), urea and non-nutritive diluents such as sand [3]. Squila, shrimp waste meal and cray fish dust meal, by-products of marine food processing industry in the Niger-Delta region of Nigeria are often used in preparing local fishmeal [6].The quality of fishmeal is quite uncertain due to the use of different processing technologies in its production. It is contaminated with ingredients such as saw dust and fish bones and the use of chemical preservation often causes toxicity to poultry [7 8 ,9]. Also [10] reported that the quality of fishmeal is often compromised despite its high cost. The variation in the chemical composition in a number of commercial fishmeal shows lack of control on the quality of a number of commercially available fishmeal in the country. A number of Feedmill outlets in South-Western Nigeria produced a commercial fishmeal from *Schilbe mystus* (African butter catfish), it is also known as Eja Isin in Yoruba. Presently, there is dearth of information on nutritional value of this fish species for the benefit of poultry production. *Schilbe mystus* belongs to the family Schilbeidae and it is a siluroid catfish of commercial importance and heavily exploited [11]. Hence the present study estimated the nutritional value of a commercial fishmeal (with unknown source), fishmeal-produced from *Schilbe mystus* and two imported fishmeal using broiler as a biological response animal. The present study examined the effects of local and imported fishmeal on the growth performance, selected organ and serum enzymes of broiler chickens.

Materials and Methods

Site of the Experiment

The study was carried out in the Broiler Unit, Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.

Source and Preparation of the Test Ingredients

Two commercially available imported fishmeal were obtained at the Feedmill in Ogbomoso, Nigeria. These were TripleNine® (A) and Type FF® (B) manufactured by TripleNine Group A/S, Norway and FFSkagen Denmark, respectively. A commercial available local fishmeal (INDO®) [C] was obtained at a Feedmill (Bovajay Feedmill Enterprises) in Ogbomoso, Nigeria. Finally, the second local fishmeal was manually prepared from African Butter Catfish (*Schible mystus*) [D]. It was sun dried and grinded using a

grinding machine and stored in a polythene bag prior to diets formulation.

Formulation of Experimental Diets

Four experimental diets were formulated for the study using the earlier described fishmeal namely; A, B, C and D at 4.5 and 3.5% in the starter and finisher diets (Table 1).

Table 1: Gross composition of experimental diets

Ingredients	T1	T2	T3	T4	T1	T2	T3	T4
	Starter Diets				Finisher Diets			
Fishmeal Type	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Maize	58.50	58.50	58.50	58.50	44.00	44.00	44.00	44.00
Soybean meal	18.00	18.00	18.00	18.00	16.00	16.00	16.00	16.00
Groundnut cake	13.72	13.72	13.72	13.72	11.72	11.72	11.72	11.72
Fishmeal	4.50	4.50	4.50	4.50	3.50	3.50	3.50	3.50
Fixed Ingredients*	5.28	5.28	5.28	5.28	24.78	24.78	24.78	24.78
Calculated Nutrients								
Energy Kcal/Kg	3036.70	3036.70	3035.80	3035.80	2878.17	2878.17	2877.47	28.77.47
Crude Protein (%)	22.46	22.46	22.14	22.14	20.78	20.78	20.54	20.54
Crude Fibre (%)	3.30	3.30	3.31	3.31	5.05	5.05	5.06	5.06
Methionine (%)	0.51	0.51	0.51	0.51	0.48	0.48	0.48	0.48
Lysine (%)	1.20	1.20	1.20	1.20	1.08	1.08	1.08	1.08
Av. Phosphorus (%)	0.57	0.57	0.62	0.62	0.66	0.66	0.61	0.66
Calcium (%)	1.09	1.09	1.26	1.26	1.38	1.38	1.24	1.38

*Fixed ingredients for the experimental diets were as follows:2% and 21% corn bran, 2% and 2.5% bone meal, 0.5% and 0.5% limestone, 0.25% and 0.25% vitamin -mineral premix+, 0.15% and 0.15% methionine, 0.13% and 0.13% lysine, 0.25% and 0.25% salt, respectively for starter and fin isher diets . Fishmeal Types :A and B were imported fishmeal while C and D were local fishmeal . Fishmeal D was prepared from *Schilbe mystus*. +The vitamin-mineral premix contained the following vitamins and trace elements per kg of the diets:.....

Management of Experimental Animals

A total number of 204 one day old Marshal broiler chicks were randomly allotted to 4 dietary treatment groups of 3 replicates per treatment. Each treatment contained 51 chicks, thus 17 chicks were in a replicate. Normal and routine management practices were offered to the birds such as feeding, provision of clean water, vaccination and medication. Experimental diets and water were supplied to the birds at *ad libitum*. Brooding lasted for a period of 2 weeks.

Data Collection

Data were collected for growth performance such as initial and final body weight, feed intake whereas weight gain and feed conversion were calculated.

On the 35th day of the experiment, 6 blood samples in a treatment were collected into bottles without anticoagulant for serum enzymes determination.

On the 42nd of the study, 6 broiler chickens were separated and fasted foe 18 hours but they had accessed to clean drinking water. These birds were decapitated and cut into carcass parts and organs. The weights of the selected organs were estimated with the aid of a sensitive weighing scale.

Chemical Analysis

Proximate compositions of of the imported and local fishmeal were analyzed according to the method of [12]. Serum enzymes such as alanine aminotransferase (ALT), aspartate aminotransferase, alkaline phosphatase were assayed by kinetic methods SPAN kits [13].

Statistical Analysis

All collected data were analyzed by One-way analysis of variance using

[14]. Significant means were separated using Duncan option of the same statistical software. A probability of 5 percent was considered significant (P< 0.050).

Results and Discussion

The proximate composition of the two imported fishmeal (A and B) revealed that their crude protein were 28.06% and 34.3%, respectively. The commercial available local fishmeal (C) had the lowest crude protein (15.95%) [Table 2]. Highest crude protein (47.60%) was obtained in the local fishmeal prepared from *Schilbe mystus* (D).The ether extract and nitrogen free extract content (NFE) of the marketed local fishmeal (C) was the highest. However, local manually prepared fishmeal from *Schilbe mystus* (D) had the lowest ether extract and NFE. The crude fibre in the imported and local fishmeal showed that it ranged from 3.5% to 4.04%.

Broiler starters fed African butter catfish (D) had the highest final body weight FBW, weight gain WG and the best feed conversion FC (Table 3). Finisher broilers fed imported fishmeal A, B and local manually prepared fishmeal from *Schilbe mystus* (D) had significantly heavier FBW than those fed marketed local fishmeal (C) [Table 4]. Broiler chickens fed marketed local fishmeal (C) had significantly heavier kidney and elevated serum alkaline phosphatase than those fed those fed other types of fishmeal [Table 5].

Table 2: Proximate composition of the imported and local fishmeal (%)

Parameters	A	B	C	D
Crude Protein	34.30	28.06	15.95	47.60
Ash	19.30	13.60	3.10	15.90
Ether Extract	6.90	7.10	8.70	6.50
Crude Fibre	3.80	4.04	3.50	4.02
Nitrogen Free Extract	35.70	47.20	69.75	25.98
Dry Matter	92.31	92.72	89.20	92.95

Table 3: Growth performance of broiler starters fed imported and local fishmeal (g/bird)

Parameters	T1	T2	T3	T4	P-value	SEM
	Fishmeal Types					
	A	B	C	D		
Initial body weight	40.86	37.45	40.68	38.10	0.069	0.94
Final body weight	420.52^{ab}	374.20^{b}	269.93^{c}	434.71^{a}	0.0002	14.64
Weight gain (g/bird/day)	18.08^{ab}	16.04^{b}	10.95^{c}	18.89^{a}	0.0002	0.74
Feed intake (g/bird/day)	51.41^{a}	37.61^{b}	37.85^{b}	43.17^{b}	0.010	2.36
Feed conversion	2.86^{a}	2.35^{b}	3.47^{a}	2.30^{b}	0.006	0.18

^{ab}Means with different superscripts along the same row are significantly different (P<0.050)

The crude protein content in the imported fishmeal (34.3% for A and 28.06% for B) showed that the qualities of these products were compromised probably by adulteration. The marketed local fishmeal (with unknown source) was even worst as it contained the lowest crude protein. Several authors have documented the proximate composition of the imported fishmeal and fish by-

Table 4: Growth performance of broiler finishers fed imported and local fishmeal (g/bird)

Parameters	T1	T2	T3	T4	P-value	SEM
	Fishmeal Types					
	A	B	C	D		
Initial body weight	420.52[ab]	374.20[b]	269.93[c]	434.71[a]	0.0002	14.64
Final body weight	1274.36[a]	1150.34[a]	979.68[b]	1183.29[a]	0.007	41.74
Weight gain (g/bird/day)	40.66	36.96	33.80	35.65	0.078	1.59
Feed intake (g/bird/day)	93.28	79.35	73.24	80.33	0.156	5.58
Feed conversion	2.30	2.15	2.17	2.24	0.850	0.13

[ab]Means with different superscripts along the same row are significantly different (P<0.050)

Table 5 : Serum enzymes and some selected organ of broiler chickens fed imported and local fishmeal.

Parameters	T1	T2	T3	T4	P-value	SEM
	Fishmeal Types					
	A	B	C	D		
Aspartate aminotransferase (IU/L)	12.92	17.17	13.02	18.17	0.146	1.94
Alanine aminotransferase (IU/L)	2.00	1.09	1.76	1.63	0.598	0.48
Alkaline phosphatase (IU/L)	25.00[b]	25.77[b]	51.00[a]	31.25[b]	0.0004	3.94
Lungs (%)	0.54	0.28	0.67	0.73	0.082	0.05
Kidney (%)	0.66[b]	0.81[ab]	0.96[a]	0.60[b]	0.053	0.09
Liver (%)	2.61	2.12	2.87	2.97	0.436	0.17

[ab]Means with different superscripts along the same row are significantly different (P<0.050)

products in a number of studies. [15] showed that imported and local fishmeal contained 66.8% :51.5% crude protein CP, 4.7% : 6.55 % ether extract EE, 1% : 2.95% crude fibre CF, 18.6% : 22.5% ash, 89.2% : 88% dry matter DM, respectively. The proximate composition of the fishmeal showed wide variation in the quality of the fishmeal whether produced locally or imported. Earlier studies have suggested similar observation. Great variation have been reported to exist in the quality of different fishmeals depending on the type of fish employed and the pre-treatment of the fishmeal before use in rations [16,17]. [18] reported that the fish waste meal produced from tilapia and catfish (collected from a fish market in Lafia, Nasarawa State Nigeria) contained 61.62% CP, 22.4% ash, 9.55% crude fat, 3.17% nitrogen free extract and 26.7kJ/g gross energy. None of the fishmeal in the present study actually meet the recommended crude protein levels of 55 to 77% [19], 60 to 72% CP [4] in a high quality fishmeal. The different fish species, different processing methods employed for the fish species and pre-treatment of the fishmeal may account for the variation.

The highest final body weight observed from starter broilers fed local fishmeal produced from *Schilbe mystus* indicated that the local fishmeal has a good potential to completely replace imported fishmeal. The similar final body weight noticed in finisher broilers fed imported fishmeal and those fed fishmeal produced from *Schilbe mystus* revealed

that a local fishmeal without adulteration could performed satisfactorily with the imported fishmeal. Furthermore, the use of preservative in the imported fishmeal may have played a crucial role in the compensatory growth experienced in birds fed imported fishmeal (particularly those fed fishmeal B). The local fishmeal produced from *Schilbe mystus* used in this study was not preserved with antioxidant. Broilers fed local fishmeal C had poor growth performance at both the starter and finisher phases. It has been reported that local fishmeal was of low quality owing to lack of control over raw fish quality, processing and storage conditions [3]. [20] reported that freshness of the raw material was another factor that influenced the protein quality of fishmeal. Hence, the regulatory institutions should checkmate the adulteration of local and imported feed ingredients used in feed formulation to arrest the trend in the market. The highest ether extract in the marketed local fishmeal C may have accounted for the elevated serum alkaline phosphatase. Fat ingestion has been shown to elevate serum alkaline phosphatase levels in healthy animals when fat is administered in a test meal [21].

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