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Substitution value of squilla meal for fish meal in broiler production: Effects on growth performance, carcass and organ proportions

Udosen, E. O., Ojewola, G. S. and Adedokun, O. O.
Department of Animal Nutrition and Forage Science, College of Animal Science and Animal Production, Michael Okpara University of Agriculture, P.M.B. 7267, Umuahia; Abia State, Nigeria.
Corresponding authors:olubukolaadedokun@gmail.com : gsojewola@gmail.com

Abstract

This experiment was carried out to evaluate the substitution effects of squilla meal for fish meal in broiler diets. One hundred and twenty unsexed day-old broiler chickens of Abor Acre strains were randomly allocated to five dietary treatments in a completely randomized design. Each dietary group had 24 birds, replicated thrice, with eight birds per replicate. The birds were managed in a deep litter pen, fed and watered adlibitum for a period of seven weeks. Diet 1 was designated as the control, while diets 2, 3, 4 and 5 had their fish meal substituted at 25%, 50%, 75% and 100%, respectively. The mean body weight changes and feed intake were significantly (P<0.05) influenced, while the feed-to-gain ration was not. Birds fed Diet 1(control) gave the best total weight gain value (1804.55g), which was closely followed by birds fed Diet 4 (1776.77g), Diet 3 (1765.85g) and Diet 5 (1616.09g). Birds fed Diet 2 gave the least value of 1565.59g. All the carcass parameters evaluated showed no significant (P>0.05) difference, but kidney, abdominal fat and proventriculus were significantly (P<0.05) different but followed no definite pattern traceable to the diets. In conclusion, Squilla meal has shown to have positive comparative effects on the mean weight gain, carcass and organ proportions of broilers fed these diets. So, it is recommended at 75% level of substitution.

Keywords: Squilla meal, fish meal, broiler nutrition

Introduction

The ever-increasing cost of dietary animal protein source for poultry nutrition has made it imperative for poultry farmers, feed millers and nutritionists to embrace the use of unconventional animal protein sources of comparative nutritive values wherever it could be cheaply obtained. Apart from dietary energy, the most important nutrient required in poultry nutrition is the animal protein. Poultry business has come to stay and efforts must be made to mitigate the various environmental and economic challenges facing the industry. Lack of information, seasonality of some of these materials, yet to be determined nutritive value, presence of anti-nutritional factors, presence of chitin and chitosan are some of the major factors that limit the use of some of the non-conventional aquatic resources. Failure to confront these challenges would further reduce the animal protein intake of the already dietary nutrient induced poverty traumatized African population. It is also necessary to bring down the cost of poultry products through the use of efficient dietary inputs without compromising the bird's wellbeing, carcass quality, and economic efficiency of production. Squilla, a stomatopod crustacean is one of the aquatics that represents unexploited source of animal protein when properly proccessed into meal that can be partially and or completely used as a substitute for the imported and expensive fish meal. According to Ojewola and Udom (2005),

squilla contained 46.24% Crude protein, 1.34% Crude fibre, 28.85% Crude fat and 7.21% Ether extract. Chow (1982) observed 18.00% ash for squilla. Squilla meal is also rich in Calcium and has 7.13MJ of apparent metabolisable Energy per Kg. According to Reddy Quadratullah (1997), Squilla meal has a lower biological value and protein digestibility coefficient when compared with the important well processed fish meal. Nevertheless, this experiment was carried out to evaluate the productive efficiencies of substituting fish meal with squilla meal in Broiler chicken's nutrition.

Materials and methods

The test material was purchased from a river side market in Akwa-Ibom State, Nigeria. It was sundried, milled into powdery form and properly stored. Five diets were formulated. Diet 1 (D_1) was designated as the control. It has fish meal as the only animal protein source (6%) while diets 2, 3, 4 and 5 designated D_2, D_3, D_4 and D_5 had their fish meal substituted at 25%, 50%, 75% and 100% respectively. One hundred and twenty unsexed day-old broiler chickens of Abor Acre strains were randomly allocated to the dietary treatments with 24 birds per treatment, replicated thrice with eight birds per replicate respectively. The birds were managed in a deep litter pen, fed and watered *adlibitum* for a period of seven weeks. The parameters evaluated include weight gain, feed-to-gain ratio, carcass and organ proportions. Data collected were subjected to analysis of variance (ANOVA) according to the procedure of Steel and Torrie (1980). The means were separated using the Duncan's multiple range Test (Duncan, 1955).

Table 1: Experimental diets showing the substitutional levels of squilla meal for fish meal in broiler diet

	Diets				
Ingredient	D_1	D_2	D_3	D_4	D_5
Yellow maize	50.30	50.30	50.30	50.30	50.30
Wheat offal	10.00	10.00	10.00	10.00	10.00
Groundnut cake	15.00	15.00	15.00	15.00	15.00
Soyabean meal	15.00	15.00	15.00	15.00	15.00
Fish meal	6.00	4.50	3.00	1.50	0.00
Squilla meal	0.00	1.50	3.00	4.50	6.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated nutrient content:					
Crude Protein (%)	21.84	21.53	21.21	20.90	20.58
Metabolizable Energy (kcal/kg)	2744.05	2753.89	2763.73	2773.57	2783.41

Vitamin A, 10,000iu; Vitamin D3, 2000iu; Vitamin B1, 0.75mg; Nicotinic acid 2.5mg; VitaminE, 2.5mg; Cobalt, 0.40mg ;Biotin, 0.50mg; folic acid, 1.00mg; Cholin chloride, 2.5mg; Copper, 8.00mg; Manganese, 64mg; Iron, 32mg; Zinc, 40mg; Iodine, 0.8mg; Flavomyain, 100mg; Spiromycin, 5mg;DL-methionine, 56mg; L-lysine, 120mg and Selenium, 0.16mg.

Results and discussion

The mean body weight changes and feed intake were significantly ($P<0.05$) influenced, while the feed-to-gain ratio was not (Table 2). Birds fed Diet 1 (Control) gave the best total weight gain value (1804.55g) which was closely followed by birds fed Diet 4 (1776.77g), Diet 3 (1765.85g) and Diet 5 (1616.09g) respectively. Birds fed Diet 2 gave the least value of 1565.59g. The parameters evaluated showed no definite pattern that could be traced to the effects of substituting fish meal with squilla meal, instead birds fed Diets 1 (control), 3, 4 and 5 were comparable in view of the mean total weight gain and the feed-to-gain ratio.

Table 2: Growth p erformance of broiler chickens fed graded levels of Squilla meal as substitute for dietary fish meal

	Diets					
Parameter	D_1	D_2	D_3	D_4	D_5	SEM
Mean initial body weight (g)	39.80	38.88	39.21	39.50	39.46	0.22^{NS}
Mean final body weight (g)	1844.34^{a}	1589.46^{b}	1805.06^{ab}	1816.27^{ab}	1655.56^{ab}	38.42
Mean total weight gain (g)	1804.55^{a}	1565.59^{b}	1765.85^{ab}	1776.77^{ab}	1616.09^{ab}	37.24
Mean total feed intake (g)	4845.06^{a}	4050.22^{b}	4761.10^{a}	4568.09^{ab}	4114.63^{b}	109.92
Mean daily feed intake	86.52^{a}	72.33^{b}	85.02^{a}	81.57^{ab}	73.41^{b}	1.96
Feed-to-gain ratio	2.68	2.59	2.70	2.57	2.55	0.03^{NS}

Means within the same row with different superscripts (a-e) are significantly different SEM – Standard Error of Mean

The result obtained in this trial is at variance with the findings reported (Fanimo, 1998; Ojewola and Udom, 2005; Aktar *et al.,* 2011; Etuk *et al.,* 2012), which stated that growth is depressed and efficiency of feed utilization is negatively affected. This was attributed to the presence of exoskeleton, which is made up of chitin, an N-acetylated glucosamine polysaccharide which forms part of the protein complex that hinders digestibility of dietary nutrients. It is possible that the age at which this squilla was harvested, processing method used, the species type, the kind of water in which they grew, the climate and nutrients available to them before they were harvested could have affected the amount of shell and chitin quality and quantity of the squilla used in this trial. The presence of enzyme chitinase in the digestive system, squilla's high calcium content, fortification of the diets with methionine (0.10%) and lysine (0.10%) coupled with the squilla's low substitution level (0-6%) could have been responsible for the result obtained in this trial.

All the carcass parameters (Table 3) evaluated showed no significant ($P>0.05$) difference. The percent dressed weight value ranged from 58.09 (D_3) to 65.64 (D_4).

Table 3: Carcass characteristics of broiler chickens fed graded levels of squilla meal as substitute for fish meal

	Diets					
Parameters	D_1	D_2	D_3	D_3	D_5	SEM
Live weight (g)	1566.67	1600.00	1666.67	1516.67	1833.33	50.11^{NS}
De-feathered weight (g)	1500.00	1516.67	1583.33	1400.00	1650.00	41.06^{NS}
Percent Dressed Weight (%)	64.87	62.66	58.09	65.64	58.59	1.48^{NS}
Cut- Parts (%):						
Breast Cavity	27.51	24.96	31.81	24.74	29.33	1.09^{NS}
Drumstick	15.22	14.77	16.37	14.09	15.60	0.45^{NS}
Thigh	16.89	17.12	18.06	15.86	17.96	0.61^{NS}
Wings	13.93	13.46	14.15	12.53	13.45	0.26^{NS}
Back Cavity	20.61	23.13	22.24	20.54	22.77	0.62^{NS}

The kidney, abdominal fat and the proventriculus showed significant ($P<0.05$) difference among the organ proportion parameters considered. The liver, gizzard, lungs, crop, spleen and pancreas were not significantly ($P>0.05$) influenced by the treatment diets (Table 4). The result is in agreement with the findings of Etuk *et al.* (2012) and Akpan *et al.* (2012) who observed no significant difference in the carcass characteristics of broiler chickens when fed crab meal and shrimp meal respectively. An indication that the squilla meal can be used as substitute for fish meal in broiler nutrition without deleterious effect on the carcass characteristics of broiler chicken.

Table 4: Percent organ proportions of broiler chickens fed graded levels of squilla meal as substitute for fish meal

	Diets					
Parameter	D_1	D_2	D_3	D_3	D_5	SEM
Heart (g)	0.50	0.46	0.31	0.47	0.38	0.29^{NS}
Kidney (g)	0.72^{b}	0.60^{c}	0.51^{d}	0.81^{a}	0.49^{e}	0.44
Liver (g)	2.07	2.15	2.20	2.48	2.05	0.85^{NS}
Gizzard (g)	1.99	2.14	1.10	1.90	1.89	0.55^{NS}
Lungs (g)	0.53	0.52	0.46	0.53	0.46	0.23^{NS}
Crop (g)	0.55	0.55	0.55	0.49	0.41	0.24^{NS}
Abdominal fat (g)	1.36^{b}	3.27^{a}	0.63^{c}	0.52^{d}	0.34^{e}	0.39
Proventriculus (g)	0.44^{b}	0.55^{a}	0.40^{c}	0.38^{d}	0.40^{c}	0.21
Spleen (g)	0.12	0.11	0.17	0.33	0.04	0.47^{NS}
Pancreas (g)	0.22	0.22	0.22	0.17	0.20	0.16^{NS}

Means within the same row with different superscripts (a-e) are significantly different SEM – Standard Error of Mean

Furthermore, the significant difference observed for kidney is in consonance with the findings of Ojewola *et al.* (2005) while the abdominal fat and proventriculus followed no specific trend that is traceable to the dietary treatment. The percent organ proportions are generally comparable and are within established normal range. Though there could be physiological differences in the utilization of the various nutrients by these organs due to structural form (Etuk *et al.*, 2012).

Conclusion

The result showed that squila meal can be used to substitute fish meal up to 75% without deleterious effect on the mean weight gain, carcass and organ proportion of broiler chickens.

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