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Nutritional Attribute and Cost Benefit Analysis of Poultry Offal Meal in the Diet of *Clarias Gariepinus Fingerling*s

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Abstract

A 12 weeks experiment was conducted to evaluate the nutritional attribute and cost benefit of substituting fishmeal with poultry offal in the diet of Clarias gariepinus fingerlings. The nutritional attribute of the poultry offal was determined using standard method of A.O.A.C, 2000. The result obtained revealed the following contents in g/100g. Dry matter 93.30, moisture 6.50, Crude protein 47.10, Crude fibre 1.77, Crude lipid 13.31, Nitrogen free extract 23.62, total ash 7.70 and gross energy 482.34. The poultry offal was used to formulate a diet of 0% Poultry Offal Meal (POM) , 25% POM, 50% POM, 75% POM, 100% POM and a commercial control. Cost per kilogram of experimental diets ranged from ₦119.75 to ₦ 180.15, profit index ranged from 0.45 to 0.60, net profit value ranged from ₦374.65 in 100% POM to ₦ 447.28 in 50%POM. The gross profit/loss showed a profit of ₦6.67 (commercial diet) and the highest ₦54.69 (50% POM). The cost benefit analysis showed that diet 50% POM is the most cost effective.

***Keyword**: Crude protein, Fishmeal, cost effective, Poultry offal, Nutritional attributes*

Introduction

Poultry offal is an interesting economic alternative to fishmeal. Chicken offal meal is highly digestible by fish and has a high nutrient composition. In Nigeria, aquaculture industry is currently faced with the problem of inadequate supply and prohibitive cost of quality fish feed. Fagbenro and Adeparusi (2003) have reported increasing attempt to develop practical diets for farmed fish in Nigeria. Poultry offal meal is one of the most important sources of animal protein used to feed domestic animals, along with meat and bone meal, blood meal, and feather meal (Meeker and Hamilton, 2006). It is made by combining the by-products coming from poultry slaughterhouses or poultry processing plants. The AAFCO (USA) defines poultry by-product meal as the ground, rendered, clean parts of the carcass of slaughtered poultry such as necks, heads, feet, undeveloped eggs, gizzards and intestine (Watson, 2006). The cost of feeding has long been recognized as the major cost in aquaculture (Olomola, 1990). To buttress this, Falaye (1992) documented that this cost claims about 60% of the recurrent cost of fish farming venture that minimized the profit margin of fish farmer& and negate the economic viability of the fish industry. Although, cost is not the most important consideration for feeding a diet to fish or in feed formulation. It is rather important that a practical or alternate diet contains all the essential amino acids, fatty acids, vitamins and minerals required by a fish for rapid growth, sound health and economic profitability (Webster *et al.*, 2000).

Aim and Objectives

The aim of the research is determine the proximate composition and cost benefit of poultry offal in the diet of *Clarias gariepinus*

MATERIAL AND METHOD

Area of the Study

The experiment was conducted at Biological Garden of Kaduna State University, Kaduna State.

Experimental Design

The experiment was completely randomized design with five isonitrogenous and isocaloric diets treatment and replication. The treatment were feeds containing Poultry Offal Meal (POM) at 0% as control, 25%, 50%, 75%, 100%, The FM in the control diet has 40% crude protein for optimal growth for *Clarias gariepinus*. Experiment was carried out in 25 liters square plastic tank.

Collection and processing of poultry offal meal

Chicken offal was procured from two slaughter house at Waff road Unguwan Rimi and Kawo Kaduna North Local Government Kaduna state. The chicken offal was washed thoroughly in clean water and boiled for 15mins at 95^{0}C in order to kill and prevent contamination by disease pathogens. The chicken offal was drained and dried for 2 days and grounded with electrical grinder.

Proximate analysis

The proximate analysis of the dietary ingredients, experimental diets, fish whole body (initial and final) were carried out according AOAC methods (2000) procedures. The proximate analysis was done in triplicates. Components such as crude protein, crude lipid, moisture content, crude fibre, ash, nitrogen free extract were analyzed.

Crude protein

The micro Kjeldahl method described by A.O.A.C. (2000) was used. Two grams of each of the samples was mixed with 10ml of concentrated sulphuric acid in a heating tube. One table of selenium catalyst was added to the tube and the mixture heated inside a fume cupboard. The digest is released which reacts with 40% sodium hydroxide and distilled water. The mixture was distilled and the distillate was collected into 2% boric acid and quantified by titration against 0.2m hydrochloric acid. Crude protein was calculated by multiplying the nitrogen content by a 6.26. This is given as percentage nitrogen

$$= \frac{(100xNx14xVF)T}{100xVa}$$

Where

N= normality of the titrate (0.1N)

VF= total volume of digest= 100ml

T= titre value

Va= Aliquot volume distilled. (A.O.A.C, 2000)

Moisture content

Moisture determination is used to convert all other nutrients to dry matter basis. Sample containing 2g dry matter was dried to constant weight at 95-100 C under pressure <100 mmHg. The dried samples was put in desiccators, cooled and reweighed. Loss in weight was reported as moisture. This was achieved by weighing the sample before and after drying. Moisture content was calculated using the formula bellow. (AOAC, 2000).

$$\text{Moisture} = \frac{initial\ mass - final\ mass\ x\ 100}{initial\ mass}$$

Lipid content

To determine the crude lipid content, the Soxhlet method (AOAC, 2000) was used to extract the lipid from the samples. Approximately 1g of sample was placed loosely in the soxhlet thimble and extracted using 150ml of acetone solvent. The system was heated in a water bath for approximately 5hrs after which the solvent was evaporated using rotary evaporator. The flask was placed in a drying oven for 1hr to remove water. After cooling, the flask was weighed and the lipid content calculated using

Lipid content= $\frac{final\ flask\ \ mass - initital\ flask\ \ mass\ x\ 100}{initial\ \ flask\ mass}$

(A.O.A.C, 2000)

Ash Content

Each sample are weighed into crucible, heated in a moisture extraction oven for 3hrs at 100 ^{0}C before being placed in a muffle furnace for approximately 6hrs or until it become powdery white and free of carbon, cooled and then placed in desiccators for further cooling to room temperature (25.5^{0}C) before the final mass was taken using the formular. (A.O.A.C, 2000)

Ash = initial mass – final mass ×100 initial mass

Crude fibre Content

Poultry offal (2g) and 1g of asbestos were put into 200ml of 1.25% of sulphuric acid and boiled for 30 minutes. The solution and content then poured into Buchner funnel equipped with muslin clothe. This was allowed to filter and residue was then put into 200ml boiled NaOH and boiled for 30 minutes. This was filtered and washed with alcohol. This is calculated using

Fibre= $\frac{initial\ mass - final\ \ mass\ x\ 100}{initial\ \ mass}$

Diet formulation and composition

The crude protein values of poultry offal derived from proximate analysis were used to formulate feed at crude protein level of 40% using pearson square method. The experimental diets comprised of poultry offal, fishmeal, yellow corn, soyabean, vitamin premix, bone meal, lysine, methionine, etc. all diets were isonitrogenous and isoproteic (40% protein)

Cost benefit analysis

A simple economic analysis was conducted to assess the cost effectiveness of the experimental diets. Only the cost of feed was used in the calculations with the assumption that all other operating costs remain constant. Costs of the feeds were calculated using the current market value of ingredients as at the time of the experiment.

1. Investment Cost Analysis (ICA): Cost of feeding + cost of fingerlings
2. Net Production Value (NPV): Mean weight + total number of survival × cost per kg
3. Gross Profit/loss (GP/L): Net Profit Value – investment cost analysis
4. Benefit of Cost Ratio (BCR): $\frac{Net\ profit\ value}{investment\ cost\ analysis}$
5. Profit index (PI)= Net profit- cost of feeding
6. Incidence of cost (r) =$\frac{cost\ of\ feeding}{Weight\ of\ fish\ produced}$

Statistical analysis

Experimental data was collected and statistically analyzed by ANOVA (analysis of variance) to test for significant differences between the 5 treatments 3 replications in each treatment using a General Linear Model procedure for Statistical Analysis System (SAS), ANOVA (analysis of variance) was used to test for significant differences between the 6 treatments 3 replications in each treatment. The LSD (Least Significant Difference) was used to determine the difference among the treatment means. $P < 0.05$ was considered significant.

RESULTS

Table 1 shows the proximate composition of the poultry offal. The crude protein was 47.10%, fat was 13.31%, crude fibre was 1.77% while nitrogen free extract and total ash were 23.62% and 7.70% respectively and moisture was 6.50%.

Table 1 Proximate Composition of Poultry offal

PROXIMATE COMPOSITIONS	COMPOSITION OF POULTRY OFFAL (%)
Dry matter	93.50
Moisture	6.50
Crude protein	47.10
Crude lipid	13.31
Crude fibre	1.77
Total ash	7.70
NFE	23.62
Energy	482.34

NFE= Nitrogen free extract

The economic evaluation of *Clarias gariepinus* fed poultry offal meal is presented in Table 2. The cost of feed decreased with the dietary level of the POM Table 2 cost per kilogram of the experimental diets ranged from ₦119.75 to ₦ 180.15 lowest was observed in 100% POM while the highest in 0% POM. Profit index ranged from 0.45 to 0.60 which 0% has the lowest and 100% has the highest, the value of fish ranged from ₦80.56 to ₦83.27with 100% being the lowest while 50% POM is the highest. The net profit value ranged from ₦ 374.65 in 100% POM to ₦447.23 in 50%POM. The gross profit/loss showed a profit of ₦6.69 while the highest profit was observed in 50% with ₦54.69. All ingredients were bought at the time when prices of goods were stable in the market.

Table 2 Economic evaluation of *Clarias gariepinus* fed poultry offal meal for 12weeks.

	commercial	0%POM	25%POM	50%POM	75%POM	100%POM	mean±SD
Cost of feed	176.16 ±0.40^{b}	180.15 ±0.40^{a}	151.11 ±0.40^{c}	142.54 ±0.40^{d}	130.97 ±0.40^{e}	119.75 ±0.40^{f}	150.11 ±22.74
Profit index	0.46 ±0.00^{e}	0.45 ±0.00^{e}	0.54±0.00^{d}	0.57 ±0.00^{c}	0.58 ±0.00^{b}	0.60±0.00^{a}	0.55±0.08
Incidence of cost	2.20±0.14^{a}	2.22±0.14^{a}	1.56±0.14^{b}	1.72±0.14^{b}	1.66±0.14^{b}	1.53±0.14^{b}	1.81±0.35
Investment cost analysis	426.16 ±0.40^{b}	430.14 ±0.40^{a}	401.11 ±0.40^{c}	392.54 ±0.40^{d}	380.97 ±0.40^{e}	369.75 ±0.40^{f}	400.11 ±22.74
Net profit value	432.86 ±2.25^{bc}	438.25 ±2.25^{b}	430.61 ±2.25^{c}	447.23 ±2.25^{a}	379.31 ±2.25^{d}	374.65 ±2.25^{d}	417.15 ±29.93
Gross profit/loss	6.69 ±2.30^{c}	8.10±2.30^{c}	29.50 ±2.30^{b}	52.2 ±2.30^{a}	-1.66±2.30^{d}	4.90±2.30^{cd}	17.02 ±20.25
Benefit cost ratio	1.01±0.01^{cd}	1.02±0.01^{c}	1.07±0.01^{b}	1.14±0.01^{a}	1.00±0.01^{d}	1.01±0.01^{cd}	1.04±0.05

Means with same letter for a given parameter in same horizontal row are not significantly different ($P > 0.05$).

KEY:

POM=Poultry Offal Meal

DISCUSSION

The proximate composition of the poultry offal indicated a crude protein of 47.1%, lipid of 13.31%, fibre 1.77% and NFE of 23.62% which correspond with the finding of Aliu *et al.* (2014) at (48.25) while Faturoti (2000) reported that local chicken offal (cooked and dried) contained 61.6% crude protein (CP). The difference observed maybe as a result of processing method and the technology used in drying the poultry offal. Poultry offal meal has a very good source of dietary protein for fish culture however; it varies widely in quality and some amino acids (Yigit *et al.*, 2006).

From the overall result of the cost benefit analysis, it was observed that there is a great reduction in the cost of feed production. The economic evaluation of all the diets were marginally different except diet 75% POM which recorded a slight loss which was due to loss of fishes in the group, the cost of producing POM (25-100%) graded feed was lower compared its corresponding POM 0%, this is similar to the finding of Ekelemu (2015), The highest cost was recorded in the group fed the commercial feed. The highest profit was observed in the fishes fed 50% POM because the group showed the highest growth rate and the highest cost benefit, this economic aspect involving the diets suggest that POM 50% should be adopted by fish farmers whose intention is profit maximization with good nutritional value since both conferred excellent fish performance without significant difference. This is in agreement with the findings of Sotolu (2009) on *Clarias gariepinus*, Sogbesan *et al*. (2011) on Hybrid Catfish, Reginald (2014) on *Heterobranchus longifilis* all observed a reduction in cost and a maximum profit when non-conventional feedstuff was utilized. Agbabiaka *et al.* (2013) on recycled dead chicken meal (DCM) in the diets of African catfish (*Clarias gariepinus*) fingerlings reported that the cost benefit analysis flavored the use of DCM as replacement for fish meal in diets of African catfish, having deduced from the study that **N**3503.00 can be saved per 25kg feed without compromising growth and/or nutrient utilization of the fish. Mohanta *et al*. (2013) evaluated of different animal protein sources in formulating the diets for Blue Gourami, *Trichogaster trichopterus* fingerlings found out that the cost of the nine experimental diets used in the study varied between Rs. 30-225/kg while the commercial diets that are sold in the local market are costing between Rs. 1100-3500/kg.

CONCLUSION

The proximate composition of the poultry offal in this study clearly showed high crude protein value of 47.10%, low crude fibre 1.77% while Nitrogen free extract and Ash 23.62% and 7.70% respectively. The Net profit value ₦447.23±2.25, gross profit ₦54.69±2.30 and Benefit cost ratio 1.14±0.01, clearly showed 50% POM inclusion is the most economical.

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