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Replacement value of feather meal for fish meal on the performance of starter mikado pheasants

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ABSTRACT

Aim: Main purpose of the study was to assess the effect of feather meal (FEM) for fish meal (FM) on the performance of mikado pheasant chicks.
Method and materials: Total 250 starter mikado pheasant chicks (*Syrmaticus mikado*) were used in a 56 days feeding trial in a completely randomized design in a deep litter house. Five replacement levels of the formulated feed: 0%, 2.5%, 5% 7.5% and 10% of FEM were used for treatments 1, 2, 3, 4 and 5 respectively with 0% FEM as control. Treatments were replicated thrice.
The deep litter house was provided with standard brooding facilities. Measurement of initial weights and final weights of birds were taken with a sensitive weighing balance (Mettler Toledo B 90001 – S brand) while mean daily weight gain, feed intake, feed conversion ratio and feed cost per kg gain were calculated.
Results: Results showed that final live weights 740.11g, 690.11g, 648.12g, 650.13g and 645.20g for birds fed 0%, 2.5%, 5.0%, 7.5% and 10% FEM respectively varied significantly (P<0.05). Also significant differences (P<0.05) were observed in daily feed intake, feed conversion ratio and feed cost/kg weights gain.
Conclusion: In conclusion, use of feather meal to replace fish meal was achieved without any deleterious effect on the chicks. Considering the results on final weight and weight gain, it appears that the optimum replacement value of FEM for FM is 7.5% level.

Keywords: Feather meal, fish meal, mikado pheasants chicks, poultry feed.

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Introduction

The term 'pheasant' usually refers to varieties and hybrids of the 'ring-necked pheasant' (*Phasianus colchicus*) (Schmidt *et al.,* 2007). Other species, such as the golden pheasant (*Callonetta leucophyrs*), make up only a tiny proportion of the pheasant population reared as game birds. Pheasants are predominantly reared in large numbers in parts of Europe for shooting as a sport on game bird 'estates' (Turner and Sage, 2003). Although at one time rearing pheasants was labour intensive and involved the use of surrogate domestic hens in the hatching and rearing stages. The usual practice now is to obtain the eggs from pheasants retained from the previous year and these are hatched in hatcheries similar to those used for commercial domestic fowl.

The birds are then reared semi-intensively until released through pens that allow the pheasants to move out gradually into the cover where they will live extensively and be driven from to be shot. There is considerable trade, both nationally and internationally in day-old and older chicks and to a lesser extent, hatching eggs (Brittas *et al.,* 1992).

Woodard *et al.,* (1977) further stated that pheasants are one of the few game birds that belong in the family *Phasianidae.* The head and neck of the male is bluish-green with a distinct white collar around the neck. The center of the breast is a rich purplish-red, the sides are lighter and the flanks are pale yellow with large black markings. Tail feathers are olive yellow with broad black crossbars. The female has crown barred black and brown neck feathers, with chestnut borders. Breast and back feathers are mottled with a blackish-brown center. The abdomen is pale brown. The tail feathers are marked with black and buff close wavy lines.

Feed constitutes the greatest input in animal production not only for milk, meat or eggs but for growth and body maintenance (Ahaotu *et al.*, 2013a and Ahaotu *et al.*, 2013b). Thus, the cheaper the feed source without sacrificing its quality, the better the return to the farmer. (Uwalaka *et al.*, 2013a, Chukwu *et al.*, 2013 and Mbachu *et al.*, 2023) reported that Nigeria, like most other developing countries suffer greatly from shortage and high cost of livestock feeds, especially those supplying protein. This situation is as a result of the competition between man and livestock for the available conventional protein feeds such as Moringa seeds (Oko *et al.* 2022), groundnut, soybean, rubber, fish and cotton seeds (Ahaotu *et al.*, 2013c).

Consequently, some unconventional materials have been used to feed poultry with good results. For instance Rubber seed cake (Uwalaka *et al.*, 2013b and Nnadi *et al.*, 2021); *Moringa oleifera* (Ahaotu *et al.*, 2013a); Unripe plantain peel (Uwalaka *et al.*, 2013a and Yitbarek, *et al.*, 2019); Irish potato (Iwuanyanwu *et al.*, 2019), sweet orange (*Citrus sinensis*) peel meal (Ahaotu *et al.*, 2017), Rice mill waste (Ahaotu *et al.*, 2012); Velvet beans (*Mucuna utilis*) (Onyekwere *et al.*, 2011), Plumeria rubra (Patricio *et al.*, 2020), African Bread Fruit Seed Meal (Ahaotu *et al.*, 2019), Sheep manure (Onu *et al.*, 2010), Poultry dropping meal (Durunna *et al.*, 2017), Red Sandalwood (*Pterocarpus santalinoides*) Leaf Meal (Ayo-Enwerem *et al.*, 2017), *Amaranthus spinosus* (green leaf) meal, (Ahaotu *et al.*, 2015), *Centrosema Pubescent* Leaf Meal (Ahaotu *et al.*, 2018) and Wild cocoyam meal (Ahaotu *et al.*, 2013b) among others.

Feather meal could be a potential source of feed for poultry (Madubuike *et al.*, 2009). It has 58% crude protein and good amino acid and mineral profile, although it has low lysine, methionine and tryptophan contents (Ahaotu, 2007). It is however capable of reducing the cost of poultry production. This experiment was therefore conducted to evaluate the effects of replacing feather meal which was usually thrown away as waste after processing birds for the expensive fish meal with a view to achieving high production at reduced cost and by making animal protein available and affordable to consumers.

Materials and Methods

The experiment was carried out in Teaching and Research farm of University of Agriculture and Environmental Sciences Umuagwo, Imo State, Nigeria. The site is situated at longitudes 7°01'E and latitudes 5°28'N (IMLS, 2013).

Procurement of experimental birds and brooding

A total of 260 – day – old mikado pheasants chicks (*Syrmaticus mikado*) procured from a local distributor were brood together for one week and fed commercial started feed “Top brand” for stabilization. After one week, 250 chicks were selected on the basis of apparent viability and good conformation and assigned to five dietary treatments of fifty birds per treatment and replicated thrice.

Processing of the feather meal

Poultry feather was collected from commercial slaughter house at the Relief Market, Owerri, Imo State, Nigeria. The feathers were washed, boiled under high pressure until the resulting process of hydrolysis converted the feather into a soluble form of protein at a reduced microbial contamination. The hydrolysation was achieved by boiling the feathers with a batch cooker (pressure pot) at internal pressure of 40 - 50n/m² for 60 minutes. After boiling, most of the feathers dissolved and on settling, the solid protein residue was dried and milled to produce feather meal. Feather meal and fishmeal were subjected to proximate analysis (Table 1) at the Animal Production Laboratory, University of Agriculture and Environmental Sciences Umuagwo, Nigeria using standard methods (AOAC, 2001) which was the basis for experimental feed formulation. The mineral analysis was carried out by the method of (Grueling, 2000), while gross energy was determined with a Gullenkamg Oxygen Adiabatic Bomb Calorimeter.

Table 1: Chemical Compositions of feather and fish meals

a.	Chemical Component	Feather meal%	fish meal%
	Crude protein	58	66
	Crude fiber	1.5	1.0
	Ether extracts	2.5	4.5
	Ash	3.8	22
	Moisture	50	15
	Nitrogen free extract	6.5	8.1
b.	Minerals		
	Calcium	0.20	6.10
	Phosphorus	0.75	3.0
	Manganese	0.0	2.0
c.	Amino acids		
	Lysine	1.55	4.5
	Methionine	0.50	1.65
	Tryptophan	0.50	0.62
	Glycine	6.20	4.20
	Arginine	5.4	3.0
	Cysteine	2.9	0.52

Formulation of the experimental diets: Five experimental mikado pheasants chicks diets containing) 0%, 2.5%, 5%, 7.5% and 10% FEM for treatments 1, 2, 3, 4 and 5 respectively were formulated in which 0% FEM, (T_1) was the control (Table 2). The ingredients were thoroughly mixed to ensure homogeneity and sent to hammer mill for grinding. The feed was fortified with vitamin premix and synthetic amino acids.

Feeding and Brooding

The experimental birds were divided according to five dietary treatments in a deep litter house made up of two hundred and fifty birds and replicated three times in a completely randomized design. All brooding facilities were available such as polyethylene sheets for controlling air movement into the brooder house, regular source of heat and light with 200 watts electric bulb in each replicate pen with one stove and one lantern, which was used when electricity failed. Adequate number of feeders and drinkers were provided for the chicks to achieve and *ad libitum* access to feed and water. Regular observation and manipulation of the brooder facilities regulated the room temperature.

Data Collection and Analysis

Initial weights of the birds were measured at the inception of the experiment (8 days old), while live weight was subsequently measured on weekly basis to evaluate growth rate. The weight at the end of the experiment (8-weeks-old) was measured as the final weight, while feed intake was measured by subtracting the feed remnant from that supplied the previous day. Data were also collected on weight gain, by subtracting the initial weight from the final weight. Feed conversion ratio was obtained by dividing the average feed intake (kg) by weight gain (kg) and the feed cost was calculated as the sum of all the items included in a diet. Data were collected from each treatment group and subjected to one way analysis of variance (Steel and Torrie, 1980), while differences in means were separated by the Duncan Multiple Range Test as outline by (Gordon and Gordon, 2004).

Table 2: Ingredient composition of experimental mikado pheasants chicks diets

Ingredients	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**
Feather meal (FEM)	0.00	2.50	5.00	7.50	10.00
Fish meal (FEM)	10.00	7.50	5.00	2.50	0.00
Maize grain	40.00	40.00	40.00	40.00	40.00
Groundnut cake	6.96	6.96	6.96	6.96	6.96
Soya bean cake	24.00	24.00	24.00	24.00	24.00
Wheat offal	14.00	14.00	14.00	14.00	14.00
Bone meal	4.12	4.12	4.12	4.12	4.12
Vitamin/mineral					
Premix	0.40	0.40	0.40	0.40	0.40
DL-Methionine-HCL	0.20	0.20	0.20	0.20	0.20
Common salt	0.32	0.32	0.32	0.32	0.32
Total	100.00	100.00	100.00	100.00	100.00
Nutrient composition					
Crude protein %	25.41	25.61	25.81	26.01	26.21
ME (Kcal/kg)	2718	2712	2705	2699	2692
Ether extract %	3.92	3.87	3.82	3.78	3.73
Crude fiber %	4.50	4.50	4.52	4.54	4.55
Moisture	1.50	2.38	3.25	4.13	5.00
NFE %	0.81	0.77	0.73	0.69	0.65
Calcium %	2.21	2.07	1.92	1.77	1.62
Phosphorus %	1.03	0.97	0.92	0.86	0.80
Lysine %	1.46	1.39	1.31	1.4	1.16
Methionine +					
Cysteine %	0.50	0.53	0.56	0.59	0.62

2.5kg of premix/tone contain; vitamin A 10,000 I.U; Vitamin D_3 20,000 I.U; Vitamin E 12,000 I.U; Vitamin K 2.5g; Thiamine 1.5g; Riboflavin 5g; Pyroboflavin (B6) 1.5g; Vitamin B_{12} 10mg; Biotin 2mg, Niacin 15g, Panthothenic acid 5g, Zinc 50g, Iron 15g, Copper 5g, Iodine 1.4g, Selenium 100mg, Cobalt 300g, BHT 125G.

Results and Discussion

The performance characteristics of the mikado pheasants chicks (Table 3) showed that significant differences (P<0.05) existed between birds in various treatments for total weight and daily feed intake. Birds on the control diet (T_1) were significantly (P<0.05) heavier than birds on T_5. The birds on T_1 gained significantly (P<0.05) more weights than birds on T_2, T_3 and T_4, which had similar weight gains, while T_5 birds were the least in weight gain. Birds on the different treatment diets significantly (P<0.05) varied in their feed intake. Additional values of FEM resulted in additional feed intake. Feed conversion ratio varied significantly (P<0.05) for birds in the various treatments. Feed cost per weight gain significantly (P<0.05) varied between treatments as increasing amount of FEM reduced cost. Ahaotu (2007) reported anti-nutritional effects of feather meal arising from keratin fiber, which reduced availability, absorption and utilization of nutrients for productive purposes. Consequently, birds fed 10% FEM (T_5) consumed more feed than those on other treatments in an attempt to satisfy their body requirements (Ahaotu, 2007). The trend was that increasing level of FEM reduced nutrient availability and thus reduced weight gain (Wise, 1994) and final weight which was traceable to higher dietary fiber of feeds with increasing FEM. This result agrees with (Ahaotu and Ekenyem, 2009) who observed that higher dietary fiber depressed weight gain in poultry birds. The feed conversion of birds depressed with increased. However, it has been suggested (Madubuike *et al.*, 2009) that fish meal can be used to remove the anti-nutritional effect of feather keratin and therefore results in improvement of production efficiency. This would be attributed to better amino acid and mineral complements of fish than feather (Keçeci and Çöl 2011).

Table 3: Performance characteristics of mikado pheasants chicks fed feather meal diets

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Initial live	54.00	53.00	53.01	53.00	52.00	0.03^{ns}
Weight (g) Daily weight						
Gain (g)	26.22	25.98	25.18	24.56	23.68	0.19^{ns}
Daily feed						
Intake (g)	30.11^a	36.01^b	39.09^b	45.12^c	48.11^c	1.28^*
Feed conversion						
Ratio	2.23^a	3.30^b	3.50^b	3.54^b	4.18^c	0.13^*
Feed cost/kg	185.96^c	180.36^b	174.76^d	169.16^e	163.56^a	0.10^{ns}

The feed cost per kg weight gain reduced with increasing levels of FEM, thereby reducing the cost of mikado pheasant chicks production. This agrees with (Madubuike *et al.*, 2012 and Uche *et al.*, 2014) that compared the utilization of five animal protein concentrates and obtained similar results.

Conclusion

The use of feather meal to replace fish meal was achieved without any deleterious effect on the cockerel chicks. Considering the results on final weight and weight gain, it appears that the optimum replacement value of FEM for FM is 7.5% level. The cost of cockerel chick production is observed to have significantly reduced following the inclusion and increasing levels of FEM in the diet thereby reducing the cost of poultry production and making poultry meat affordable to consumers. It is therefore recommended that 7.5% level of feather meal for fish meal be adopted considering the cost effectiveness and final weight potentials of cockerel birds. However, higher levels such as 10% could be adopted if fortified with yeast or exogenous enzyme to improve fiber digestion.

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