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Effects of snail offal meal on performance of broiler chickens

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The study investigated the effects of inclusion of various levels of snail offal meal (SOM) on the performance of broiler chickens. The study was carried out in the animal farm of the Department of Animal Science, Nnamdi Azikiwe University, Awka Anambra State. The experiment was designed on a 4×3 Completely Randomized Design (CRD) with four dietary treatments having 0, 2.5, 5 and 7.5% inclusion of SOM over a period of eight weeks. Twelve birds (12) were assigned to each of the dietary treatment and each replicated three times such that each replicate has four birds. The diet with 0% snail offal meal served as the control. The birds were housed in pens measuring 2 × 2 × 2.5 m^3. A total of forty eight birds were used for the experiment. Twelve birds were assigned to each of the dietary treatment and each replicated three times such that each replicate has four birds. The diet with 0% snail offal meal served as the control. Results obtained showed that there was a progressive increase in weight gain over time in all the dietary treatment. The highest mean weight gain was recorded in the broilers subjected to treatment with 2.5% inclusion level of SOM. For the feed intake, the highest fed intake was recorded in the treatment with 2.5% SOM inclusion level followed by 7.5% inclusion level while the least was observed in treatment with 5% SOM inclusion level. For the linear body measurements, the highest thigh increase was recorded in treatments with 2.5 and 7.5% SOM inclusion level. For the carcass weight measurement, the broiler chicken fed different levels of SOM recorded high performance in their cut up parts. The treatment with inclusion of 2.5% has the highest mean weight of the cut up parts namely thigh, breast, defeathered and eviscerated while the least was recorded in the treatment with 7.5% SOM inclusion level. For the organ weight measurement, the broiler chicken in treatment with 2.5% SOM inclusion had the highest mean weight of the organs: liver, pancreas, heart, lungs, gizzard, caeca and small intestine while the least was observed in treatment 0% inclusion. The study recommends that waste from micro livestock such as snail should be incorporated in the diets of broiler birds to partially replace fishmeal in poultry feed formulation.

Key words: Linear body measurement, carcass weight, organ weight, growth performance.

INTRODUCTION

Animal production in the tropics is adversely affected by high cost and inadequate feed supply (Ahaotu et al., 2013). Feed contribute over 60% of total cost of animal production resulting in low yields and high cost of production. Reduction of feeding cost is therefore a fundamental issue in poultry production. The high cost of feed is also linked to reliance of on conventional feed resources. Fish meal has been used as a source of dietary animal protein. Incidentally, the direct competition between man and poultry for fish has led to the scarcity, high cost and adulteration of fishmeal. This may be achieved by using a less expensive non-conventional feed resources in poultry diets, as for example animal by products and offals such as sardine fish silage (Al-Marzooqi et al., 2010), poultry offal meal and crayfish waste meal (Asafa et al., 2012; Ologhobo et al., 2012) and shrimp waste meal (Caires et al., 2010). Snail offal meal (SOM) is an important ingredient that can replace the fish meal in feedstuffs. Its proximate analysis shows that it has a nutritive value that corresponds to fishmeal. In Nigeria, farming of snails is practiced to sustain livelihoods (Ayodele, 1992). Snails have high nutritional values (Yusuf, 1998). The making of snail meat is accompanied by production of large quantities of offal that are difficult to dispose, and that quickly spoils and emit offensive odour (Lincoln et al., 2004). However, until now inclusion of snail offal meal in poultry diets have not been adequately investigated. This paper reports results from experiments on feeding of snail offal to poultry.

MATERIALS AND METHODS

Study area

The study was carried out in the animal farm of the Department of Animal Science, Nnamdi Azikiwe University, Awka Anambra State. The farm is located between geographical coordinates 6° 10' 0" North, 7° 4' 0" East. Average temperature is between 29 and 34°C and annual rainfall of 1000 to 1500 mm with two seasons (rainy and dry season) (Ewuim, 2004).

The poultry house has an area of 100 m^2 and the snail pens were placed in roofed enclosure and protected from direct rain and sunlight. There were plantain trees and rich vegetation around the farm to minimize wind and temperature effects.

Experimental animal

Forty eight (48) two weeks old Anak broiler chicks purchased from Sunchi farms and Hatchery Emene, Enugu State were used in the experiment. They were transported to the study site in the evening of the same day of purchase to avoid stress and death of the birds. The birds were given routine vaccinations.

Experimental feed material

The snail offal of the species *Archachatina marginata* consisted of heart, kidney and loop of intestine and reproductive tracts including residual snail eggs. The snail offal was extracted from the shell by manual breaking of the shell with a hammer after the edible parts were removed. The snail offal collected from Ochanja market, Onitsha in Anambra State. The offals were initially sun dried for three days before further oven drying at controlled temperature of 100°C for 4 h at Department of Zoology Laboratory. The dried snail offal was ground to powder in the laboratory with an electric blender (QASA grinder and blender) and sample analyzed for its proximate composition (Table 1). The test feeds were formulated and mixed at in a privately owned feed milling industry known as Farm Associates Mill, Enugu. Proximate analysis for each of the experimental diets (starter and finisher) was assessed (Tables 2 and 3).

A 4×3 Completely Randomized Design (CRD) with four dietary treatments having 0, 2.5, 5 and 7.5% inclusion of snail offal meal (SOM) was used in the experiment. Twelve birds (12) were assigned to each of the dietary treatments, replicated three times such that each replicate had four (4) birds. The diet with 0% snail offal meal served as the control. The birds were housed in pens measuring 2 × 2 × 2.5 m^3. The birds were fed and water was given *ad libitum* for eight weeks.

Chicks weights were obtained using a precision weighing balance weekly (CAMRY EC- 201), feed conversion ratio by dividing the feed consumed by the weight gain all in grams at the end of the experiment; the feed intake was measured as the difference between the quantity of feed given and the quantity left over on daily basis, feed efficiency ratio was calculated by dividing the weight gain (g) by the feed consumed (g) at the end of the experimental period, the linear body measurements were taken using a metre rule and tailors tape on weekly intervals. All measurements were taken to the nearest 0.1 cm, the total body length was taken as the length from the tip of the beak to the uropigeal gland, shank length was taken on the length between the knee and the Regiotarsus taken on the right limb, thigh length is the length between the hip bone and that of the knee on the right limb, wing length is the length from the base of the shoulder to the tip of the longest primary feather, girth is the circumference of the body at the tip of the pectus, the carcass and organ characteristics was also assessed at the end of the experimental period. These were done by starving the birds overnight but water was made available. The birds were weighed, slaughtered by severing the jugular vein and allowed to bleed thoroughly according to the methods recommended by Odunsi et al. (1999). One bird per replicates were scalded at 75°C in water bath for about 30 s before defeathering and then the birds were reweighed to know the feather weight by difference. The dressed chicks were later eviscerated; the wings were removed by cutting anteriorly severing at the humeo-scapular joint. The cuts were made through the rib head to the shoulder girdle; the back was removed intact by pulling anteriorly. The wings, thigh, breast and organs were dissected from each carcass and weighed separately with a sensitive electronic scale. The carcass and body organs weight were taken on a fresh basis. Data generated was subjected to Analysis of Variance (ANOVA). Duncan's new multiple range test was used to determine the level of significance among the treatments at 5% probability.

RESULTS AND DISCUSSION

The result of proximate composition of the snail offal meal used in feed formulation is shown in Table 1. The result showed that SOM have high crude protein content, good fibre and fat contents for poultry feed formulation.

The composition of the experimental diets are shown in Table 3 while the proximate analysis of the experimental diets (Table 2) did not show significant difference though

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Table 1. Proximate composition of snail offal meal (g/kg dry matter).

Parameter	Amount (g/kg)
Crude protein	50.85
Crude fiber	4.27
Fat	9.73
Ash	9.74
Nitrogen free extract	25.41

Table 2. Proximate composition of the experimental diets.

Parameter	Broiler	Starter			Broiler	Finisher		
	T1	T2	T3	T4	T1	T2	T3	T4
	(0%)	(2.5%)	(5%)	(7.5%)	(0%)	(2.5%)	(5%)	(7.5%)
Crude protein %	23.50	23.45	23.41	23.62	20.10	20.05	20.01	20.23
Crude fiber %	3.40	3.48	3.57	3.59	3.10	3.18	3.27	3.29
Ether extract %	3.95	3.94	3.93	3.99	4.00	3.99	3.98	4.04
Ca%	1.84	1.79	1.75	1.75	1.84	1.79	1.75	1.75
P%	1.06	1.03	0.98	0.97	1.03	1.00	0.96	0.94
Lysine	1.50	1.67	1.83	2.02	1.26	1.42	1.59	1.78
Methionine	0.69	0.68	0.67	0.68	0.65	0.64	0.63	0.64
Energy (ME Kcal/kg)	2802.47	2780.42	2758.37	2743.25	2904.47	2882.42	2860.37	2845.25

**T1 contains 0% SOM inclusion (control diet), T2: 2.5% SOM inclusion, T3: 5% SOM inclusion, T4: 7.5% SOM inclusion.

Table 3. Gross composition of the experimental diet.

Parameter	Broiler	Starter			Broiler	Finisher		
	T1	T2	T3	T4	T1	T2	T3	T4
	(0%)	(2.5%)	(5%)	(7.5%)	(0%)	(2.5%)	(5%)	(7.5%)
Maize	50	50	50	50	60	60	60	60
Soybean cake	30	30	30	28.5	20	20	20	20
Fish meal	6	3.5	1	0	6	3.5	1	0
Snail offal meal	0	2.5	5	7.5	0	2.5	5	7.5
Wheat offal	4	4	4	4	4	4	4	4
Palm kernel cake	5	5	5	5	5	5	5	5
Bone meal	4	4	4	4	4	4	4	4
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vit. Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100	100

**T1 contains 0% SOM inclusion (control diet), T2: 2.5% SOM inclusion, T3: 5% SOM inclusion, T4: 7.5% SOM inclusion.

the crude protein of starter diets are higher than that of the finisher diets and all the parameters are in line with other literature reports for tropical climates. The result of weight gain (Table 4) shows significant difference (P<0.05) and that there was a progressive increase in weight gain over time in all the dietary treatment was also observed. The highest mean weight gain was recorded in the broilers subjected to treatment with 2.5% inclusion level of snail offal meal (SOM) followed by 5% inclusion level while the least was observed in treatment with 7.5% SOM inclusion level. The reason for this outcome could be due to the fact that crude protein in fishmeal that was

Table 4. Effect of SOM at various levels on weight, specific growth rate and feed intake of Broiler chicks.

Parameter	Treatment inclusion			
	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)
Initial weight (g)	557.14±27.78	561.42±34.31	509.63±24.13	422.21±33.21
Final weight (g)	2700.00±23.33	2847.22±17.34	2741.67±21.21	2500.00±13.6
Mean weight gain (g)	2142.86±25.21^{b}	2285.80±18.31^{a}	2232.04±19.21^{a}	2077.79±19.31^{c}
Feed conversion ratio	0.266^{c}	0.277^{a}	0.245^{d}	0.274^{b}
Feed efficiency ratio	3.757^{a}	3.608^{c}	4.073^{d}	3.638^{b}
Feed intake(g)	570.33±21.32^{b}	633.41±25.21^{a}	547.94±17.43^{c}	571.06±23.43^{b}

**Rows with different superscripts are significantly different; T1 contains 0% SOM inclusion (control diet), T2: 2.5% SOM inclusion, T3: 5% SOM inclusion, T4: 7.5% SOM inclusion.

Table 5. Effect of SOM at various levels on the linear measurement of broiler chickens.

Parameter (cm)	Treatment inclusion level			
	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)
Thigh length	6.37 ±2.51	8.44 ±2.77	6.37 ±4.29	8.44 ±2.77
Shank length	4.58 ±1.63	5.57 ±4.29	6.99 ±2.14	6.37 ±4.23
wing length	12.25 ±4.64	18.99 ±2.14	16.10 ±5.95	18.33 ±2.14
Body length	21.73 ±9.29	26.74 ±5.00	23.33 ±8.26	28.74 ±5.10
Girth	9.28 ±4.19	9.33 ±2.86	7.37 ±4.29	10.33 ±4.86

**T1 contains 0% SOM inclusion (control diet), T2: 2.5% SOM inclusion, T3: 5% SOM inclusion, T4: 7.5% SOM inclusion.

being replaced with a higher quality protein from snail offals is well known to have a superior protein quality and amino acid profile content which agrees with the findings of Asafa et al. (2012), Ologhobo et al. (2012) and Al-Marzooqi et al. (2010). The highest feed conversion rate of 0.277 was recorded in treatment T2 followed by treatment T4 (0.274), treatment T1 (0.266) while the least FCR of 0.245 was observed in treatment T3 which implies that the lower the feed conversion ratio, the better the food conversion efficiency of each experimental diets. Also, the higher the feed efficiency ratio as recorded in treatment T3 shows that they have high/better efficiency potential to convert feed to appreciable body mass as evident in good weight gain of the broiler chickens subjected to various inclusion levels of SOM (Table 4).

For the feed intake, the highest fed intake was recorded in the treatment with 2.5% SOM inclusion level followed by 7.5% inclusion level while the least was observed in treatment with 5% SOM inclusion level. The observations agreed with the findings of Tacon et al. (2007) who reported that using weight gain as criterion for evaluation, the incorporation of snail meal of *Achatina* species in the diet of chicks replacing the fishmeal on weight basis showed that at 10% level of inclusion snail meal, it had no deleterious effect on the chicks.

For the linear body measurements (Table 5), the highest thigh increase was recorded in treatments with 2.5 and 7.5% SOM inclusion level. The shank length recorded the highest increase in treatment with 5% SOM inclusion level while the least was observed in treatment with 0% SOM inclusion level. Birds in treatment with 2.5% SOM inclusion level was significantly (P<0.05) the highest in terms of wing increment, back length increase was the highest in treatment with 0% SOM inclusion level; girth increase was significantly (P<0.05) the highest in treatment with 7.5% SOM inclusion level while the least was observed in 5% SOM inclusion level and the total body length was significantly (P<0.05) the highest in treatment with 7.5% SOM inclusion level while the least was observed in treatment with 0% inclusion level. This agreed with the findings of Asafa et al. (2012), Ologhobo et al. (2012) and Sethi and Chawla (1994) that incorporated snail offal at the level of 25, 50, 75 and 100% in the diets of layers replacing the fishmeal on nitrogen basis.

In terms of carcass weight measurement (Table 6), the broiler chicken fed different levels of SOM recorded high performance in their cut up parts. The treatment with inclusion of 2.5% has the highest mean weight of the cut up parts namely thigh, breast, defeathered and eviscerated while the least was recorded in the treatment with 7.5% SOM inclusion level. The mean weight of wing was the highest in treatment with 0% SOM inclusion while the lowest was recorded in 5% SOM inclusion. This observation was in agreement with the findings of Akinmutimi and Onenm (2008).

In terms of organ weight measurement (Table 7), the broiler chicken in treatment with 2.5% SOM inclusion had

Table 6. Summary of the mean of defeathered, eviscerated and cut up parts weight measurement (g).

Treatment	Defeathered	Eviscerated	Thigh	Breast	Wing
T1 (0%)	2750±100[b]	1700±200[b]	572.10±2.00[c]	637.03±1.95[c]	275.83±2.84[d]
T2 (2.5%)	3500±100[c]	2600±200[c]	830.33±1.52[d]	869.50±2.00[d]	250.27±1.61[c]
T3 (5%)	2400±100[a]	1300±200[a]	520.00 ±2.00[a]	523.00±2.00[b]	191.40±2.00[b]
T4 (7.5%)	2320±100[a]	1400±200[ab]	524.90±2.00[b]	229.03±1.95[a]	184.87±1.25[a]

**Columns sharing different superscripts are significantly different (P<0.05); T1 contains 0% SOM inclusion (control diet), T2: 2.5% SOM inclusion, T3: 5% SOM inclusion, T4: 7.5% SOM inclusion.

Table 7. Summary of the findings on the organ weight measurement.

Organs (g)	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)
Kidney	5.10±0.200[c]	1.30±0.200[a]	1.90±0.200[b]	1.70±0.200[b]
Liver	69.73±0.643[b]	120.40±0.529[d]	61.27±1.617[a]	102.27±2.411[c]
Lungs	4.00±0.200[c]	6.40±0.200[d]	2.70±0.200[a]	3.60±0.200[b]
Pancreas	8.27±2.411[a]	17.60±0.608[c]	13.13±0.321[b]	14.80±0.200[b]
Caeca	12.00±2.00[a]	18.40±2.000[b]	30.50±2.000[c]	20.07±2.050[b]
Gizzard	72.07±1.531[a]	102.20±2.307[b]	70.97±1.361[a]	73.93±1.721[a]
Heart	13.87±0.757[a]	18.03±1.050[c]	16.50±0.200[b]	13.67±0.666[a]
Crop	77.40±1.709[c]	23.67±1.258[a]	75.40±3.460[c]	31.07±1.901[b]
Small intestine	130.47±1.450[b]	160.43±0.814[d]	140.07±1.102[c]	107.07±2.101[a]

**Rows sharing different superscripts are significantly different (P<0.05); T1 contains 0% SOM inclusion (control diet), T2: 2.5% SOM inclusion, T3: 5% SOM inclusion, T4: 7.5% SOM inclusion.

the highest mean weight of the organs: liver, pancreas, heart, lungs, gizzard, caeca and small intestine while the least was observed in treatment 0% inclusion. The mean kidney and crop weight was the highest in control (0%) SOM inclusion. The significant difference (P<0.05) in the organ weight of broiler chicken between the dietary treatment and control concurred with the report of Philip et al. (2014) who fed broiler chicken with rumen epithelial scrapping meal in replacement for fish meal.

Conclusion

The study showed that snail offal meal can be used as a protein feed ingredients in broiler chicken diets. The study recommends that the best dietary treatments are the 2.5 and 5% SOM inclusion levels owing to the better weight gain and feed conversion potential of the treatment diets. Therefore, further research is necessary to improve the feed quality and to determine if snail offal meal can completely replace fishmeal in poultry feed formulation as this will encourage waste to wealth creation.

CONFLICT OF INTERESTS

We hereby declare that there was no conflict of interest.

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