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Performance of finisher broiler chickens fed maggot meal as a replacement for fish meal

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A 35-day feeding trial was conducted to evaluate the performance of finisher broiler chickens fed maggot meal as a replacement for fish meal. Maggot meal was analysed to contain 44.44% CP, 1.84% CF, 9.76%EE, 14.29%Ash, 16.81%NFE, 0.03%Ca and 0.05%P. Five diets were formulated such that maggot replaced fish meal at 0, 20, 30, 40 and 50%. The chicken fed the control diet consumed less feed (P<0.05) than those fed the 40 and 50% of maggot meal. The birds fed the control diet gained lower weight (P<0.05) than those fed the 20 and 30% maggot meal, but similar (P>0.05) to those fed 40 and 50% maggot meal. The chicken fed maggot meal diets has superior feed conversion ratio than those fed the control diet. The cost of diets decreased with increased level of maggot meal. A kilogram live weight of the birds fed 50% dietary maggot meal was 34.22% cheaper than those fed the control diet. Dressing percentage was similar (P>0.05) for chicken fed the control (0%), 30, 40 and 50% maggot meal. The weight of the heart significantly (P<0.05) reduced with increase in the level of dietary maggot meal. The weight of liver did not indicate significant (P>0.05) differences. Weight of gizzard was significantly (P<0.05) increased by dietary maggot meal. Inguinal fat deposit was significantly (P<0.05) promoted by dietary maggot meal, especially at the 30% and 40%.The replacement of a 4.00% dietary fish meal in finisher broiler chicken's diet with 50% maggot meal showed superior performance characteristics to the basal diet, and also proved to be a more economical option.

Key words: Finisher broiler, chicken, fish meal, maggot meal, diets, replacement
AREA: Feed Resources and Nutrition

Introduction

The rising cost of conventional feed ingredients is a compelling factor to seeking for alternative feed resources not directly used by human as food in order to reduce cost of poultry feeds and poultry products. This will go a long

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way in ameliorating the protein food crisis and malnourishment in the developing countries. Such alternatives should have comparative nutritive value but cheaper than the conventional feed ingredients. The protein feed resources though not required in a large quantity as the energy sources, are higher in cost per unit than the latter. Any effort towards reducing the cost of protein feed resources will highly reduce the cost of livestock production and poultry in particular. For the highly expensive fish meal, maggots would seem to satisfy the criteria for alternative.

Maggots, which are larvae from housefly, grow easily on poultry droppings or any organic waste in a short period of 2 to 3 days. Teotia and Muller (1973) reported that housefly maggots and adults are source of high quality protein. Maggots have an amino acid profile that is superior to that of groundnut cake (NRC, 1984). The qualities of housefly maggots are indicative that it has the potential to replace some of the expensive protein supplements in livestock feeds if well processed. Atteh and Ologbenla (1993) observed that maggots could provide a partial replacement for fish meal in broiler diets. Earlier studies on red blood cell counts by Awoniyi and Aletor (1999); Awoniyi *et al*. (2000) suggested that the maggot meal was not nutritionally inferior to the fish meal. Bondari and Sheppard (1981) showed that 1-2 tonnes of maggots could be produced in a month in a 20,000 hen laying house. The use of maggots makes the compounded poultry feed a lot cheaper than when fish meal is used. Atteh and Ologbenla (1993) reported the cost of harvesting and processing of maggots to be N5.38 per kg, which was about 83.28% cheaper than equivalent weight of fish meal which cost N 32.00 /kg. Maggot meal is an inexpensive replacement for fish meal in broiler chicks feeding (Awoniyi *et al*., 2003). This study was therefore conducted to evaluate the performance of finisher broiler chickens fed maggot meal as a replacement for fish meal.

Materials and methods

Production of maggots and chemical analysis

Maggots were produced by culturing housefly larvae in poultry droppings. The larvae matured within 3-4 days and were harvested, dried and milled to form maggot meal. Proximate analysis was carried out on the maggot meal to determine the chemical composition (AOAC, 2000) (Table 1).

Experimental diets and management of experimental birds

Five diets were formulated with maggot meal to replace fish meal at 0, 20, 30, 40 and 50% levels, designated T_1, T_2, T_3, T_4 and T_5 respectively (Table 2). A total of ninety (90), 35-day old Anak broiler chicks were divided into five groups of eighteen birds, which were sub-divided into three replicates of six birds. They were randomly assigned to any of the five diets in a completely randomized design (CRD) experiment. Each replicate was housed in a 1.2m x 1.2m concrete floored deep litter compartment. Routine medication and good hygiene were observed to forestall any disease outbreak. Feed and water were offered ad libitum during the study which lasted for 35days.

Data collection and analysis

Individual body weights of the birds were recorded at the beginning of the experiment and weekly thereafter, while feed intake was recorded daily. Daily body weight gain of birds and feed conversion ratio were computed weekly. Data collected were subjected to analysis of variance according to Snedecor and Cochran (1980). Where significant differences were observed between treatment means, they were separated by Duncan's multiple range test (SAS, 1999).

Results and discussions

The proximate composition of maggot meal is presented in Table 1. The composition of the experimental diets is shown in Table 2, while the calculated chemical composition of the diets is presented in Table 3. Data on performance and organ characteristics are presented in Tables 4 and 5 respectively. The 44.44% crude protein reported in this study was within the range of 39-54% crude protein reported elsewhere (Atteh and Ologbenla, 1993) but the 9.76% ether extract reported in this experiment was quite lower than the 20.70-25.30% reported by Atteh and Ologbenla (1993). These nutrients have been reported to be dependent upon the maturity stage of the larvae (Chapman, 1971). The birds fed the control diet consumed less feed ($P<0.05$) than the maggot meal groups.

However, feed intake significantly ($P<0.05$) reduced with increase in the level of maggot meal in the diets. Earlier studies by Moran (1982), Atteh and Ologbenla (1993) and Akpodiete (1997) had also reported reduced feed intake by birds fed diets of maggot meal. The superior growth performance by birds fed maggot meal diets over the control group agreed with the reports elsewhere (Ross *et al*., 1978; Awoniyi and Aletor, 1999; Awoniyi *et al*., 2000) that maggot meal was not nutritionally inferior to fish meal. The feed conversion ratio of birds fed maggot meal diets were better ($P<0.05$) than for those fed the control diet. It therefore follows that inclusion of maggot meal in the diets of broilers enhanced nutrient utilization than the fish meal based diet. The cost of production of maggot meal in this study was N 13.00/ kg, while fish meal was bought at N 180.00 /kg, a cost differential of N 167.00 (92.78%). This was evident in the reduced cost of feed and subsequently the cost of production of birds. At 50% dietary replacement of fish meal with maggot meal, cost of 1kg live weight of the broiler chickens was 34.22% less than same weight in the control diet. The inclusion of maggot meal in the diets of broiler chickens in this study significantly ($P<0.05$) reduced the weight of the heart of the chickens. However, the weight of the liver was not significantly ($P>0.05$) influenced. This seems to suggest that there was no foreign body in the maggot meal that negatively affected nutrient metabolism. The weight of gizzard was significantly ($P<0.05$) higher in birds fed the maggot meal diets, except for the 30% maggot meal group. However, no reason was adduced for the weight difference in gizzard as there was no definite pattern in weight changes. The inguinal fats was significantly ($P<0.05$) higher in the groups fed 30% and 40% maggot meal diets. This might be partly due to higher nutrient intake and mainly due to physiological condition of individual birds.

Table 1. Proximate composition of maggot meal (%DM)

Parameters	Composition
Dry matter (%)	87.13
Crude protein	44.44
Crude fibre	1.83
Ether extract	9.76
Total ash	14.29
NFE	16.81
Calcium (%)	0.03
Phosphorus (%)	0.05
ME ($KcalKg^{-1}$)*	2381.00

*Based on the prediction equation by Morgan *et al.* (1975)

Table 2. Composition of the experimental diets fed finisher broiler chicks

Ingredients (%)	T_1	T_2	T_3	T_4	T_5
Maize	58.00	58.00	58.00	58.00	58.00
Soybean meal	20.60	20.60	20.60	20.60	20.60
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	4.00	3.20	2.80	2.40	2.00
Maggot meal	0.00	0.80	1.20	1.60	2.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00	1.00
Premix *	0.25	0.25	0.25	0.25	0.25
Methionine	0.40	0.40	0.40	0.40	0.40
Common salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00

*Each 2.5kg contains: Vit.A-10,000,000IU; Vit.D3-2,000,000IU; Vit.E- 20,000IU; Vit. K- 2,250mg; Thiamine-1750mg; Riboflavin-5,000mg; Pyridoxine-2,750mg; Niacin- 27,500mg; Vit. B12- 15mg; Pantothenic acid-7,500mg; Folic acid – 7,500mg; Biotin-50mg; Choline chloride- 400g; Antioxidant-125g; Manganese-80g; Zinc-50g; Iron-20g;Copper-5g; Iodine-1.5g; Selenium-200mg and Cobalt-200mg

Table 3. Calculated chemical composition of the experimental diets (%)

Parameters	T_1	T_2	T_3	T_4	T_5
Crude protein	21.15	21.00	21.00	21.00	21.00
Crude fibre	3.45	3.41	3.41	3.40	3.40
Ether extract	6.61	6.65	6.67	6.69	6.71
ME ($Kcalkg^{-1}$)	2939.32	2916.44	2905.00	2893.56	2882.12
Calcium	1.08	1.04	1.01	0.99	0.96
Phosphorus	0.71	0.68	0.67	0.66	0.65
Lysine	1.20	1.16	1.15	1.13	1.11
Methionine	0.86	0.84	0.83	0.83	0.82

Table 4. Effects of different replacement levels of maggot meal on performance of finisher broiler chicks

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Initial body weight (g)	1205.55	1200.00	1286.11	1277.78	1247.22	16.52
Final body weight (g)	2586.67^{c}	3171.67^{a}	2997.78^{ab}	2947.22^{ab}	2847.22^{bc}	103.40
Body weight changes (g)	1381.11^{c}	1971.66^{a}	1711.65^{ab}	1669.44^{abc}	1600.00^{bc}	105.20
Daily body weight gain(g)	183.41^{b}	184.86^{ab}	188.60^{ab}	190.24^{a}	189.21^{a}	2.04
Daily feed intake (g)	39.46^{c}	56.33^{a}	48.90^{ab}	47.70^{abc}	45.71^{bc}	3.01
Feed conversion ratio	6.17^{a}	3.40^{b}	3.86^{b}	4.08^{b}	4.26^{b}	0.52
Mortality (%)	0.00	5.56	5.56	0.00	0.00	-
Economic evaluation						
Cost / kg feed	69.59	68.25	67.59	66.92	66.25	0.57
Cost / kg feed consumed	38.29	38.13	38.24	38.19	37.60	0.13
Feed cost/kg live weight gain (N)	429.25	231.83	261.37	273.18	282.36	103.44

^{a,b,c} Means within the same row with different superscript differ significantly ($P<0.05$)

Table 5. Organ characteristics of finisher broiler chicks fed dietary maggots

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Live weight (kg)	2.60^a	2.22^c	2.58^{ab}	2.55^{ab}	2.35^{bc}	0.08
Dressing percentage	63.23^a	48.90^b	61.89^a	62.72^a	61.35^a	1.93
Heart (%)	0.42^a	0.41^{ab}	0.36^b	0.32^{bc}	0.30^c	0.02
Liver (%)	1.73	1.84	1.69	1.43	1.54	0.13
Gizzard (%)	1.51^c	1.94^a	1.66^{bc}	1.83^{ab}	1.89^a	0.07
Inguinal fat (%)	1.91^c	2.07^c	3.15^{ab}	3.44^a	2.18^{bc}	0.33

^{a,b,c} Means within the same row with different superscript differ significantly ($P<0.05$)

Conclusion and Recommendation

The replacement of 50% of a 4.00% dietary fish meal with maggot meal in a finisher broiler chicken's diet was superior to the fish meal based diet in both performance and economics of production. However, the effect of dietary maggot meal on the performance of birds might depend on the nutrient profile of the maggot meal, and also on the amount of dietary fish meal in the reference diet. Further studies might be necessary to determine the optimal level of replacement of fish meal with maggot meal in finisher broiler chicken's diet.

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