Performance and slaughter characteristics of broiler chickens fed different sources of maggot meal

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Abstract

In this study, the effect of three different sources of maggot meals was conducted to evaluate the performance and slaughter characteristics of broiler chickens. Five diets were formulated to include Diet 1 (control) which contained 3.5 % fish meal, while Diets 2, 3 and 4 contained 3.5% maggot meal from broiler droppings (BMM),maggot meal from layers droppings (LMM) and maggot meal from rabbit faeces (RMM) respectively. Eighty (80) day-old unsexed Marshall Broilers were randomly allotted to four dietary treatments in a completely randomized design (CRD). Thedietary treatments had 20 birds each with two (2) replicates. Data were generated on proximate analysis and performance indices including feed intake and weight gain, slaughter characteristics and mortality rate. They were subjected to analysis of variance (ANOVA) and means significantly different were separated using Duncan's Multiple Range Test (DMRT) at 5% probability level. Results from proximate analysis showed that maggots from layer droppings had the highest crude protein and ether extract. Results on performance indices showed that birds fed on diet 3 (layer maggot meal) had significantly ($P<0.05$) best performance than others as regards feed intake. Layer maggot meal (LMM) in this study enhanced bestproductive performance compared to those from broiler and rabbit maggot.Birds fed layer maggot meal had the best (1.85) feed conversion ratio. They also had the best body weight gain (2501g) and feed intake (4627g). In conclusion, layer maggot meal is recommended as analternative animal protein source to expensive fish meal.

Keywords: Performance, broiler droppings, layer dropping, rabbit faeces, maggot meal

Introduction

Inadequate intake of animal protein has been identified in most of the developing countries where the average daily animal protein intake of 25g was reported by Daghir (2008). According to Taiwo *et al*. (2005), Nigeria is not an exception as malnutrition among the poor populace is predominantly due to marked inadequate (in quantity and quality) intake of protein. Efforts tobridge the animal protein gap prevailing in Nigeria have therefore be geared towards exploring the potentials of fast growing and rapidly multiplying animals such as poultry.Among other constraints, poultry industry in developing countries is been confronted with high cost of production which brings down profits from the venture. Reports indicated that feed is the most important factor of production accounting for 60 – 80% of the total cost (Fasuyi, 2005; Abeke *et al*., 2013). Thisisattributed to the exorbitant prices of the conventional feedstuffs commonly used in formulating poultry diets. To overcome this problem, substitution of the expensive conventional feedstuffs with relatively cheaper ones is the way out. Several researchers have attemptedreplacing the expensive conventional feedstuffs with cheap and locally available alternative feedstuffs.The expensive fishmeal could be replacedpartly or completely with the locally available maggot meal (MGM). It compares favourably with fish meal in the amino acid profile (Atteh and Oyedeji, 1994). Adesulu and Mustapha (2000) reported that the levels of some amino acids like cysteine, histidine, phenylalanine, tryptophan and tyrosine in maggot meal are higher than in fish meal and soyabean. Maggot meal, according to Akpodiete and Ologhobo (1999), is of high biological and nutritive value. Ogunji*et al*. (2008b) reported that the biological value of maggot meal was equivalent to that of whole fish meal. Maggot meal has been included in broiler diets as a replacement for conventional fish meal. Most of these researchers (Awoniyi, *et al*. 2004; Adeniji, 2007; Hwangbo, *et al.* 2009; Okah and Onwujiariri, 2012) revealed that fish meal could be replaced with maggot meal without any deleterious effects on the animals.

Maggot is a larva of housefly (*Musca domestica*). It can be sourced form wastes (kitchen wastes, poultry droppings, cattle dungs, rabbit faeces, sludge or any substrate) on which housefly can survive. Housefly constitutes environmental hazards and nuisance. It is a fact that houseflies are carriers of pathogens but researches have shown that maggot meal did not pose any health problems to the animals when used to replace fish meal in the diets of poultry and fish. Adeniji (2007) reported no mortality when maggot meal was used to replace groundnut cake in the diets of chicks. On this note, the expensive fish meal could be replaced partly or completely with the locally available maggot meal (MGM). It was on this basis of these potentials that maggot meals from different substrates were used to replace fish meal at 100% level of inclusion in diets of broiler chickens.

Materials and Methods

Experimental site The experiment was conducted at the Poultry Unit of Teaching and Research Farm of Ibrahim Badamasi Babangida University, Lapai, Niger State. Lapai lies on longitude 9.02^{0}N and latitude 6.34^{0}E of the equator. The area is located in the vegetative zone of guinea savannah, middle belt of Nigeria. It has an average temperature of 23^{0}C – 34^{0}C and a maximum rainfall of 107.3mm (Anonymous, 2010).

Harvesting and preparation of the maggot meal

Maggots used in the experiment were produced from three different sources (broilers, layers and rabbit droppings). They were obtained by culturing housefly larvae (*Musca domistica*) on the faecal substrates. The droppings were spread on wet bowls in order to attract houseflies that introduced the larvae on the droppings. Four days later, they were ready for harvesting, as they migrated to the surface of the substrate. Sieve was used in harvesting them into different flasks containing ice block. The harvested maggots were oven-dried at 75^{0}C for three hours in order to reduce its moisture content for proper storage. The dried maggot was milled and a sample of the meal was taken to the Animal Production Laboratory for determination of the proximate composition according to A.O.A.C (2000) (Table 3).

Experimental diets

The experimental diet comprised of 3.5% fish meal as source of animal protein in Diet 1, (control), 3.5% of maggot meal (MGM) from broiler droppings in Diet 2; 3.5% of maggot meal from layer droppings in Diet 3; and 3.5% of maggot meal from rabbit faeces in Diet 4, replacing fish meal in those diets (Tables 1 and 2). Micro ingredients such as salt, methionine, lysine and premix were weighed using Mettler sensitive digital scale while other macro feedstuffs were weighed with top loader weighing scale.

Table 1: Gross composition of experimental broiler starter diets

Ingredient (%)	Treatment			
	Diet 1	**Diet 2**	**Diet 3**	**Diet 4**
Maize	53.00	53.00	53.00	53.00
Soybean	4.80	4.80	4.80	4.80
GNC	30.00	30.00	30.00	30.00
Wheat offal	5.20	5.20	5.20	5.20
Fish meal	3.50	0.00	0.00	0.00
BMM	0.00	3.50	0.00	0.00
LMM	0.00	0.00	3.50	0.00
RMM	0.00	0.00	0.00	3.50
Bone meal	2.00	2.00	2.00	2.00
Limestone	0.80	0.80	0.80	0.80
*Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0-10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated:				
CP (%)	23.88	23.63	23.74	23.53
ME (kcal/kg)	2888.12	2884.83	2894.21	2881.80

*Slomix premix to supply Vitamin A (10,000mg), vitamin D (2,000mg), vitamin E (10mg), vitamin K_3 (2,000mg), Vit. B_{12} (10,000mg), pantothenic acid (10,000mg), Niacin (26,000mg), folic acid (1,000mg), biotin (100,000mg), choline (150,000mg), Antioxidant (125,000mg) , Manganese (10,000mg), Zinc (50,000mg), Cobalt (250mg), Iron (40,000mg), Copper (6,000mg), Iodine (500mg), Selenium (100mg).
BMM: Broiler maggot meal LMM: Layer maggot meal RMM: Rabbit maggot meal

Experimental birds and management

Eighty (80) day-old broiler chicks (MarshallBreed) were used for the study. They were randomly allotted to four treatments of twenty (20) chicks in a completely randomized design (CRD). Each treatment was further divided into two replicates of ten (10) chicks each. On arrival, the chicks were placed on the experimental diets and Vitalyte® (anti-stress) in water was equally served. The chicks were brooded on deep litter using charcoal as source of heat. Temperature of the brooding pens was maintained and routine management exercises were adopted as recommended by Oluyemi and Roberts (2000). Feed and water were supplied to the birds *ad libitum*. First dose of Gumboro vaccine was administered to the chicks against Newcastle diseases at two weeks of age and the second Gumboro at the fourth week while Lasota was administered at fifth week of age. Neoceryl® and Amprollium® were administered at prophylactic doses (according to the manufacturer's directives)

Table 2: Gross composition of experimental broiler finisher diets

Ingredient (%)	Treatment			
	Diet 1	Diet 2	Diet 3	Diet 4
Maize	56.40	56.40	56.40	56.40
GNC	26.40	26.40	26.40	26.40
Wheat offal	10.50	10.50	10.50	10.50
Fish meal	3.00	0.00	0.00	0.00
BMM	0.00	3.00	0.00	0.00
LMM	0.00	0.00	3.00	0.00
RMM	0.00	0.00	0.00	3.00
Bone meal	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
*Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0-10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated:				
CP (%)	20.80	20.59	20.68	20.50
ME (kcal/kg)	2829.77	2811.83	2819.21	2821.80

*Slomix premix to supply Vitamin A (10,000mg), vitamin D (2,000m g), vitamin E (10mg), vitamin K_3 (2,000mg), Vit. B_{12} (10,000mg), pantothenic acid (10,000mg), Niacin (26,000mg), folic acid (1,000mg), biotin (100,000mg), choline (150,000mg), Antioxidant (125,000mg), Manganese (10,000mg), Zinc (50,000mg), Cobalt (250mg), Iron (40,000mg), Copper (6,000mg), Iodine (500mg), Selenium (100mg).

BMM: Broiler maggot meal LMM: Layer maggot meal RMM: Rabbit maggot meal

to prevent bacterial infections and coccidiosis respectively.

Data collection

Data collected on body weight gain and feed intake were on weekly basis, and were used to determine feed conversion ratio. Feed intake was determined by finding the difference between feed served and the left-over. Mortality was recorded as it occurred throughout experimental period. At the end of the eight-weeks long feeding trials, two birds per replicate were randomly selected, fasted overnight, slaughtered by severing the jugular veins and were thoroughly bled. Each carcass was de-feathered and eviscerated carcass weight, cut-up parts and organ weights were determined.

Statistical analysis

Data collected were subjected to one-way analysis of variance (ANOVA) according to the procedure of Steel and Torrie (1980). Significantly ($P<0.05$) different means were separated using Duncan's Multiple Ranges Test (Duncan, 1955).

Results

The gross compositions of both starter and finisher diets used in this experiment were shown in Tables 1 and 2 respectively. The calculated metabolizable energy value of the diets ranged approximately between 2800 at starter phase and 2900 kcal/kgat finisher phase. Calculated crude protein value ranged from 23.53% in treatment 4 to 23.88% in treatment 1 at starter phase, and20.50% in treatment 4 to 20.80% in

Table 3: Nutrient composition of the maggot meal fed to broiler chickens

Nutrient (%)	BMM	LMM	RMM
Dry matter	90.34	92.13	92.70
Crude protein	61.63	64.63	59.63
Crude fibre	5.54	2.35	4.82
Ash	4.55	2.55	6.11
Ether extract	23.53	24.09	21.27
Carbohydrate	0.63	0.86	5.69
ME (kcal/100g)	199.00	180.44	206.15

Table 4: Performance characteristic of broilers fed maggot meal

Parameter	Treatment				SEM
	Diet 1	Diet 2	Diet 3	Diet 4	
Initial weight (g)	50.00	50.00	49.00	50.00	-
Final weight (g)	2120.00	2330.00	2550.00	2170.00	-
Dressed weight (g)	2000.00[b]	2110.00[b]	2340.00[a]	2150.00[ab]	0.06
Eviscerated weight (g)	1790.00[c]	2000.00[b]	2200.00[a]	2100.00[ab]	0.06
Body weight gain (g)	2070.00	2280.00	2501.00	2120.00	0.75
Feed intake (g)	4401.00	4500.00	4627.00	4552.00	0.11
FCR	2.13	1.97	1.85	2.15	0.03
Mortality (%)	10.00	0.00	5.00	10.00	-

[abd] *Means in the same row with different superscripts differ significantly (P<0. 05), SEM = Standard Error of Mean,* FCR = Feed conversion ratio

treatment 1 at finisher phase.

The proximate compositions of the maggot meals were presented in Table 3.Crude protein in broiler maggot meal, layer maggot meal and rabbit maggot meal were 61.63, 64.63 and 59.63% respectively. Ether extract values were high and ranges from 21.27 – 24.09% in the test ingredients. Metabolizable energy (Kcal/100g) in broiler, layer and rabbit maggot meals were 199.00, 180.44 and 206.15 respectively.

The productive performance of broiler birds fed diet containing the different maggot meals sources is shown in Table 4. Mean final weight gains of the birds were 2120, 2330, 2550 and 2170g for Diets 1, 2, 3 and4 respectively. Body weight gains in gram were 2070, 2280, 2501 and 2120 for Diets1, 2, 3 and 4 respectively. Dressed weight ranged from 2000g in birds fed control diet (Diet 1) to 2340g in birds fed layer maggot meal (Diet 3). Eviscerated weight also followed the same pattern with birds fed control having the least (1790g) and the highest (2200g) in those fed layer maggot meal (LMM). Feed conversion ratio ranged from 1.85 to 2.15. Mortality was calculated in percentage and obtained as 10, 0, 5 and 10% in Diets1, 2, 3 and 4 respectively. Performance indices measured in this experiment showed no significant (P>0.05) differences except in dressed and eviscerated weights where there were significant (P<0.05) differences among the treatment means.

Table 5 shows the results of carcass analysis of the broilerchickens fed maggot meal as replacement for fish meal. There were significant (P<0.05) differences in the back and thigh of the treatment means. Head,

Table 5: Cut-up parts of broiler chickens fed maggot meal

Cut-up part (%LW)	Treatment				SEM
	Diet 1	Diet 2	Diet 3	Diet 4	
Head	0.71	0.64	0.59	0.53	0.06
Neck	5.47	5.02	4.59	5.25	1.58
Wing	5.42	4.94	4.51	5.35	0.50
Back	25.52[a]	23.13[b]	24.12[a]	23.78[b]	16.92
Breast	27.83	23.18	22.69	28.34	26.14
Shank	0.63	0.47	0.59	0.59	1.20
Drumstick	14.91	13.56	12.45	14.52	1.35
Thigh	14.93[a]	13.52[b]	12.35[b]	14.52[a]	0.25

[aB] Means in the same row with different superscripts differ significantly (P<0.05), SEM = Standard Error of Means

Table 6: Visceral organs of broiler chickens fed maggot meal

Cut-up part (%LW)	Treatment				SEM
	Diet 1	Diet 2	Diet 3	Diet 4	
Liver	0.78	0.69	0.59	0.69	0.56
Kidney	0.71	0.60	0.59	0.69	0.50
Pancreas	0.24	0.21	0.24	0.23	0.50
Spleen	0.24	0.17	0.20	0.23	0.50
Heart	0.57	0.64	0.51	0.65	0.71
Intestines	5.42[a]	4.76[b]	4.12[b]	5.18[a]	1.25
Gizzard	0.73	0.64	0.55	0.61	1.04
Abdominal fat	0.71	0.64	0.59	0.69	0.48
Proventriculus	0.59	0.64	0.59	0.65	1.35

[ab] Means in the same row with different superscripts differ significantly (P<0.05), SEM = Standard Error of Means

neck, wing, breast, shank and drumstick showed no significant (P>0.05) difference. Numerically, head varied from 0.53 to 0.71%, neck, 4.59 to 5.47%, wing, 4.51 to 5.42%, back, 23.13 to 25.52%, breast, 22.69 to 28.34%, shank, 0.47 to 0.63%, drumstick, 12.45 to 14.91%,and thigh, 12.35 to 14.93%. There were no significant (P>0.05) differences in the means of all the visceral organs measured except in intestines (Table 6).

Discussion

The proximate compositions of the test materials revealed that the crude protein values obtained for the maggot meal were higher than what (44.44%) was reported by Okah and Onwujiariri (2012), and the range of values (39-54%) reported by Atteh and Ologbenla (1993). The differences might be due to the different substrates used. However, the values obtained in this study for crude protein are very close to what (63.99%) Hwangbo *et al*. (2009) reported. The 21.27 – 24.09% ether extract reported in this study fell within the range (20.70 – 25.30%) reported by Atteh and Ologbenla (1993). Ether extract values from maggot meals from Broiler and rabbit substrates were lower than the report (24.31%) of Hwangbo *et al*. (2009).There were no significant (P>0.05) differences among the treatment means of feed intake. Diet 3 had the highest value (4627g) which was not significantly (P>0.05) different from others. Body weight gain showed that Diet 3 had highest value (2501g) but not significantly

(P>0.05) different statistically from Diet 1 (2070g), Diet 2 (2280g), as well as Diet 4 (2120g).The higher body weight gains in birds fed maggot meal may be attributed to the essential amino acid profile of the maggot meals as noticed by Hwangbo *et al*. (2009). This agrees with the report of Boorman and Eillis (1996) that increased dietary protein digestibility aids weight gain in chicks and is seen as a result of protein accumulation related to nutrient changes and the given energy content of the feed.The feed conversion ratio (FCR) showed no significant different (P>0.05) across the diets asDiet 4had the highest (2.15) which is the poorest, while Diet 3had the best (1.85) followed by Diet 2(1.97). This is an indication of the rate of utilization of the diets which is also a reflection of the rate of increase in weights of the broilers due to maggot meal. This corroborate with the resultsreported byOkah and Onwujiariri (2012) who reported increased performance of finisher broiler chickens fed maggot meal diets. Nzemujo (2010) also reported that fishes fed maggot meal diets gained weight faster than those on fish meal. The weekly feed intakes of the birds on maggot meals were higher than those fed fish meal.This is not far from being the concept since those birds grew and developed faster than those fed diet 1 which was the fish meal diet. The highest mortality record in D1 and D4 (10%) might be due to improper management or handling of the birds as the mortality occurred at the first week of the experiment. There were significant (P<0.05) differences among the treatment means of the thigh muscles. D1 had the highest value with (317g) than D2, D3 and D4 that had (315g). Diet 3 had the highest value for dressed and eviscerated weight (2.34kg and 2.20kg) which might be probably be as a result of increased rate of protein accumulation with maggot meal due to the maggot's optimal essential amino acid profile (particularly lysine) and protein digestibility which agrees with the potential of layers maggot meal. There were also significant (p<0.05) differences among the means of the back weights. Values recorded in this study for thigh deviated greatly from the report of Okorie (2013) who fed broiler chickens with maggot meal at lower level of inclusion. Back means recorded in this study were higher than reports of Okorie (2013) but lower than what Agbede and Aletor (1997) reported. In the visceral organs, there were significant (P<0.05) differences among the treatment means of intestines, but other organs showed no significant (P>0.05) differences among the treatment means.

Conclusion

This study revealed that maggot meal especially the one from layers droppings can completely replace fish meal at 100% inclusion rate in broiler chicken diet without any significant effects on weight gain, feed intake and feed conversion ratio. The performance data in this study pointed to the potential of layers maggot meal as an inexpensive alternative animal protein resource to fishmeal.

References

Abeke, F. O., Bawa, G. S. and Bot, M. H. 2013. Response of broiler chickens to graded level of locust bean (*Parkia biglobosa*) pulp meal. *Nigerian Journal of Animal Production*, 40(1): 57 – 66.

Adeniji, A. A. 2007. Effect of replacing groundnut cake with maggot meal in the diet of broilers.*International Journal of Poultry Science*,6(11): 822-825

Adesulu, E. A. and Mustapha, A. K. 2000.

Use of housefly maggots as a fish meal replacement in tilapia culture: A recent vogue in Nigeria. In: K. Ftzimmons and J.C. Filho (Ed.). Proceeding of the Fifth International Symposium on Tilapia Aquaculture. 3-7 September, Rio de Janeiro: 138-143.

Agbede, J. O. and Aletor, V. A. 1997. The Performance, nutrient utilization and cost implications of feeding broiler finishers conventional or under – utilized feed resources. *Appl. Trop. Agric.*, 2: 57-62.

Akpodiete, O. J. and Ologhobo, A. D. 1999. Biochemical evaluation of Maggot (larvae) meal on the growth and sexual maturity of replacement pullets, *Trop. J. Anim. Sci*., 1(2): 45-51.

Anonymous 2010. Retrieved from Weather Station, Airport, Minna, Niger State.

A.O.A.C. 2000. Official Method of Analysis, 17th edition.*Association of Official AnalyticalChemist, Washington D.C.*

Atteh, J. O. and Ologbenla, S. 1993. Replacement of fish meal with maggot in broiler diets: Effect on performance and nutrient retention. *Nigerian Journal of Animal Production*, 20(1): 44-49

Atteh, J. O. and Oyedeji, J. O. 1994. The replacement value of maggots for groundnut cakein broiler diet. *Centerpoint*, 10: 39-46.

Awoniyi, T. A. M., Adetuyi, F. C. and Akinyosoye, F. A. 2004. Microbiological Investigation of maggot meal stored for use as livestock feed component. *J. Food Agric. Envir*. 2 (3-4): 104-106

Boorman, K. N. and Ellis G. M. 1996. Maximum nutritional response to poor quality and amino acid utilization.*Br. Poult. Sci.*, 37:145-156

Daghir, N. J. 2008. *Present status and future of the poultry Industry in hot regions, Poultry roduction in hot climates,* 2nd ed. Published by CAB International, UK.

Duncan, D. B. 1955. Multiple Range and F-test. *Biometrics*. 11: 1 – 42.

Fasuyi, A. O. 2005. Nutritional evaluation of cassava leaf protein concentrate as alternative protein sources in rat assay. *Pakistan Journal of Nutrition,* 4:50 – 56

Hwangbo, J., Hong, E. C., Jang, A., Kang, H. K., Oh, J. S., Kim, B. W. and Park, B. S. 2009. Utilization of housefly-maggots, a feed supplement in the production of broiler chicken.*J. Environ. Biol.*, 30(4): 609-614

Nzemujo, A. 2010. Comparative effects of partial replacement of maggot meal, academic publications.org.

Ogunji, J. O., Kloas, W., Wirth, M. Neumann, N. and Pietsch, C. 2008b. Effect of housefly maggot meal (magmeal) diet on the performance, concentration of plasma glucose, cortisol and blood characteristics of *Oreochromis niloticus* fingerlings. *J. Anim. Physiol. Anim. Nutr*. 92(4): 511-518.

Okah, U. and Onwujiariri, E. B. 2012. Performance of finisher broiler chicken fed maggot meal as a replacement for fish meal. *J. Agri. Technol.*, 8(2): 471-477.

Okorie, K. C. 2013. Comparative effects of partial replacement of fish meal with maggot meal on the performance, carcass, organ weights characteristics and nutrient digestibility of broiler finishers. *Int. Sci. Research J.* 4(2): 109-117.

Oluyemi, J. A. and Roberts, F. A. 2000. *Poultry production in warm wet climates,* Macmillan Press, Ltd, London.

Steel, R. G. D and Torrie, J. H 1980. *Principles and Procedures of Statistics.*McGram Hill Bk. CO., New York.

Taiwo, A. A., Adejuyigbe, A. A., Olusegun, A. A., Gbadamosi, M. B., Obe, O. J. and Adebowale, E. A. 2005. Effect of varying levels of inclusion of soybean residue on the performance of broiler finisher birds; Proceedings of the 30th Annual Conference of Nigerian Society for Animal Production (NSAP) 20-24th March. University of Nigeria, Nsukka, 207-208.

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