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BIOLOGICAL EVALUATION OF MAGGOT (LARVAE) MEAL ON THE GROWTH AND SEXUAL MATURITY OF REPLACEMENT PULLETS

O.J. AKPODIETE* AND A.D. OLOGHOBO[2]
Department of Animal Science
Delta State University, Asaba Campus
Delta State, Asaba

Target Audience: Animal scientists, nutritionists, farmers, feedmillers and feed toxicologists.

ABSTRACT

The replacement value of maggot meal for fish meal on the growth and sexual maturity of growing replacement pullets was evaluated for 11 weeks. One hundred and twenty 14-week-old growing pullets of the Nera strain were fed five diets. The control diets (grower and layer) contained 3% fish meal composition which was replaced at 25, 50,75, and 100% of its equi-protein contribution by maggot meal. Maggot meal improved hen-day production, egg number and feed conversion ratio (feed:eggs) at 75% replacement. Weights of first eggs laid were heavier for maggot meal containing diets. Final liveweight, weights gain, age at first egg, age at sexual maturity (50% hen-day production) and the average egg weight were similar in all the treatments. Cumulative feed intake was lowest in those birds fed the 100% maggot meal diet and highest in those fed the 75% maggot meat diet. No mortality was recorded during the experimental period.

Keywords: Growing replacement pullets; maggot meal; growth; sexual maturity; feed conversion ratio.

DESCRIPTION OF PROBLEM

The high cost and scarcity of the conventional feed ingredients particularly the sources of protein, fish meal, soyabeans and groundnut cake, have largely contributed to the high cost of poultry production in the tropics. Attempts at reducing production costs have led nutritionists to find alternative sources of protein to the conventional ones. However, little has been achieved for fish meal, the conventional animal protein source.

*Coresponding author

[2]Department of Animal Science, University of Ibadan, Ibadan

Various attempts at recycling poultry dropping into poultry feeds have not been encouraging. Its inclusion at above 5% level tended to decline growth and feed efficiency (1,2). However, poultry dropping is a good source of nutrients for the growth and survival of maggots (fly larvae) which could be harvested and processed and used as a potential alternative to fish meal. It has been shown to be of high protein quality containing essential amino acids and also essential fatty acids (3,4,5). The determined proximate and amino acid compositions of maggot meal is shown in Table 1. Information about the use of maggot meal as a source of animal protein is scarce in the tropics. Hence the objective of this study was to evaluate maggot meal as a replacement for fish meal, in growing pullet diets on growth performance and sexual maturity (50% hen-day production).

Table 1: Proximate and Amino Acid Composition of Dried Maggot Meal and Fish Meal (Percentage Dry Matter)

Proximate Composition	Maggot Meal	Fish Meal[1]
Crude Protein	54.30	72.00
Ether Extract	9.80	7.63
Ash	11.70	4.90
Nitrogen Free Extract	15.55	14.16
Moisture	8.65	
Amino Acid Composition		
Aspartic Acid	4.43	-
Glutamic Acid	6.40	-
Serine	2.10	-
Histidine	1.12.	3.42
Glycine	2.26	6.78
Threonine	2.21	5.00
Arginine	2.23	5.87
Alanine	3.37	-
Tyrosine	2.50	1.02
Methionine	0.87	2.81
Valine	2.45	4.73
Phenylalanine	2.18	5.18
Isoleucine	1.87	4.78
Leucine	3.02	7.92
Lysine	3.18	7.98

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MATERIAL AND METHODS

Diets

Maggots (fly larvae of *Musca domestica*) were produced from palm oil enriched poultry droppings, dried and milled into maggot meal as described in an earlier study (5). The maggot meal (54% crude protein) was used to replace the protein contribution from fish meal in the basal grower and layer diets at

the rate of 25, 50, 75 and 100% replacements. These corresponded to 9.2, 18.4, 27.2 and 36.4 g/kg maggot meal in the diets respectively.

The basal grower and layer diets which represented the control contained no maggot meal and are shown in Table 2.

Management of Replacement Pullets

One hundred and twenty 14-weeks-old growing pullets of the Nera strain were divided into 15 groups of eight pullets each. These groups were randomly allocated to each of the five dietary treatments in two replicates. The birds were housed in caged units with each replicate of a treatment group occupying a different tier of the cage unit at alternative positions. The birds were first transferred to the cages at 12 weeks and fed the control growers diet for two weeks for acclamatization and conditioning before the start of the experiment. The photoperiod was equal length of day and night. The birds were fed the experimental grower diets from 14 to 19 weeks and subsequently replaced with the corresponding layer diets from 20 to 24 weeks when sexual maturity was attained and stabilized in all groups. Sexual maturity was determined at 50% hen-day production(6). The birds were initially weighed at the start of the experiment and their liveweights and weight gains determined on weekly basis till the end of the experiment. Feed and water were offered *ad libitum*. Records of feed consumption and weight gains each week and cumulative were keep on a replicate basis.

Chemical Analysis

Samples of dried maggots meal and diets were dried in a forced-draught oven at 60°C for 24 hours and ground in laboratory hammer mill. Subsequently samples were subjected to proximate analysis(7). The maggot meal sample was analysed for amino acids using the gas-liquid chromatography method (8).

Statistical Analysis

The data were subjected to the analysis of variance and significantly different means were separated by Duncan Multiple range test(9).

RESULTS AND DISCUSSION

The proximate composition (Table 1) shows maggot meal to contain 54.30% crude protein. This is lower than the crude protein of fish meal which is usually 72% for the imported stock. The Table 1 also shows the amino acid composition of fish meal which appeared to double those of maggot meal with the exception of tyrosine

Final liveweight and weight gain of birds for the whole period were not significantly ($P>0.05$) different among treatment groups (Table 3). Feed intake per bird per day and cumulative feed intake for the period showed higher ($P>0.05$) feed intake for pullets fed 75% of maggot meal and lower ($P<0.05$) feed intake for those fed 100% of maggot meal. No mortality was recorded for the period.

Table 2: Composition (g/kg) of Fish Meal Based Diet Fed to Growing and Laying Pullets

	Growing Pullet					Layer				
(%)MM:FM Ingredients	0:100	25:75	50:50	75:25	100:0	0:100	25:75	50:50	75:25	100:0
Maize	269.0	269.0	269.0	269.0	269.0	433.0	433.0	433.0	433.0	433.0
Maize Offal	209.0	207.3	205.6	204.3	202.6	145.0	143.0	141.6	140.3	138.6
Wheat Offal	418.0	418.0	418.0	418.0	418.0	100.0	100.0	100.0	100.0	100.0
Soyabean meal	46.0	46.0	46.0	46.0	46.0	180.0	180.0	180.0	180.0	180.0
Fish meal	30.0	22.5	15.0	7.5	-	30.0	22.5	15.0	7.5	-
Maggot meal	-	9.2	18.4	27.2	36.4	-	9.2	18.4	27.2	36.4
Bone Meal	20.0	20.0	20.0	20.0	20.0	30.0	30.0	30.0	30.0	30.0
Oyster shell	-	-	-	-	-	75.0	75.0	75.0	75.0	75.0
Premix*	3.0	3.0	3.0	3.0	3.0	2.5	2.5	2.5	2.5	2.5
Salt	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0
Methionine	3.0	3.0	3.0	3.0	3.0	1.5	1.5	1.5	1.5	1.5
Calculated:										
Crude Protein	150.0	150.0	150.0	150.0	150.0	170.0	170.0	170.0	170.0	170.0
Metabolizable Energy (M/Kg)	10.0	10.0	10.0	10.0	10.0	10.92	10.92	10.92	10.92	10.92

* Premix providing per kg diet: Vit A, 10000iu; Vit D_3, 2000iu Vit B_2, 45mg; Vit B_6, 3mg; Niacin. 250mg; Pantothenic acid, 8.0 mg; Vit E, 8.0 iu, Vit B_{12}, 0.01mg; Folic acid, 0.05mg; Choline chloride, 300mg; Chlortetracycline, 20mg; Dinitro-ortholonamides, 125mg, Mn, 100mg; Fe, 50 mg, Zn, 40 mg; Cu, 2.40mg; 1, 1.40mg; Co, 0.02mg; Se, 0.08mg.

Table 3: **Growth and Egg Laying Performance of Growing/Laying (14-24 weeks of Age) Pullets Fed Graded Levels of Maggot (Larvae) Meal as Replacement for Fish Meal**

Parameters	Replacement Levels (MM:FM)%					
	0.100	2.5:75	50:50	75:25	100.0	SEM
Initial live Wt. (kg)	0.87	0.86	0.87	0.90	0.84	0.08
Final live Wt. (kg)	1.63	1.59	1.69	1.70	1.49	0.17
Weight Gain (Kg)	0.76	0.74	0.82	0.80	0.65	0.15
Feed Intake (g/bird/day)	91.0	89.68	91.01	91.67	83.71	0.33
Cumulative Feed intake (kg)	6.37	6.27	6.38	6.77	5.86	0.33
Egg Laying:						
Age at first Egg (days)	145.00	150.00	150.00	147.00	150.00	0.88
Age at 50% Production Sexual Maturity (days)	152.33	155.67	154.33	151.00	154.67	0.76
Hen-day production	54.94	50.39	42.47	59.70	46.82	1.49
Weight of first Egg (g)	38.27	48.70	50.00	42.00	45.33	1.27
Ave. Egg Weight (g)	51.58	52.57	52.77	52.46	53.14	0.45
Ave. Total Egg/bird	12.58	10.58	9.00	15.33	9.83	2.60
Kg Feed:Kg Egg (20-24Wks)	5.56	5.19	6.39	3.73	4.91	0.38

MM: Maggot meal; FM: Fish Meal.

Weights of first eggs layed for the treatment groups, were higher ($P<0.05$) in birds fed 25% and 50% maggot meal equi-protein replacement levels than other treatment groups. The weight was smallest for the group fed the control diet. Hen-day percent production of pullets fed 75% maggot meal was numerically highest ($P>0.05$) while those fed 50% maggot meal was the lowest ($P > 0.05$). Total eggs per birds were highest ($P>0.05$) for pullets fed 75% maggot meal and lowest in pullets fed 50% maggot meal which were similar ($P>0.05$) to those fed 100% maggot meal. Feed conversion in terms of kilogram feed intake to kilogram egg produced was best ($P>0.05$) for pullets fed 75% maggot meal and poorest ($P<0.05$) for those on 50:50 maggot meal:fish meal diet. Rate of attainment of sexual maturity, age at first egg and average egg weight were not significantly influenced by the replacement levels of maggot meal for fish meal.

The consistent growth observed in all pullets fed the experimental diets and similarity ($P>0.05$) in their final liveweight at 24 weeks of age appeared to indicate adequate supply of nutrients from all diets. This may imply that bioavailability and utilization of nutrients from maggot meal were similar to those of fish meal. In spite of statistical similarity observed for the liveweight, the growth of pullets on complete replacement of fish meal with maggot meal tended to be consistently lower during the experimental period. This perhaps is a reflection of the higher values of the amino acid content of fish meal as compared to maggot meal (Table 1). However, the liveweights at points-of-lay recorded for the experimental pullets compare well with other reports (10), and similar to the target weights for most breeders pullets. Body weight at

point-of-lay is claimed to be related to optimum laying performance. Therefore, their comparable liveweights at point-of-lay may have contributed to similarity in rate of attainment of sexual maturity and perhaps their age a first lay. This may mean that maggot meal provides adequate nutrients to support optimum performance of pullets.

The non-occurrence of mortality in all treatment groups agrees with previous report (3,11,13) on the health implication of using fly larvae (maggots) in poultry diets.

The similarity in the ages at first egg and sexual maturity in all treatment groups are indications that the replacement of fish meal with maggot meal did not result in nutrient restriction that could delay sexual maturity in pullets (13, 16). This observation, coupled with the attainment of highest hen-day percent production and better feed:egg ratio at 75% replacement of maggot meal for fish meal is suggestive of a high biological value for maggot meal. The exceptionally lower hen-day production and feed: egg ratio observed for equal inclusion of maggot meal and fish meal in the diet did not appear to reflect the true nutrients bioavailability of these ingredients.

The variation in weights of first eggs layed appeared to bear a relationship with age at first egg hen-day production rather than the level of replacement, since body weights of birds were not affected by the treatments. Pullets on control diet which came in to lay slightly earlier had smaller weights than those of 50% replacement levels which on the other hand came into lay slightly later and had heavier weights than the first eggs layed. This relationship tends to agree with Oluyemi and Roberts (14) and Lesson and Summers(6). The realization of the highest total egg per bird at 75% replacement level and slight increment in average egg weight with incremental use of maggot meal are indications of the high nutritive quality of maggot meal to support egg production in replacement pullets. This also agrees with antecedent reports (11,12).

CONCLUSION AND APPLICATIONS

(1) The slight improvements in final liveweight, weight gain and egg weight with use of maggot meal up to 75% replacement level, and higher hen-day percent production and feed: egg ratio obtained for 75% replacement level are strong support for the use of maggot meal in replacing fish meal in pullets diets.

(2) The use of maggot meal did not delay sexual maturity or cause mortality in the replacement pullets.
Therefore the use of maggot meal as replacement for fish meal in the diet of growing pullets is recommended.

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