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Utilization of maggot meal in the nutrition of African cat fish

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A twelve week feeding trial was carried out to evaluate the growth and nutrient utilization of African catfish (*Clarias gariepinus*) fingerlings fed varying levels of maggot meal. Maggot meal was produced from a mixture of 25 kg of cattle blood, 70% wheat bran, and 30% saw dust and substituted for fish meal in the fish diet to produce five varying levels of maggot meals- Treatment 1 (Trt 1) contained 0% of maggot meal (control), Trt 2 (50% maggot meal), Trt 3 (33.3% maggot meal), Trt 4 (66.6% maggot meal), and Trt 5 (75% maggot meal). A total of 150 fingerlings (two weeks old ±21.74 g) were allotted to five dietary treatments (fifteen fingerlings per tank) in a randomized design. Highest mean weight gain (MWG), percentage weight gain (PWG) and specific growth rate (SGR|) (35.47 g, 63.23%, 1.30%/day) were observed in Trt5 (75% maggot inclusion) respectively while the least values, 13.545 g, 62.29%, 0.69%/day were observed in Trt1 (control) respectively. In the same vein highest value of feed intake (116.4 kg) was recorded for Trt5 and least value (71.8 kg) was found with Trt3. However, FCR were significantly (P< 0.05) higher, Trt5 had the least FCR (3.13) and the highest value of 5.07 was found with fish fed control diet. Trt5 had the highest values of protein intake (PI) 47.60 and protein efficiency ratio (PER) 0.75, respectively. The results observed for FI showed that the feed were highly acceptable by the fish and the best growth response was achieved at higher level of maggot inclusion (75% maggot meal inclusion). Highest PER is also an indication that maximum utilisation of nutrients was obtained at the higher levels of maggot meal in the diet. Also, best of feed to flesh gain ratio was attained at the higher level of maggot inclusion. Therefore, it can be concluded that maggot meal can replace fish meal up to 75% without any adverse effect on the growth of the fish.

Key words: Replacement value, maggot meal, growth performance, weight gain.

INTRODUCTION

Recently, the increasing cost of feed has been at alarming rate and this has been affecting the development and expansion of aquaculture in African countries particularly Nigeria (Sogbesan et al., 2006). Fish meal been the major protein source in the fish diet constitutes the highest cost thereby making the price of the feed to rise exponentially. Therefore, several attempts have been made to substitute fish meal with other animal protein sources such as earth worm, shrimp waste, insect and plant protein sources such as sun flower, rape seed, soy bean meal and cottonseed meal. However, they cannot replace fish meal wholly but partially due to the presence of chitin in their exoskeleton. Ng et al. (2001) reported that chitin found in the exoskeletons is a polymer of glucosamine insoluble in common solvents and the presence of chitin do leads to depression of

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growth performance and protein utilization in catfish fed high levels. In the same vein problem of anti- nutritional factor in tropical legumes have limited their usage and direct incorporation into animal feeds (Ogunji and Writh, 2001) Maggot meal is an animal protein source produced from waste, it has been reported to be highly nutritive with crude protein ranging between 43.9 and 62.4%, lipid 12.5 and 21%, and crude fbre 5.8 and 8.2% (Awoniyi et al., 2003; Fasakin et al., 2003a,b; Ajani et al., 2004).Maggot meal is also rich in phosphorus, trace elements and B complex, vitamins (Teotis and Milles, 1973). According to Fashina– Bombata and Balogun (1997), the cost of harvesting and processing one kilogram of maggot meal is smaller compared to the cost of 1kg of fish meal, thereby showing the cost effectiveness of using maggot meal in the diet of African cat fish. This study therefore evaluates the nutritive value and growth performance of Clarias gariepinus fed with maggot meal.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the fisheries unit Ladoke Akintola University of Technology Teaching and Research Farm, Ogbomoso, Oyo State.

Maggot production

25 kg of fresh cattle blood, 5 kg of wheat bran and saw dust (70 and 30% respectively) were mixed together to a thickness of 5 cm to constitute substrate. The mixture was spread in a box of 1.4 m by 1.4 m screened with plastic net with one end open. The blood product were left to ferment for 48 h and the odour released attracted flies to perch on the mixture, then the open side was closed the second day. The eggs laid by the female flies on the substrate hatched into larvae within two days, after which the larval matured and was harvested. The whole process took five days. The larvae were harvested and oven dried to a constant weight, after which the dried maggots were milled into a meal and kept in an air tight container at room temperature.

Experimental diets

Feed ingredients were purchased from a feed ingredient store in Ogbomoso. The major feed ingredients used were yellow maize, wheat bran, groundnut cake (GNC), fishmeal, vitamins, mineral premix, oyster shell (Table 1).

Five isonitrogenous diets of 40% crude protein were formulated: Treatment 1 (Trt 1) contained 0% of maggot meal (control), Trt 2 (50%maggot meal),Trt 3 (33.3% maggot meal), Tit 4 (66.6% maggot meal),.Trt5 (75% maggot meal), with these ratios of maggot meal to fish meal 0, 1:1, 1:2. 2:1. 3:1 respectively.

The feed were made into pellets with the use of pelletizing machine; pellets were sun dried for three days to reduce the moisture content and to prevent deterioration. The feeds were packed and stored in air tight container at room temperature.

Experimental procedure

One hundred and fifty catfish fingerlings (*Clarias gariepinus*) of the same age (two weeks old) and uniform size (± 21.64 g) were procured and allotted to ten circular bowls of 50 L capacity at the rate of fifteen juveniles per bowl. The fish were acclimatized for two weeks during which the fish were fed floating feed to empty their gut in preparation for the experiment. After the acclimatization, the fish were fed 3% body weight subject to change every two weeks during which the fish were weighed

Data collection

The parameters measured were weight gain, average daily weight gain and feed intake. Each of these parameters was measured at 2 weeks interval. Performance characteristics were evaluated according to the method of Olvera- Novoa et al. (1990) as follows:

Mean weight gain (MWG) = Final mean weight (g) - Initial mean weight (g);
Average daily weight gain (ADWG) = Mean weight gain (g) / length of feeding trial (days);
Percentage Weight Gain (PWG) = Mean weight gain (g) / Initial mean weight × 100
Specific growth rate ($_{SGR}$ % /day) = $100[(Log_eW_2 – Log_eW_1)/N_O$ of days
Feed conversion ratio (FCR) = total feed fed (g) / net weight gain (g);
Protein Intake (PI) = total feed consumed × %Crude protein in feed
Feed intake (FI) = amount of feed throughout the period of the experiment;
Protein gain (PG) = mean protein intake (g) / length of feeding trial (days);
Protein efficiency ratio (PER) = Net weight gain (g) / Amount of protein fed (g) while
Protein productive value (PPV) = protein gain in fish (g) / protein in food (g) × 100.

Chemical analysis

The proximate analysis of maggot meal diet and the fish carcass were done, using the procedure outlined by AOAC (1990).

Statistical analysis

The data collected were subjected to analysis of variance (ANOVA) using completely randomized design (CRD) SPSS computer package (Field, 2000) means were separated by Duncan's option of the same statistical package.

RESULTS

The proximate compositions of diets are presented in Table 2. The ether extract, crude fiber and ash content showed a progressive increase in their content as maggot meat increased in the diets, while the crude protein values followed no definite order.

Table 3 showed the growth performance and nutrient utilizationof *Clarias gariepinus* fingerlings fed maggot meal, The mean weight gain (MWG), Percentage mean weight Gain (PWG), mean weight gain /day(MWG/Day), and specific growth rate were significantly different at p>005 in all the treatment. Treatment 5 (7 5% maggot meal) had the highest values in MWG, %MWG,MWG/day

Table 1. Gross composition of the experimental diets (%).

Parameter	Trt_1 (0%): Control	Trt_2 (50%)	Trt_3 (33%)	Trt_4 (66%)	Trt_5 (75%)
Yellow maize	22.36	19.13	22.15	17.32	16.17
Wheat bran	11.18	9.57	11.07	8.66	8.80
Groundnut cake	31.73	22.77	15.95	17.76	14.55
Fishmeal	31.73	22.77	31.89	17.76	14.55
Maggot meal	-	22.77	15.95	35.57	43.65
Mineral premix	1.50	1.50	1.50	1.50	1.50
Vitamin premix	0.50	0.50	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25
Vegetable oil	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.01	100.01	100.01	100.01
Calculated CP (%)	39.94	39.71	39.51	39.57	39.55

Trt_1, Trt_2, Trt_3, Trt_4, and Trt_5 represent control, 1:1, 1:2, 2:1 and 3:1 replacement level of maggot meal:fish meal in the diet fed to African catfish (*Clarias gariepinus*) fingerlings.

Table 2. Proximate composition of experimental diets.

Parameter	Trt_1 (0%) control	Trt_2 (50%)	Trt_3 (66%)	Ttr_4 (33%)	Trt_5 75%)
CP	44.20^{a}	43.50^{b}	44.23^{a}	43.48^{b}	44.03^{ab}
CF	3.74^{b}	3.76^{b}	3.74^{b}	3.85^{b}	4.10^{a}
EE	4.76^{a}	4.60^{a}	4.50^{a}	4.76^{a}	4.85^{a}
ASH	13.37^{ab}	12.77^{c}	13.11^{b}	13.16^{b}	13.60^{a}
DM	90.04^{b}	90.10^{b}	90.19^{b}	90.06^{b}	95.11^{a}
NFE	23.98^{d}	25.47^{b}	24.52^{d}	24.80^{c}	28.54^{a}

Means within the row with different superscript are significantly different ($p<0.055$).

and SGR (35.47 g, 163.23%, 506.72 mg,1.37 g respectively), while the least values of MWG, %MWG, MWG/day, and SGR were recorded in Treatment 1 (control) (13.54g, 62.39 %,193.36mg, and 0.69%/day respectively). Feed intake was very high in Treatment 5 (75% maggot meal) followed by Treatment 3 (33%maggotmeall) while the fish fed control (diet T1) consume less compare to the fish in all other treatments.The FCR were significantly different ($p<0.05$), fish fed at 75% inclusion level (Treatments 5) had the best FCR (3.1 3 g) followed by Treatments 3 (33% inclusion) (3.57 g) while Treatments 1 (control) has the highest FCR which makes it to be less efficient in terms of feed conversion (5.07 g). In the same vein Treatment 5 also have the highest gross feed conversion efficient (GFCE) while Treatment 1 (control) had the lowest GFCE.

DISCUSSION

All the five diets were accepted and utilized for growth by the fingerlings. The proximate composition of five experimental diets was as follows: Crude protein ranging from 43.48 to 44.20%, crude fibre 3.74 to 4.10%; ash 12.77%, to 13.60%, dry matter 90.04 to 95.11%, ether extract 4.50 to 4.88% (Table 2). The result of this study, compare favourably with Aniebo et al. (2009) who reported a CP of 40.59 to 40.74%. The crude fiber in this study ranging from 3.74 to 4.10% agreed with Aniebo et al. (2009) who reported crude fiber ranging from 4.1 to5.2%.

Growth response by catfish fed maggot meal based diets in Table 3 showed that an increase in the maggot meal in the diets gave an improvement in growth and feed conversion efficiency. Progressive increment in MWG, PWG and SGR were observed with increasing levels of maggot meal. The best growth for all treatments was observed in catfish fed 75% maggot meal based diet (Trt 5). The improving growth response observed with increasing levels of maggot, may be caused by the high level of crude protein in maggot meal. This agreed with Ogunji et al.(,2009) who observed a better performance of diets containing maggot meal over those fed 100% fish meal. Fish fed 75% maggot meal inclusion level (Trt5) recorded the least FCR (3.13) this is an indication that it has lower feed to flesh conversion.

The lowest growth rate was noticed in the control diet, this may be attributed to the low feed conversion efficiency. A11 the five treatment were accepted and

Table 3. Growth performance and feed utilization of *C. gariepinus* fingerlings fed diet containing varying inclusion of maggot meal.

Parameter	Trt_{1}- (0%) Control	Trt_2 (50%)	Trt_3 (66%)	Tr_{t4} (33%)	Trt_5 (75%)	SEM
Initial MW(g)	21.73^{b}	21.80^{a}	21.67	21.80^{a}	21.73^{b}	0.00
Final MW(g)	35.26	42.67	47.36^{b}	40.93	57.20^{a}	0.38
MWG(g)	13.54	20.87	25.70^{b}	19.14	35.47	0.23
MWG/day (mg)	193.26	298.16	367.08	273.35	506.72^{a}	5.39
%MWG (%)	62.39	95.73	118.57^{b}	87.77	163.23^{a}	1.73
SGR(%/ day)	0.69^{b}	0.96^{ab}	1.12^{a}	0.90^{ab}	1.37^{a}	0.32
TFI(g)	71764.14	86822.40	96386.43	83295.24	116396.28	767.21
AFI(g)	68.35	82.69	91.80	79.33	110.85^{a}	0.73
FCR	5.07	3.96	3.57	4.16	3.13	0.05
GCFE	19.79	25.25	27.98	24.08	32.01^{a}	0.23 2.23
PI	29.35^{d}	35.68^{c}	41.4^{b}	33.35^{c}	47.60^{a}	0.12
PER	0.46^{c}	0.58^{b}	0.62^{a}	0.57^{c}	0.75^{a}	

Means within the row with difference superscripts are significantly different ($p<0.05$); PMWG, Percentage means weight gain; MWG/day, mean weight gain/day; SGR, specific growth rate; TFI, average feed intake; FCR, feed conversion ratio; Pl, protein intake; PER, protein efficiency ratio.

utilized by the fingerlings with the highest total feed intake observed in Trt 5 (75% maggot meal) while control (Trt 1) showed the lowest value, this is in agreement with Alegbeleye et al. (1991) and Idowu et al. (2003) that maggot meal like other animal protein sources was well accepted and utilized by the fish. The significantly ($P > 0.05$) higher protein efficiency ratio (PER) of fish fed 50, 66 and 75% maggot meal based diets compare to others, attests to the fact that maximum utilisation of nutrients was obtained at the higher levels of maggots in the diet.

CONCLUSION AND RECOMMENDATION

From the results obtained, diet 5 (75% maggot meal) has the best performance in term of F'CR, MWG, SGR, PER therefore it can be concluded that maggot meal can be included in fish diet up to 75% in the diet of catfish fingerlings.Based on the result obtained from the experiment, it is hereby recommended that 75% maggot meal can be included in the diet of *C. gariepinus* to reduce cost and maximize profit.

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