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Growth and nutrient utilization of hybrid catfish heteroclarias fed maggot meal at varying inclusion levels

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ABSTRACT: Seventy-day growth trial was conducted with *Heteroclarias:heterobranchus bidorsalis* male x *Clarias garienpinus* female (mean weight 0.64±0.006g) fed diets based on various inclusion levels of Maggot meal. The fish meal in the control diet was replaced with maggot meals at 25%, 50%, 75% and 100% levels to supply 40% crude protein in the final diets. The trials were conducted in glass tanks (60cm x 30cm x 30cm). Evaluation of growth parameters and nutrient utilization of the fish was based on weight gains, protein intake, protein efficiency ratio, net protein utilization, feed conversion efficiency and carcass analysis. Best growth and feed conversion efficiency were obtained with the 75% dietary inclusion of maggot meal. There was no significant differences ($P>0.05$) between the group of fish on 50% and 75% dietary inclusion maggot meal in growth performance and protein efficiency ratio but, there was a significant ($P<0.05$) difference in the NPU (Net Protein Utilization) and protein gain between the control diet and those fed on maggot meals. There was no marked variation in the survival rate of fish on all diets.

Key words: Growth rate, Nutrient utilization, maggot meal, *Heteroclarias*, Hybrid, fishmeal, dry feed.

Introduction

Feed represents a large part of production costs during intensive culture (Chen and Tsai, 1994). Protein represents the most expensive component in fish feed and the protein sources (especially fish meal) are often the major factor in the high feed cost, it is important to search for alternative feedstuffs from unconventional sources so as to reduce cost.

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In Nigeria most fish farmers feed the cultured fish with agricultural wastes and in recent times, novel protein supplement like housefly maggot has been commonly substituted successfully for fish meal at varying levels in fish feeds (Ugwumba and Abumoye, 1998; Faturoti *et al*., 1998).

Maggots could be removed from these agricultural wastes and served to fish live or processed, dried and incorporated into fish feed as meal. There is Paucity of data on the effects of maggot meal protein as fish feed in tropical fish feed. The maggot meal is being evaluated in this study as a source of protein in the diet of the African catfish hybrid:- *Heteroclarias* which is popularly culture fish in Nigeria because of its remarkable fast growth rate (Aluko, 1998).

Materials and Methods

A total of 200 fingerlings of *Heteroclarias* (mean weight, 0.68±0.0006g) obtained from the hatchery of the National Institute for Freshwater Fisheries Research, New Bussa, Niger State, Nigeria. The fish were acclimatised for two weeks, and starved for 24 hours before they were placed on the experimental diets. Fish were held in glass tanks (60cm x 30cm x 30cm) at a rate of twenty fingerlings per tank with adequate aeration. Each glass tank was filled with 40 litres of filtered water.

Five diets were formulated and prepared at a desired 40% crude protein level as recommended for *heterobranchus bidorsalis* fingerlings (Fagbenro *et al*., 1992). Fishmeal in the control diet was replaced with maggot meal at 25%, 50%, 75% and 100% levels (Table 1).

Poultry droppings were obtained from a poultry farm in New Bussa, Niger State. The container was moisture with water to prevent drying and exposed for two days to allow flies to lay eggs on it. The container was covered and left for between 3 days and a week to allow maggot for be fully grown before harvesting. The harvested maggots were sundried and ground into powder, which was then used as test diets. Proximate analysis of experimental diet is presented in Table 2.

Table 1: Ingredient/gross composition of experimental diets (% dry weight).

	DIETARY INCLUSION OF MAGGOT MEAL				
Ingredients	**0% (Control)**	**25%**	**50%**	**75%**	**100%**
Fish meal	14.70	11.03	7.35	3.68	-
Maggot meal	-	3.68	7.35	11.03	14.70
Yellow maize	25.00	25.00	25.00	25.00	25.00
Soybean meal	54.10	54.10	54.10	54.10	54.10
Blood meal	4.70	4.70	4.70	4.70	4.70
Vitamin premix	0.50	0.50	0.50	0.50	0.50
Vegetable oil	1.00	1.00	1.00	1.00	1.00

Table 2: Proximate analysis of experimental diets (% dry weight basis).

% Composition	DIETARY INCLUSION OF MAGGOT				
	0% (Control)	**25%**	**50%**	**75%**	**100%**
Crude protein	41.93	41.22	40.51	39.80	39.08
Crude fat	11.44	11.23	12.65	12.48	15.63
Crude fibre	9.44	9.12	9.64	10.84	10.32
Ash	12.29	11.46	12.42	11.35	11.05
Moisture	12.10	12.04	11.85	11.05	11.34

Table 3: Summary of water quality readings from all treatments over 70 days during feeding trials.

Parameter	Minimum	Maximum	Mean±S.E.
Temperature (°C)	27.00	27.50	27.25±0.25
Dissolved oxygen (mg/L)	54.20	6.50	5.85±0.65
pH	7.40	7.90	7.65±0.25

Each treatment was in duplicate. The fish were fed twice daily at 5% body weight for 10 weeks.

Batch weighing of fish in each tank was carried out every 14 days. Feeding allowance was adjusted in accordance with the body weight. Water was partially replaced once or twice daily after each cleaning and completely changed during 14-days sampling.

Composite samples of ten whole fish were analysed for proximate composition at the start of the feeding trial and at the end of the experiment, five fish were taken from each treatment for carcass composition, using AOAC (1990) methods. Dissolved oxygen, pH and temperature followed the method described by Boyd (1981). (Summary of the water quality parameters measured during the experiment is shown in Table 3).

Results of weight gain, specific growth rate, feed conversion ratio, net protein utilization and percentage survival were pooled for each treatment computed and analysed using one-way analysis of variance (ANOVA) followed by the least significant difference (LSD) test for comparisons among means.

Results

Data on growth performance and nutrient utilization of the fish during the experiment are shown in Table 4 and 6. The fish actively consumed all rations of the diets and appeared healthy. Survival of the fish during the experiment ranged from 85.0% - 90.0% and was generally higher but could not be attributed to the inclusion levels.

Similarly no significant differences ($P>0.05$) were found between the percentage survivals. Mean weight gain (3.22g) and specific growth rate (2.20%) were significantly ($P>0.05$) highest in the fish fed diet of 75% maggot inclusion level and lowest (1.20g and 1.27%) respectively in those fed the control diet of 0% maggot inclusion level. The gross food conversion efficiency (35.71%) and protein efficiency ratio

(1.08) were significantly higher (P>0.05) in fish fed diet of 75% maggot inclusion level. Those on 25% maggot inclusion level had the least gross food conversion efficiency (22.22%) while control diet 0% maggot inclusion level had the least protein efficiency ratio (0.53%). There was no significant difference (P>0.05) in the protein efficiency ratio between the control diet, 0% maggot inclusion level and 25% maggot inclusion level.

Table 4: Growth performance of *Heteroclarias* fingerling fed maggot meal at different inclusion levels during the experimental period (70 days).

	Dietary inclusion of maggot Meal					
	0%	**25%**	**50%**	**75%**	**100%**	**Significance**
Initial weight (g)*	0.84	0.75	0.92	0.88	0.96	NS
Final weight (g)*	2.04	2.39	3.96	4.10	2.90	S
Weight gain (g)	1.20	1.64	2.94	3.22	1.94	S
Daily weight gain (g dry)	0.02	0.02	0.04	0.05	0.03	S
% weight gain	142.9	218.87	319.6	365.9	202.1	S
Total feed intake (g dry matter/fish)	5.69	6.37	8.43	9.44	7.60	S
Daily feed intake (g/dry matter/fish)	0.08	0.09	0.12	0.14	0.11	NS
SGR (% day	1.27	1.66	2.05	2.20	1.58	S

*Mean of duplicate values
N = 80 fish per treatment
NS = Not significant at 5% level
S = Significant at 5% level.

Protein intake was highest (3.78g) in fish fed diet of 75% maggot inclusion level while the lowest value (2.28g) was obtained in the control diet 0% maggot inclusion level. Protein intake was significantly different (P<0.05) in all the treatments.

The net protein utilization was highest (89.50%) in fish fed the control diet while the lowest value (55.82%) was obtained in the diet of 75% maggot inclusion level.

Carcass composition of *Heteroclarias* fingerlings fed at different maggot inclusion levels are shown in Table 6. Fish fed 75% maggot inclusion level had the highest body protein (72.32%) while the lowest value (72.00%) was obtained in the 25% maggot inclusion diet.

Table 5: Nutrient utilization of *Heteroclarias* fingerlings fed with maggot meal at varying levels of inclusion.

	Inclusion Levels					
	0%	**25%**	**50%**	**75%**	**100%**	**Significance**
Daily weight gain*	0.02	0.02	0.04	0.05	0.03	S
Daily protein intake*	0.03	0.04	0.05	0.05	0.04	S
PER	0.53	0.64	0.87	1.08	0.64	NS
Proteins gain*	2.04	1.79	2.08	2.11	1.92	NS
Daily protein gain	0.03	0.03	0.03	0.03	0.03	NS
NPU (%)	89.50	70.20	61.72	55.82	63.16	S
FCE	25.00	22.22	33.33	35.71	27.27	S
Survival rate%	90.0	87.05	92.5	90.0	85.0	NS

*Mean of duplicate values
S = Significant at 5% level
NS = Not significant at 5% level.

Table 6: Proximate composition of the fish carcass before and after feeding the diets with maggot meal at various levels of inclusion (% dry weight basis).

% Composition		**DIETARY INCLUSION OF MAGGOT MEAL**				
	Initial	**0%**	**25%**	**50%**	**75%**	**100%**
Crude protein	70.21	72.25	72.0	72.20	72.32	72.13
Crude fat	4.24	4.67	5.46	5.00	5.00	5.08
Ash	0.06	9.37	9.26	9.18	9.14	9.32
Moisture	10.10	9.70	9.00	8.95	9.21	9.18
Crude fibre	2.34	2.35	2.10	2.14	2.22	2.18

*Mean of duplicate values.

Discussion

The performance of *Heteroclarias* fingerlings when fed on maggot meal substituted diet gave significant difference ($P<0.05$) in growth performance when compared with the control diet. This is indicative of the suitability of maggot as a protein sources in the diet of this species. However, the dietary protein level in the experimental diet in this study falls within suitable levels (35% - 40%) reported by Faturoti *et al* (1986) and Dada *et al* (1999) for the culture of cat fishes.

The proximate composition of the fish carcass showed an increase in the values of crude protein, crude lipid and ash content at the end of experiment over the initial fish sample. The increase in the carcass crude protein level at the end of the experiment may be indicative of the adequacy of the protein levels of the various diets as well as the protein intake. This means that the experimental fish adequately converted and made use of protein from the food into body protein. Dada *et al*., (1999) reported that dietary protein intake resulted in an increase in fish muscle protein level. Fingerlings fed maggot-based diet demonstrated improve growth over the control diet (0% maggot inclusion level). Gierrero (1985) made similar observations with earthworm meal in tilapia diets, where the meal caused an increased in fish carcass protein concentration. Otubusin and Ifili (2000) also reported that maggot help to increase growth of fish.

Growth was best in fingerlings on diet 75% maggot meal inclusion followed by those on diet 50% maggot inclusion. Similarly, food conversion efficiency was best in fingerlings on diet 75% maggot inclusion level followed by those on 50% maggot inclusion diet. Protein efficiency ratio was not significantly different ($P<0.05$) between all the diets. The cost of producing the maggot meal based diets would be lesser than that of the control, because the maggot spare much of the quantity weight of the fish meal require, thereby reducing the cost of production.

The dissolved oxygen, pH and temperatures estimated during the experiment were within the acceptable range recommended for cat fishes (Viveen *et al*., 1986). Based on the results and the foregoing, it could be concluded that maggot meal may be used in fish (*Heteroclarias*) diets to reduce the feed cost and for optimum growth and nutrient utilization, 50-70% level of replacement of fish meal with maggot meal is recommended.

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