GROWTH RESPONSE OF *HETEROBRANCHUS LONGIFILIS* FINGERLINGS FED WITH VARYING LEVELS OF DIETARY FRESHWATER MUSSEL (*ASPATHARIA SINUATA*).

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ABSTRACT:

A common bivalve: Freshwater mussel, Aspatharia sinuata was evaluated as a dietary protein supplement in the production diet for Heterobranchus longifilis fingerlings with mean body weight 8.34±10g reared in aquaria tanks. Four diets containing fishmeal protein at a rate of 25%, 50% and 75% along with the freshwater mussel flesh were formulated. The diet without the freshwater mussel served as the control. The fish fingerlings were fed at 5% body weight per day for 56 days. It was revealed at the end of the experiment that freshwater mussel was most suitable as a protein supplement when incorporated at 25% replacement. The body weight gain, specific growth rate and feed conversion ratio values of 6.83g. 1.06%/day and 0.62 respectively were highest in diet with 25% replacement closely followed by diet with 50% replacement. Beyond 75% inclusion level there was no significant growth (P>0.05). However, complete replacement of fishmeal by freshwater mussel decreases growth rates and should not be used in Heterobranchus longifilis diets.

INTRODUCTION

The rapid growth of our nation's population which leads to the insufficiency in the supply of proteins source food had led to the tremendous efforts to improve the lack of proteinous food amongst the Nigerian populace. Fish is a typical example of animal protein source, which is the cheapest to be consumed. It has been revealed that fish contain essential amino acids such as tryptophan, methionine, etc. that the body needs. Feeding of culture fishes accounts for a substantial amount of the variable expenditure of a fish farming enterprise. Fish nutrition has become a major aspect of study and research in aquaculture system operation (Idoniboye and Ayinla; 1991).

Among the prerequisites for successful fish farming is the availability of suitable artificial feeds formulated from locally available and cheap ingredients that contains all the nutritional requirements of the fish culture (Lovell, 1989). However, fishmeal is very scarce and when available, it is usually very expensive (Eyo, 1986). The high cost and scarcity of fish meal in formulated feeds had lead to the use of other source, locally available plants and animal's protein such as freshwater mussel, periwinkle, snail, crab. lizard and frog (Guerrero, 1982, Smith *et.al.* 1988; Balogun and Ologbobo, 1989; Lim and Dominy, 1989; Falaye. 1992; Fagbenro, 1993; Akegbejo 1999).

The freshwater mussel, *Aspatharia sinuata* is a common bivalve found in many rivers and lakes of West Africa (Blay, 1986). It lies almost completely buried in mud with only its posterior from where the ventral inhalant and the dorsal exhalant siphons emerged. *Aspatharia sinuata* like most bivalves is a filter feeder and feed on suspended particles on the bottom of the water where it is found. They are commercially important shellfishes in many countries (Vakily 1992). Their tissues are used as a source of protein for humans, duck and pig.

Heterobranchus longifilis is a species of catfishes with remarkable fast growth rate (Madu and Olurebi, 1987; Ayinla *et.al*; 1994). The genus *Heterobranchus* belongs to the family

Clarridae. It is highly esteemed in Nigeria and commands very high commercial valve in our markets due to its ability to adapt readily to pond condition, fast growth rate, acceptability of artificial feed, high conversion of artificial feeds, tolerance to crowded condition and high quality of its flesh. Therefore, efforts have been made in this study to find alternative for high cost fishmeal use in fish feed preparation for the growth of *Heterobranchus* longifilis fingerlings under intensive culture system. The objective of this study is to evaluate the effects of dietary inclusion of freshwater mussel; *Aspatharia sinuata*, an important bivalve as substitutes for high cost of fishmeal protein on growth response of *Heterobranchus* longifilis fingerlings.

MATERIALS AND METHODS

Collection and processing of freshwater mussel

Freshwater mussels were harvested from Kigeria reservoir, one of the tributaries of Kainji Lake at the National Institute for Freshwater Fisheries Research (NIFFR) New Bussa, Nigeria. Samples were removed by first soaking them in hot water at 80°C for 30 minutes. The flesh was then removed from the shells using sterilized forceps of the dissecting set. The removed flesh was oven dried at 80°C for 72 hours and was finally ground into fine particles. The freshwater mussel were analysed for moisture, protein, lipid, fiber and ash, according to methods of AOAC (1990), and amino acid analysis was performed using an automatic amino acid analyzer on the principles of Moore (1963) and Spackman *et.al.* (1958).

Collection and Preparation of feedstuff

The ingredients used along with the freshwater mussel in this study include fishmeal, groundnut cake, yellow maize, rice bran, vegetable oil, vitamin premix, starch and salt. These feedstuffs were bought at New Bussa local market, grinded into fine powder by the hammer mill. The vitamin premix was added to supply vitamins and minerals, which the feedstuffs could not supply.

Proximate composition of dietary ingredients (g/100g dry matter)

The feed ingredients and experimental diets were analysed for the proximate composition as follow; Moisture content by drying in an oven at 85°C to constant weight, crude protein determined indirectly from the analysis of total nitrogen (crude protein = N x 6.55) by the Kjeldahl method (AOAC; 1990) and crude lipid was determined after soxhlet extraction of dried samples with 1.25% H_2SO_4 and 1.25% NaOH. Ash was determined from weighed samples in a porcelain crucible placed in a muffle furnace at 550°C for 6 hours as shown in Table 1.

Table 1: Proximate composition of dietary ingredients (g/100g dry mater fed to *Heterobranchus longifilis* fingerlings)

Component	Crude protein	Lipid	Crude fiber	Ash	Dry matter
Fishmeal	71.33	7.97	1.08	20.22	90.22
Freshwater mussel	24.93	2.00	9.00	32.74	90.28
Yellow maize	10.77	3.56	3.47	1.94	90.42
Rice bran	6.88	4.44	40.23	21.75	91.15
Groundnut cake	40.59	23.39	6.03	6.20	92.41

Source: (Eyo, 1994).

Experimental Diets

The feed ingredients were weighed using an electronic sensitive weighing balance; OHAUS-LS-2000 into a plastic bowl and small quantity of water was added. The moist

ingredients were made into dough and pelleted with the improvised pelleting machine. The pellets were spread under the sun until drying was accomplished. The pellets were grinded into fine particles at the beginning of the experiment for easy uptake b the fish. The weight of the feed was determined based on the total weight of the fish. Four isnitrogenous experimental diets were formulated to 40% crude protein (Table 2). The fishmeal protein in the diets was substituted at 25%, 50% and 75%. A diet without the freshwater mussel served as the control (diet I)

Experimental Fish and feeding methods

Fingerlings of *Heterobranchus longifilis* were obtained from the Genetics Improvement Laboratory of the National Institute for Freshwater Fisheries Research (NIFFR), New Bussa, and Niger State, Nigeria. The fish were climate for one week while being fed on a single diet of 35% crude protein twice daily. The feeding trial was conducted in glass aquaria (60x30x30cm). The glass tanks were thoroughly washed rinsed and filled with clean water to half of its volume and aerated using Tecax air pumps so as to ensure proper oxygenation of the fishes. Ten fish were randomly stocked into each tank with three replicates per treatments. Experimental diets were assigned randomly to the tanks and each group of fish was fed at 5% body weight per day in two equal portions between 8:00am and 6.00 pm. All fish were removed from each tank every week and batch weighed, and the amount of diet was adjusted to each tank according to the new weight.

Growth responses and nutrient utilization indices were calculated as described by Olvera-Novoa *et al.* (1990) as follows:

Mean weight gain [(MWG) (%) = (Wt-Wo)/Wo] x 100

Where: - Wt is weight of *H. longifilis* at time t;

Wo is weight of *H. longifilis* at time O

t is culture period in days.

Specific Growth Rate (SGR) (%/DAY) = 100 x In Wt-In Wo)/t

Feed Conversion Ration FCR = (dry weight of diet fed (g))/(fish weight gain).

Water Quality Parameter

Water quality was monitored at regular interval water temperature and dissolved oxygen (DO) concentration was determined weekly using Brannan thermometer and Winkler's titration method. The pH was monitored weekly using a lovibond comparator.

Statistical Analysis

Data were subjected to one-way analysis of variance (ANOVA) using SPSS

Statistical package. Duncan's multiple range tests was used to compare differences among individual means (Duncan. 1955).

Table 2: Percentage composition of the experimental diets (g/100g diets fed to *Heterobranchus longifilis* fingerlings)

Ingredients	I	II	III	IV
	0%	25%	50%	75%
Fishmeal	25	19	12 5	6
Freshwater mussel	0	6	12 5	19
Yellow maize	35	35	35	35
Rice bran	17	17	17	17
Groundnut cake	15	15	15	15
Vitamin Premix	2	2	2	2
Vegetable oil	2	2	2	2
Starch	2	2	2	2
Bone meal	1 5	1 5	1 5	1 5
Salt	0 5	0 5	0 5	0 5

RESULTS AND DISCUSSION

Mean fish growth during the experiment presented in figure 1 and survival of the fish ranged between 95% - 99%. The proximate composition of experimental diets containing freshwater mussel is shown in Table 1. Water quality during the study showed pH; (7.50), dissolved oxygen (6.70mg/l) and temperature (29.30°C) and these is presented in Table 6. These values were within the tolerable range for catfishes Viveen *et.al.* (1986).

Growth performance and nutrient utilization of *Heterobranchus longifilis* fingerlings fed experimental diets are presented in Table 5.

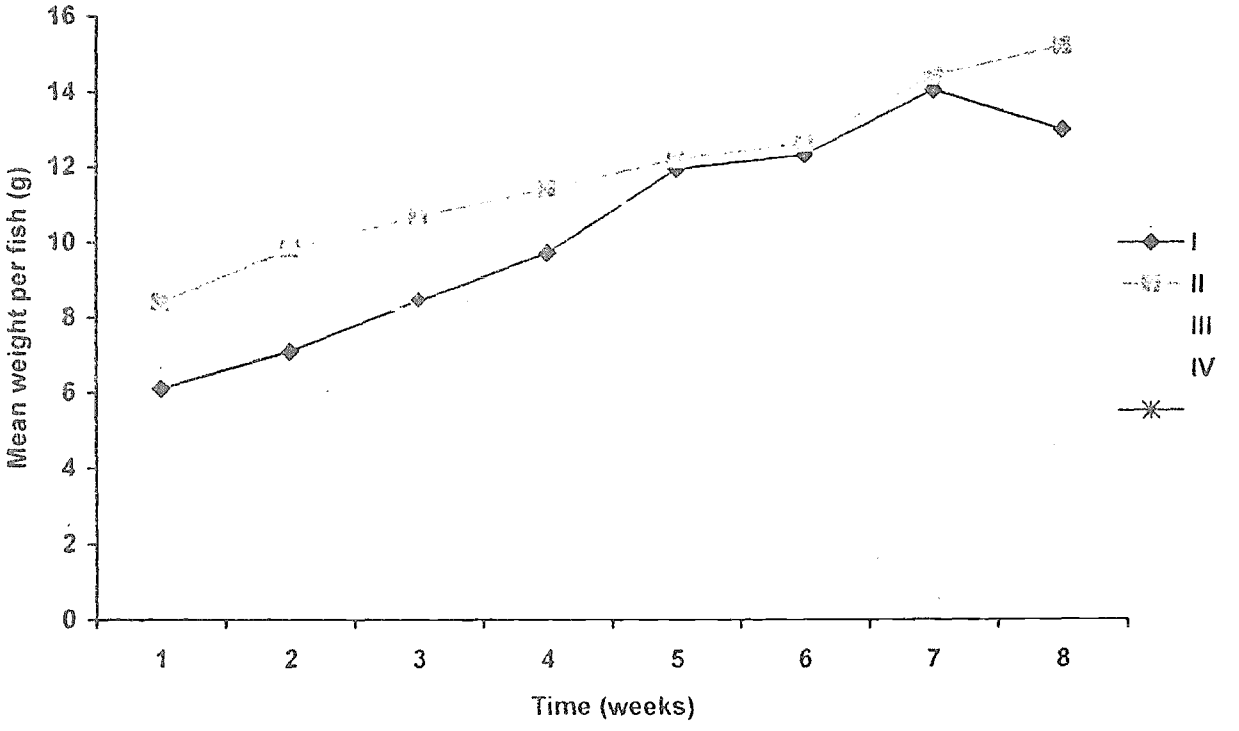

Figure 1: Mean growth *of Heterobranchus longifilis* fingerlings feed with varying of dietry freshwater mussel (*Aspatharia sinuata*)

Table 3: Mean growth of fish fed varying levels of dietary freshwater mussel for 8 weeks.

Weeks	1	2	3	4	5	6	7	8
I	6.10	7.10	8.47	9.73	11.97	12.33	14.7	13.00
II	8.40	9.83	10.70	11.43	12.23	12.63	14.43	15.23
III	9.00	9.97	10.50	11.00	11.07	11.2	10.63	10.40
IV	8.17	8.20	8.23	8.57	8.57	8.60	8.90	8.54

Table 4: Proximate composition of experimental diets for *Heterobanchus longifilis* (g/100g dry matter) containing varying inclusion levels of freshwater mussel

Parameters	DT I	DT II	DT III	DT IV
	0%	25%	50%	75%
Moisture	2.00	1.00	1.00	2.00
Crude protein	40.50	40.98	39.70	39.00
Crude lipid	9.20	9.80	9.40	9.40
Crude fiber	4.92	5.52	6.20	5.90
Ash content	13.29	12.30	12.00	11.90
N.F.E.	32.09	31.42	32.70	33.80

Table 5: Growth and food utilization of Heterobranchus longifilis fingerlings Fed diets for containing varying levels of freshwater mussel 56 days.

Growth parameters	I	II	III	IV
	0%	25%	50%	75%
Mean initial weight (g)	8.43	8.40	8.17	8.37
Mean final weight (g)	13.00	15.23	10.40	8.54
Mean weight gain (g)	4.57	6.83	2.23	0.17
Percentage weight gain (%)	54.21	81.30	27.29	2.03
Specific growth ate	0.77	1.06	0.43	0.04
Food conversion ratio	0.88	0.62	1.88	18.82
Percentage survival rate (%)	97	95	98	99

Table 6: Water Quality monitored at weekly interval during the experiment.

Weeks	1	2	3	4	5	6	7	8	Means
Water temperature (^{o}C)	30.70	29.80	29.30	29.20	28.90	28.80	28.70	28.60	29.30
Dissolved oxygen (mg/l)	6.80	6.90	6.90	7.00	7.00	6.90	6.50	6.00	6.70
Hydrogen ion concentration (pH)	7.40	7.40	7.50	7.50	7.50	7.60	7.60	7.60	7.50

The mean weight gain was highest in fish fed 25% freshwater mussel along with 75% fish meal of 7.06g (diet II) and the lowest in fish fed 75% freshwater mussel and with 25% fish meal (diet (IV). There was significant effect on the inclusion of freshwater mussel in the growth of the fish. The percentage weight gain followed a similar tend. Fish fed freshwater mussel – based diets had higher growth rates at 25% inclusion level than fish fed with the control diet. Growth of *Heterobranchus longifilis* deceased with increasing dietary levels of the freshwater mussel; Diets containing 75% of the freshwater mussel gave the lowest values for fish growth and nutrient utilization.

This study shows the inadequacy of total replacement of fishmeal with freshwater mussel at high levels of incorporation in practical diets for *Heterobranchus longifilis* fingerlings. This result agrees with El-Sayed (1992) and Almazan *et.al.* (1986) That growth of fish decreases with increasing levels of added aquatic plants ingredient. Okoye and Alatise (1999) also reported similar growth reduction and poor FCR with increasing of water hyacinth meal incorporated into the diets of *Heterobranchus longifilis* fingerlings.

The inclusion of freshwater mussel meal at 25% dietary inclusion as a replacement for fishmeal in practical diets appears suitable, particularly in a low-cost diet for *Heterobranchus longifilis*. However, complete replacement of fishmeal by freshwater mussel decreases growth rates and should not be used in *Heterobranchus longifilis* diets.

RECOMMENDATION AND CONCLUSION

This study was carried out to determine the effect of freshwater mussel, *Aspatharia sinuata* in the diets of *Heterobranchus. longifilis* fingerlings. Diet II gave the highest mean weight gain, specific growth rate as well as the best food conversion ratio.

Based on the results, it could be recommended that in practices 25:75% replacement of freshwater mussel with fishmeal in practical diet of *Heterobranchus. longifilis* fingerling is preferable. It can be concluded that a higher percentage of freshwater mussel inclusion levels is not favourable for *Heterobranchus longifilis*.

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