JASEM ISSN 1119-8362

Full-text Available Online at www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage. *September*, 2007
Vol. 11(3) 87 - 90

The effect of replacing Fish meal with 10% of Groundnut cake in the diets of *H. longifilis* on its Growth, Food conversion and Survival

OVIE SO; OVIE SI

National Institute for Freshwater Fisheries Research P.M.B.6006, New Bussa, Niger State, Nigeria.

ABSTRACT: Growth, food conversion efficiency and survival of *H. longifilis* fed diets with varying levels of protein in which 10% of fish meal was replaced with groundnut cake were studied for 84 days. Fish fed the diet containing 44.17% crude protein showed the best weight gain, specific growth rate, food conversion ratio and efficiency. There was no significant difference (P>0.05) in all the growth parameters and the survival rate of the fish. Addition of fishmeal to fish diets increases feed efficiency and growth although it is a very expensive ingredient. In northern Nigeria 1kg of fishmeal costs about five hundred Naira while its equivalent of groundnut cake is about one hundred Naira. Cost – effectiveness of diets could be improved by replacing fishmeal with more economical protein sources such as groundnut cake. @JASEM

Feeding in fish farming takes 60% of the operating cost. In formulating suitable nutritive feed for fish, fish meal is the major component. This has made the cost of growing fish over a period of time to be very high. In order to seek for alternative to fish meal suitable plant protein has been investigated over the years (Lim and Dominy 1990; Shiau et al 1990). Fish meal forms the major protein source in fish feed because of its high nutritive value and palatability. Studies have shown that high levels of plant protein in fish diets or complete substitution of animal proteins has resulted in poor growth and feed efficiency in feed (Dabrowski et al 1989; Lim 1992). Poor growth in such studies have been attributed to anti nutritional factors or toxic substances; improper balance of essential nutrients such as amino acids, energy and minerals, high amount of fibre and carbohydrate, decrease in palatability of the feed; and reduction of pellet quality especially water stability (Lim and Dominy 1989). Fish require a well – balanced mixture of essential and non essential amino acids. The most effective, economical source of these amino acids is a proper combination of high quality natural proteins in feedstuffs. A protein that is deficient in one or more essential amino acids is of low biological value while that which closely matches that required by the fish is of high nutritive value (Lim and Dominy 1989). In groundnut cake the sulphur containing amino acids (methionine + cystine) are the most deficient followed by lysine. Groundnut cake is said to be highly palatable and has better binding properties for pelleting than soybeans (Lovell, 1989) According to Jackson et al (1982) groundnut cake can replace 25% of fish meal in the diet of S. *mossambicus* at higher levels growth rate decreased rapidly. Combining groundnut cake with fish meal which is rich in methionine and lysine will go a long way to produce a highly nutritive feed. This study sets out to investigate the effect of the substitution of fish meal in the diet with 10% of groundnut cake on the growth, food conversion and survival of *H. longifilis*.

MATERIALS AND METHODS

Fingerling *H. longifilis* of mean weight 14.83 ± 0.64g were stocked in 26.4 litre of water in plastic troughs of 25cm in depth and 55cm diameter. The experiment consisted of 18 troughs in a mini – flow through system. Each trough was supplied with an outlet pipe which was covered with a sleeve borne with holes for overflow. A rubber hose of 2mm diameter served as the water inlet pipe. The hose is connected to a tap linked to overhead tank which gets water from a biological sedimentation tank. Water is sprinkled into each trough through tiny holes borne on the hose at every plastic trough. The flow – through was run for 15 hours daily. Sampling was carried out by bulk weighing biweekly. Feeding rates were adjusted after sampling. The flow – through system does not remove all faecal materials and feed remnants and so cleaning was done daily by siphoning. Total exchange of water was done on sampling days. Some water quality parameters were monitored during the period. They include temperature, pH, dissolved oxygen and conductivity. The formulation and proximate composition of experimental diets are shown in Table 1. Feeding was done at 10% body weight twice daily for 84 days.

Food conversion ratio (FCR) and Gross conversion efficiency (GCE), Specific growth rate (SGR) and condition factor (K) were derived using the following: *FCR* = Food Eaten ÷ Weight Gain; *GCE* = (*SGR* ÷ Ration) × 100 (Priede and Secombe, 1988); *SGR* = 100 × (ln Final mean weight – ln initial mean weight) ÷ time (days)

$K = (W \div L^3) \times 100$

Where W is weight in g and L is length in cm.

Statistical analysis was carried out using the computer package of SPSS version 10 to derive the regression coefficient, correlation between length and

*Correspondence: *E-mail stella_ovie@yahoo.com*

weight. The test for significance was done using Fishers' LSD.

At the beginning a sample and at the end of the experiment 5 fingerlings were collected from each of the treatments for proximate carcass composition using the method described in AOAC (1990). Some water quality parameters, temperature, pH, dissolved oxygen and conductivity were taken weekly using standard methods (APHA 1980).

Table 1: Proximate composition of the formulated diet

Ingredients (%)	DIET I	DIET II	DIET III	DIET IV	DIET V	DIET VI
Fish meal	20.17	27.49	34.81	42.13	49.45	56.77
Groundnut Cake	10.00	10.00	10.00	10.00	10.00	10.00
Guinea corn	67.83	60.51	53.19	64.12	55.15	31.23
Premix	2.00	2.00	2.00	2.00	2.00	2.00
Proximate Analysis						
Moisture	8.35	8.85	6.15	6.70	5.20	10.30
Crude protein	24.09	30.16	34.89	40.39	44.17	50.75
Lipid	9.55	2.80	15.50	12.90	15.95	2.55
Crude fibre	2.00	1.70	1.90	2.80	2.60	3.50
Ash	5.40	7.52	6.87	8.08	5.60	5.96
Total carbohydrate	52.61	50.67	36.59	31.93	39.08	30.43

Vit. A I.U. 4000.00 20,000.00 Biotin mg 160.00 0.80 Iron mg 8000.00 40.00
Vit. D3 I.U. 400,000.00 2000.00 Niacin mg 30,000 150.00 Iodine mg 1000.00 40.00
Vit. C mg 40,000.00 200.00 Vit. B12 mg 10.00 0.05 Manganese mg 6000.00 30.00
Vit. K mg 16,000.00 8.00 Folic acid mg 800.00 4.00 Copper mg 800.00 4.00
Vit. B1 mg 4000.00 20.00 Vit. C mg 100.00 500.00 Zinc mg 800.00 40.00
Vit.B2 mg 6000.00 20.00 Chloride mg 120.00 600.00 Selenium mg 40.00 0.20
Vit. B6 mg 2400 12.00 Inositol mg 40.00 200.00 Methionine mg 20,000 100.00
Pantotenic acid mg 10,000 60.00 Cobalt mg 400.00 200.00 Anti-oxidant mg 20,000 100.00

RESULTS AND DISCUSSION

No significant differences were observed in the MIW, MFW, FCR, SGR, GCE, K and PS of *H. longifilis* fed the varying diets (P>0.05) (Table 2). Diet V was best utilized while diet I had the poorest nutrient utilization values. The scattered graph shoed a highly positively correlated length/weight relationship (r^2 = 0.915). The correlation was significant at 0.05. The correlation coefficient r^2 = 0.838. The equation for the graph was

Y = -14.19 + 12.51X.

The K ranged from 1.65 for diet IV to 3.76 for diet II. The body condition factor (K) was best for fish fed 30.16% crude protein followed by that fed 50.75% crude protein. The fish fed 40.39% crude protein had the poorest body condition. The proximate analysis shows that the moisture content, protein content, lipid and ash differ significantly (P<0.05) although the crude fibre content did not vary significantly (P>0.05) (Table 3).

Table 2: Growth performance, Food conversion and Survival of *H. longifilis* for 84 days

Diets/ Parameters	Diet I	Diet II	Diet III	Diet IV	Diet V	Diet VI
Initial weight(g)	15.83 ±0.6	14.07 ±0.5	14.7 ±1.23	15.33 ±1.4	14.43 ±1.16	14.6 ±1.5
Final weight(g)	28.47 ±13.42	43.93 ±11.86	40.53 ±1.98	50.50 ±16.15	58.10 ±12.79	46.13 ±9.29
Weight gain(g)	12.64	29.86	25.83	35.17	43.67	31.53
Initial length(cm)	3.50	3.50	4.00	5.20	5.20	3.80
Final length(cm)	3.70	4.60	4.50	5.50	5.60	4.30
K	3.26	3.76	2.52	1.42	1.67	1.37
SGR	0.70	1.36	1.20	1.42	1.67	1.37
FCR	12.55 ±4.75	8.73 ±2.91	8.44 ±1.49	8.89 ±3.10	6.59 ±1.29	8.74 ±1.24
GCE	0.37	1.59	0.55	0.51	0.60	0.51
PS	69.33 ±32.08	65.33 ±6.11	70.67 ±6.11	73.33 ±16.65	66.67 ±9.24	68.00 ±10.58

The fish fed diet V showed the best growth and food conversion. This feed which contained 44.17% crude protein has a protein level very close to the requirement observed in Ovie (2003), 45.36% for *H. longifilis,* Eyo (1995), 45% and for hybrid *H. longifilis* , Olufeagba (1999), 45%. The replacement of 10% fish meal in this diet did not have an outstanding change on the protein requirement of the fish. According to Lim and Dominy (1989) the ability of fish to utilize plant proteins differ among fish species. The inclusion of high levels of plant protein usually results in reduced growth and feed efficiency. Ten percent inclusion of groundnut cake in this study seems to be favourable in the diet of *H. longifilis*. The fish with the poorest growth was fed diet I, although the level of replacement of fish meal in this diet was the same as the fish with the best growth, growth relied highly on the total level of protein. According to Lim and Dominy (1989), protein requirement of warm water fishes range from 30% to 56%. The crude protein level of diet I falls below this and hence the poor performance. Food conversion ratio and gross conversion efficiency were best with diet V. In each case the FCR and GCE did not vary significantly for fish fed the varying levels of protein. The FCR for all treatments were generally high being 6.59:1 for the best. In aquaculture a feed with FCR of 1:1 and 1:2 (Huet 1972) are considered very efficient but in this study none fell within these acceptable ratios. The poor conversion may be attributed to the feeding management, culture system, experimental condition, water management, improper balance of amino acids, high carbohydrates and decrease in palatability or reduction in pellet quality. The poor conversion may also be attributed to the low lysine. Although methionine and lysine are low in groundnut cake the incorporation of methionine through the premixes may have made up for the low level while lysine remains low. The condition factor in the feeding trials were all greater than 1 indicating that the fish in all the treatments were in good condition and feeding well. The results of the body composition in this experiment showed the moisture content of the fish did not vary significantly from the initial. The protein content of fish fed diets III and VI were lower than the initial. The fish fed diet I had the highest protein content followed by the fish fed diet V. The fish fed diet III had the highest lipid content while fish fed diet V had the least which was not different from the initial. The ash content of the fish fed varying diets was higher than the initial. The crude fibre content was high with fish fed diet II which was not different from the initial.

Table 3: Proximate body composition of *H. longifilis* fed varying levels of protein

Diets/ Parameters	Initial	Diet I	Diet II	Diet III	Diet IV	Diet V	Diet VI
Moisture (%)	81.20	76.80	82.20	80.95	76.45	74.65	78.30
Protein (%)	13.75	16.34	14.56	12.83	15.26	16.25	11.70
Lipid (%)	2.70	3.85	4.10	6.45	3.20	2.60	3.25
Ash (%)	1.55	2.75	1.80	2.00	2.80	2.80	2.79
Crude fibre (%)	0.90	0.90	0.80	1.00	1.20	1.40	6.00

The fish fed diet IV had the highest percentage survival while that fed diet II had the lowest percentage survival. There was no significant difference in the survival of the fish in all treatments. The mortalities experienced in the experiment may not be diet related as the fish with the poorest growth and that with the best growth had survival rates that are not significantly different from one another. The results of this study show that 10% replacement of fish meal in *H. longifilis* diet can be efficiently utilized for production of the fish. The palatability, the binding property for good pelleting quality and the non availability of anti-nutritional factor in groundnut cake gives it an advantage over other plant proteins for fish food formulation.

AcknowledgemenT: The authors are thankful to the Federal Government of Nigeria for providing fund to undertake this study.

REFERENCES

AOAC (1990). Official methods of analysis (15th edtion). Association of Official Analytical Chemists, Virginia. 1298pp.

A.P.H.A (1980). Standard methods for analysis of water and waste water. The American Public Health Association. 1270pp.

Dabrowski, K; Poczyczynski, P; Kock G; Berger B (1989). Effect of partially or totally replacing fish meal protein by soybean meal protein on growth, food utilization and proteolytic enzymes activities in

rainbow trout (*Salmo gairdneri*). New in vivo test for exocrine pancreatic secretions. Aquaculture 77: 29-49.

Eyo, AA (1995). Dietary protein requirement of *Heterobranchus longifilis*. National Institute for Freshwater Fisheries Research (N.I.F.F.R.) Annual Report. pp118-125

Huet, M. (1972). Textbook of fish culture . Breeding and cultivation of fish. Fishing News Books Ltd. Farnham, Surrey England

Jackson, AJ; Capper BS; Matty AJ (1982). Evaluation of some plant protein in complete diets for the tilapia *Sarotherodon mossambicus*. Aquaculture 27: 97-109

Lim, C (1992). Fullfat soybean meal utilization by fish. Asian Fisheries Science 5: 181-187

Lim, C; Dominy W (1989). Utilization of plant proteins by warm water fish Proceedings of world congress on Vegetable Protein Utilization in human food and animal feedstuffs: 2445-251. American Oil Chemists Society, Champaign, Illinois

Lim, C; Dominy W (1990). Evaluation soybean meal as a replacement for marine animal protein in diet for shrimps (*Penaeus vannamei*). Aquaculture 86:401-407

Lovell, RT (1989). Fish Nutrition and Feeding. Van Nostrand Reinhold Co., New York, NY

Olufeagba, SO. (1999). Induced triploid *Heterobrachus longifilis* and its aquaculture potentials Val. 1840 (Family Clariidae) Ph. D Thesis submitted to biological Science Dept. University of Ilorin. p 63.

Ovie, SO. (2003). Macro-nutrient requirements of the African mudfish, *H. longifilis*. Ph.D Thesis submitted to School of Agriculture and Agricultural Technology, Fisheries Dept. Federal University of Technology, Minna, Nigeria

Priede IG. and Secombe CJ. (1988). The biology of fish production. In: Salmon and Trout Farming (ed by L.Laird and T. Needham), pp. 32-67. Ellis Horwood Limited, Chichester.

Shiau, SY;.Lan, SF; Yu, SL; Lin AL; Kwok, CC (1990). Defatted and fullfat soybean meal as partial replacements for fishmeal in tilapia (*Oreochromis niloticus* x *Oreochromis aureus* diets at low protein level. Aquaculture 86:401-407