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THE EFFECT OF DIFFERENT PROTEIN SOURCES IN SUPPLEMENTARY FEEDS ON TILAPIA *(OREOCHROMIS NILOTICUS)* IN FLOATING NET-CAGES

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Target Audience: Fish farmers, feed millers, fish nutritionists, groundnut farmers/oil millers, slaughter houses

ABSTRACT

The effect of locally available protein sources including fish meal (FM), soyabean meal (SBM), groundnut cake (GNC), and blood meal (BM)) at 25% inclusion level in pelleted feeds (layer's concentrate/corn bran in ratio 1:3, and premix 1.0%) were tested on tilapia (*Oreochromis niloticus*) in floating net-cages. *O. niloticus* fingerlings with mean weight, of 20.0g±0.84, were stocked at 50 fish/m^3 and fed the different feeds at 5% body weight for a 120-day culture period.

GNC in feed (28.02% crude protein, CP) performed best in terms of daily weight gain, final average weight/fish, feed conversion ratio (FCR), specific growth rate (SGR) and total fish production; closely followed by BM in feed (40.28% CP) but worst performance was in fish fed FM in feed (33.27%CP). The mean total fish production (kg/m^3) in treatment receiving GNC in feed was significantly different from mean total fish production in all the remaining three treatments (P<0.05)

Key words: Tilapia production, protein sources in feeds, net-cages

DESCRIPTION OF PROBLEM

Weatherly and Cogger (1) had identified cost of protein in culture diets as a principal obstacle in culture of fish wherein intensive feeding using formulated feed is necessary.

In a systematic study using agro-industrial by-products for the formulation of practical feeds for fish production in fish cage culture systems, Otubusin and Onyeabo (2) concluded that feed containing 74% cornbran + 1% premix + 25% fish meal performed best in the production of tilapia fingerlings in floating net-hapas. Since fish meal is keenly competed for by humans aside from the cost, feeding fish to fish especially under a large scale commercial intensive aquaculture systems could be uneconomical. The objective of this experiment, therefore, was to determine the effect of some other readily available local protein sources like soyabean meal, blood meal and groundnut cake in supplementary feeds on fish production in floating net-cages.

MATERIALS AND METHODS

A commercial feed (with soyabean meal as the major protein source) and three other feeds with different protein sources were tested. The composition of the feeds is shown in Table1.

Table 1.Composition of four feed formulations fed to *O. niloticus* in floating net-cages

Ingredient	a Feed (%)			
	I	II	III	IV
Blood meal	-	25.0	-	-
Fish meal	-	-	25.0	-
Groundnut cake	-	-	-	25.0
[b]Layer's concentrate/Corn bran (in ratio 1:3)	-	74.0	74.0	74.0
[c]Premix	-	1.0	1.0	1.0

a Feed I is a commercial feed composed of 34% SBM, 37% PKM, 26% CMC and 1% CO. Where

SBM - Soyabean meal
PKM - Palm kernel meal
WB - Wheat bran
CO - Chromic oxide

B The Layer's concentrate is a product of Bendel Feed Flour Mill Limited, Benin City, Nigeria. It is composed of fish meal, animal protein, groundnut cake, wheat bran, lime stone, minerals, vitamins antioxidants and preservatives. Its nutrients analysisi was given as: Crude protein, 26.2%; Crude fat 4.0%: Crude fibre, 5.7%; Calcium; 9.4% Phosphorous, 1.3%; Metabolizable energy, 1812 UE/kg.

c. Premix used in poultry feed manufacture contains antioxidant, selenium, iodine, copper, iron, manganese, choline, chloride, methionine, lysine, riboflavin, vitamins A, D_3, E, B_3 and B_5.

The commercial feed was bought from the manufacturer (Nigerian Institute for Oceanography and Marine Research, Lagos, Nigeria). The proximate analysis of the four feeds is presented in Table 2. The treatments I, II, III and IV correspond to feeds I, II, III and IV respectively. The treatments were assigned to net-cages (1m x 1m x 1.5m, with hapa netting at the bottom to retain feed) using a completely randomized design and each treatment was replicated twice. *O. niloticus* (tilapia) fingerlings with mean weight of 20.0g ± 0.84 were stocked at the rate of 50 fish/m^3 early morning (07.00h).

The fish were fed with pelleted feeds corresponding to their treatments at the rate of 5% body weight. Ten percent 10% of the stock was sampled for growth and feed ration was adjusted monthly based on estimated biomass obtained from the sampling exercise. Some physicochemical parameters viz: temperature, dissolved, oxygen, pH and conductivity of the water (reservoir) around the floating cage area were monitored weekly during the culture period (Table 3). The fish were harvested after 120 days culture period.

Table 2 Proximate analysis of the four feeds used.

Feed	Crude Protein	P	K	Ca	Mg	Mn	Na	Fe	Ash	Moist-ure
1. Commercial feed (Soyabean meal protein source)	24.52	0.07	0.08	0.04	0.03	0	0.01	0.02	8.0	5.30
II. Blood meal in feed	40.28	0.06	0.28	0.17	0.01	0	0.01	0.05	9.9	5.10
III. Fish meal in Feed	33.27	0.09	0.05	0.22	0.02	0	0.03	0.02	11.8	6.65
IV Groundnut Cake in feed	28.02	0,05	0.04	0.13	0.02	0	0.01	0.02	8.9	8.30

NB All figures expressed in percentages except for Mn (in ppm)

Table 3. Range and mean of some physico-chemical parameters in the freshwater reservoir during the feeding experiment.

Parameters	Range			Mean
Temperature (°C):				
Water	26.0	-	29.0	27.5
Air	29.0	-	31.0	30.0
D.O (ppm)	2.40		4.50	4.45
pH	7.0	-	7.4	7.2
Conductivity (µmhos/cm)	200	-	350	275

RESULTS AND DISCUSSION

The summary of the results and other related data obtained from the experiment are shown in Table 4. The highest mean survival rate of 75.0% was recorded in treatment I. followed closely by 73.0% in treatment II. 68.0% in treatment IV and least 63.0% in treatment III. Figure I shows the growth curves of the fish receiving the pelleted feeds (I to IV) in floating net-cages. The mean daily weight gain per fish were 0.79. 0.65. 0.53 and 0.37g/day in

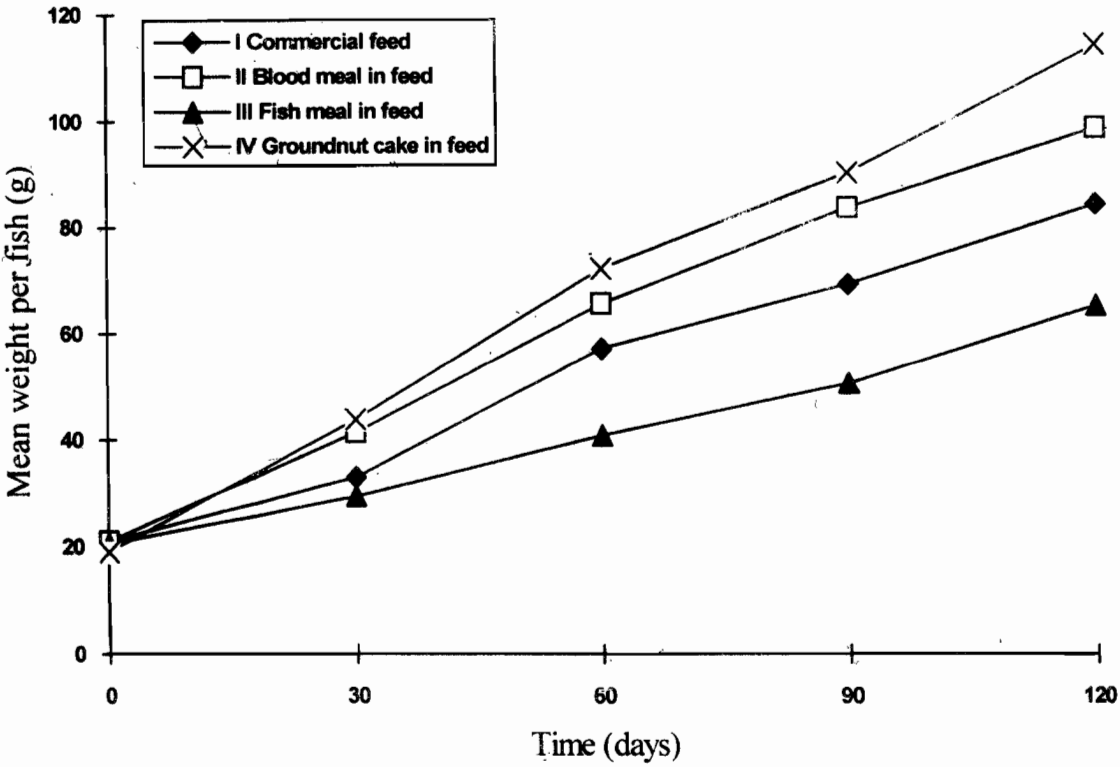

Fig. 1. Growth curves of *Oreochromis niloticus* fed different protein sources in cages for 120 days

treatments IV, II, I and III respectively (Table 4). A critical analysis of the values of mean final weight, daily weight gain, feed conversion ratio and total fish production (Table 4) showed that the performance of the fish on the diets in descending order were treatment IV (groundnut cake) > treatment II (blood meal) > treatment I (soyabean meal) > treatment III (fish meal). The feed (28.02% CP) containing groundnut cake as a major protein source used in treatment IV gave the highest daily weight gain (0.79g/d), highest final average weight/fish (113.8g), best FCR, (1.12), best SGR (0.65%/day) and highest total fish production (kg/m^3) 3.869. These observations corroborate the report by ADCP (3) that 27% protein feed was suitable for intensive culture of tilapia. The growth rate (0.79/d) using groundnut cake based feed compared very well with growth rate, 0.73g/day obtained by Ishak and Hassanen (4) feeding 29.0% crude protein (CP) feed to *O.niloticus* in cages for 120 days in Egypt. The efficiency of groundnut cake as a protein source in fish feed was further confirmed by FAO (5) which reported that in India it was demonstrated that diets containing 50% groundnut cake as principal protein source could be used as complete feeds for carp. In Nigeria, groundnut cake has successfully been used as a major supplemental feed in pond for catfish, *Chrysichthys nigrodigitatus* (6). Ezenwa (6) reported that without feed, catfish had a 114.1% gain in weight, and those given groundnut cake supplemental feed had a 858.1% gain in weight.

Table 4 Summary of results of *Oreochromis niloticus* receiving different protein sources in pelleted feeds in floating net-cages for 120 days

Treatment	Average Wt (g) Initial	Final	Average daily wt. gain (g/day)	FCR	Survival Rate %	SGR (% d)
I	21.0	87.0	0.55	1.51	70.0	0.51
Commercial	21.0	81.0	0.51	1.42	80.0	0.49
feed	21.0	84.0[a]	0.53[a]	1.47[a]	75.0[a]	0.50
II	21.0	93.0	0.60	1.33	84.0	0.54
Blood meal in	21.0	103.8	0.69	1.31	62.0	0.58
feed	21.0	98.4[b]	0.65[b]	1.32[b]	73.0[a]	0.56
III	20.0	64.2	0.36	1.86	72.0	0.40
Fish meal in	21.0	65.6	0.38	1.86	54.0	0.43
feed	20.5	64.9[c]	0.37[c]	1.86[c]	63.0[a]	0.42
IV	19.0	113.8	0.79	1.14	76.0	0.65
Groundnut cake	19.0	113.8	0.79	1.09	60.0	0.65
in feed	19.0	113.8[d]	0.79[d]	1.12[d]	68.0[a]	0.65

Mean in a column with the same superscript are not significantly different at 5 % DMRT.

The superiority of the feed containing 25% groundnut cake was further confirmed in an aquarium experiment reported by Otubusin *et al.* (7) for *O. niloticus* fry for a period of 43 days. They observed the best performance in the treatment using groundnut cake-based feed thus: average final weight, 2.288g; average daily weight gain, 0.041g/d; FCR, 1.42. The Feed Conversion Ratio (FCR) 1.12 recorded in the net-cage experiment for groundnut cake-based

feed was obviously lower than that of the aquarium experiment because the fish in the net-cage in addition to the supplemental feed given also benefited from the natural food in the culture medium.

The second best performance was recorded for fish under the blood meal-in-feed treatment. average final weight. 98.4g ± 0.75. average daily weight gain. 0.65g/d: FCR. 1.32. and total fish production. 3.562kg/m^3. despite the fact that this feed had the highest crude protein content (40.28%). This confirms the observation of Cullison (8) that protein fed in excess of an animal's needs is deaminated and does not contribute to growth.

The feed (33.27% CP) in the treatment with fish meal as the major protein source surprinsingly recorded the least growth rate. 0.37g/d; least average final weight. 64.9g; poorest FCR. 1.86: least SGR. 0.42% per day and least total fish production. 2.041kg/m^3 despite the generally reported efficiency of fish meal as a *sine qua non* in fish feed formulation and the higher crude protein (33.27%) and higher minerals contents (i.e.P. K. Ca. Na and Fe) than in groundnut cake feed (Table 2). However the plant protein source. groundnut cake in feed seemed to have met the protein and minerals requirments of the planktivorous fish (tilapia) under culture in the net-cages. The water environment obviously contributed substantially to the mineral and protein requirements of the fish under culture.

Considering the cost (as at January. 2000) of the protein sources in the feeds used in this experiment: fish meal (FM). toasted soyabean meal (SBM). groundnut cake (GNC) and blood meal (BM) which were N70.00. N50.00. N40.00 and N26.00 per kg respectively in addition to the performances of the feeds. GNC in feed and BM (at 25% optimal inclusion) are recommended for tilapia rearing in the net-cages system. It is note worthy that blood meal has long been recognised as a valuable feed. and a rich source of essential amino acids for pigs and poultry. and that Crawshaw (9) reported that globally. the potential yield of bloodmeal was in excess of 1.7 million tonnes per year. F.A.O (5) reported that in Nigeria. from an annual groundnut crop of 620.000 tons. more than 388.000 tons of groundnut cake (63% of the crop) could be made available if all the seeds were crushed for oil.

CONCLUSION AND APPLICATIONS

1. Depending on ready availability. GNC or BM (at 25% inclusion in pelleted feed) are recommended for intensive tilapia production in floating net-cages.
2. Like cotton seed in Egypt. groundnut cake can become a cheap (at least as equally cheap as blood meal) principal protein source for poultry and fish feeds in Nigeria based on this study.
3. Since Nigeria has large reserves of petroleum or natural gas. it is also recommended that the possibility of large scale production of single cell protein from these natural resources be exploited.

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