EFFECTS OF FISH-MEAL, COW BLOOD-MEAL AND SORGHUM DIETS ON FOOD UTILIZATION AND GROWTH OF CAGE CULTURED *Sarotherodon niloticus*

by

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ABSTRACT

The growth responses and feed utilization of *Sarotherodon niloticus* held in metal cages in a pond and fed diets containing fish-meal, cow blood-meal or sorghum was studied. Results indicate that the best growth, feed conversion and protein effeciency ratio were obtained with the diet containing 60% fish-meal. The growth performance of fish on 40% fish-meal, and 40% and 60% blood meal were not significatly different ($P < 0.05$), and were quite close to the performance with 60% fish-meal. The growth and food utilization of fish on 84% sorghum diet was significantly ($P < 0.05$) lower than the rest. The Caged fish without supplemental feeding had a slight gain in weight. All fish with supplemental feeding appeared healthy. It is concluded that cow blood meal at 40% or 60% inclusion in diet can adequately replace fish-meal in *S.niloticus* supplemental diet in pond culture.

INTRODUCTION

Though Nigeria is the sixth greatest oil producer of the World, and is regarded as a rich country, there is insufficient protein in the food of many Nigerians. In 1975, a total of about three hundred thousand metric tonnes of fish were imported and the nation spent approximately ₦99m in foreign exchange in the fisheries sector alone that year. Despite the abundance of fresh, brackish and salt water in Nigeria, scarcity of fish feed has been observed to be a great hindrance to the development of intensive fish culture, (Ezenwa, 1979). Warm water fish such as carp has been shown to be able to efficiently metabolise up to 45% of crude carbohydrate in isonitrogenous diets (Ufodike & Matty, 1983). Fish meal may be regarded as the traditional source of dietary protein in fish feed. However, in Nigeria, even "thrash" fish for the manufacture of fishmeal could be expensive while blood from cow is usually discarded at slaughter houses.

The intensive culture of *S.niloticus* in Nigeria has been unencouraging mainly because the fish is highly prolific and hence tend to overcrowd ponds and to be stunted. To salvage this situation, cage culture has been tried in different parts of the world and recently in Lake Kainji in Nigeria, (Coche, 1976). The major problem in cage culture is food losses and silting up of cage net. This experiment was therefore designed to study comparatively nutrient utilization and growth performance of *S. niloticus* held in cages in a fish pond when fed diets containing fish meal, cow blood meal and sorghum meal. The group of fish fed only sorghum meal and the group that had no supplemental feeding served as controls.

MATERIALS AND METHODS

Thrash fish from Nigerian continental shelf in Lagos area and coagulated cow blood from government abattoir in Jos were cooked and oven dried at 105°C for 24 hours, milled and used for the diet formulation. Sorghum purchased from the open market in Jos was equally milled and used for formulating the diets (Table 1). The diets were analysed for proximate Composition using slight modifications of AOAC methods (AOAC, 1980; Ugwuzor, 1982). Nitrogen free extract (NFE) was computed by difference (Table 2). Diets were stored in sealed polythene bags at 20°C in a deep freezer till used.

Four metal cages were constructed with tubular frames and metal net of 2mm mesh size. Each cage had two compartments each of which measured 45cm x 60cm x 80cm. Cages were coated with white oil paint. Three quarters of the 80cm axis of the cages were submerged in a fish pond at Federal Government Girls College (F.G.G.C) Buachi, the pond having been originally dried, cleaned and refilled three months before the experiment. Cages were held in position with cables attached to metal supporting poles, one end of each pole being anchored into the floor of the pond.

Ninety fingerling Sarotherodon niloticus collected from Panyam fish farm near Jos were quarantined in the Fisheries and Hydrobiology Research Unit of Jos University, (Ugwuzor, 1982). Ten fish were analysed for proximate tissue composition while eighty were anesthetised using benzocaine, tagged, weighed and stocked at ten fish per cage compartment. Fish in cage 1 through 7 were fed diets 1 to 7 respectively at a total of 2% of their body weight daily at 9. am and 5 pm. Fish were weighed every ten days while under the effect of anesthesia. On the 70th day, a random sample of five fish per tank were taken for proximate tissue assay.

Water quality parameters were monitored every ten days throughout the experimental period (Table 3). Analysis of variance (ANOVAR) was done using Duncan's multiple range F-test at 5% level of singificance (Duncan, 1955).

Table 1:- Composition of diets fed to caged S. niloticus (g.%)

Ingredients	Diets						
	1	2	3	4	5	6	7
Fish meal	-	20	40	60	-	-	-
Blood meal	-	-	-	-	20	40	60
Sorghum	84	64	44	24	64	44	24
Vitamin mix[1]	2	2	2	2	2	2	2
Mineral mix[1]	4	4	4	4	4	4	4
Cod-liver oil	2	2	2	2	2	2	2
Corn oil	6	6	6	6	6	6	6
Cellulose (binder)	2	2	2	2	2	2	2
TOTALS	100	100	100	100	100	100	100

[1]Composition as in Ufodike & Matty (1983).

Table 2:- Proximate, composition of S. niloticus diets from biochemical assay (% weight)

Ingredients	Diets						
	1	2	3	4	5	6	7
Moisture	9.21	8.50	9.11	9.13	9.80	10.61	10.00
Protein	9.65	20.47	36.30	44.24	19.80	34.95	42.97
Fat	11.10	9.57	11.81	11.89	8.24	8.68	3.75
Ash	6.45	7.47	9.10	10.35	3.51	3.68	3.75
Sub-totals	36.41	46.01	66.32	75.61	41.35	57.92	66.17
NFE[1]	63.59	53.99	33.68	24.39	58.65	42.08	33.83

[1]Nitrogen free extract: Computed as difference between subtotal and 100.

Table 3:- Mean water quality monitored every 10 days during the experimental period

Days	Dissolved O_2 (mg/1)	Free Co_2 (mg/1)	Water temperature (°C)	Turbidity (m)
0	4.10^{a}	4.30^{a}	29.00^{c}	1.28^{bc}
10	5.05^{a}	4.33^{a}	29.30^{c}	0.83^{a}
20	5.15^{a}	4.61^{a}	28.60^{bc}	0.94^{ab}
30	5.10^{a}	4.67^{a}	29.00^{c}	0.68^{a}
40	5.55^{a}	4.79^{a}	27.60^{ab}	0.70^{a}
50	5.75^{a}	5.65^{a}	26.85^{a}	1.15^{b}
60	6.05^{a}	5.10^{a}	26.60^{a}	1.46^{c}
70	8.40^{b}	4.84^{a}	26.89^{a}	1.23^{bc}
±SEM	0.65	0.51	0.49	0.08

Figures in the same column having the same superscript are not significantly different (P 0.05).

RESULTS AND DISCUSSION

The best growth was obtained in fish on diet 4 (60% fish meal). However, no significant difference ($P > 0.05$) was obtained in the Mean Growth Rate (MGR) of fish on diets 3. 5 and 6. Poor growth was manifested in fish receiving no animal protein supplement (group 1) (Figures 1 and 2).

The best Food Conversion Ratio (FCR) was obtained with diet 4. There was no significant difference ($P > 0.05$) between the FCR of groups 3, 5, 6 and 7 Table 4). FCR of groups 1 and 2 which were not significantly different ($P > 0.05$) were the poorest. Protein Efficiency Ratio (PER) increased with increase in percentage protein, with diet 4 having the highest PER. Some feed utilization parameters could not be computed for fish in cage 8. This was because the amount of food consumed by this group could not be determined. However, because of the small mesh size of the cages, influx of large planktons was obviated. This group had marginal but fluctuating weight changes (Figure 1) and a mean weight increase of 4.66% (Table 4).

From these results, the 60% fish meal diet resulted in only slightly better fish growth and feed utilization than the 40% and 60% blood meal diets. Variations in water quality (Table 3) was within the tolerance range for warm water fishes. However, the sharp rise in the oxygen content of the water in the last 20 days and the corresponding drop in water temperature probably contributed to the faster growth during this period (Figs. 1 & 2).

Attempts to spare dietary protein using cheap carbohydrate sources have been quite successful especially in recent times (Ufodike & Matty, 1983). In this attempt however, the quantity of fish meal in diet was not reduced. From this present investigation, it is obvious that though fishmeal diets might be more palatable to fish and resulted in better growth, blood meal at 40% or 60% inclusion in diet could be an adequate substitute. In view of the cost differences between these two protein sources, which has been discussed earlier, it is recommended that blood meal rather than fishmeal be used in the formulation of S.niloticus supplemental diets.

Table 4:- Food utilization of caged *S. niloticus* fed for 70 days on differen diets

Cages	1	2	3	4	5	6	7	8	$\pm$ SEM
Initial weight (g)	43.12^{a}	42.06^{a}	43.22^{a}	43.17^{a}	43.24^{a}	42.82^{a}	42.35^{a}	43.11^{a}	0.89
Final weight (g)	55.90^{b}	56.40^{b}	61.10^{c}	75.80^{d}	59.50^{c}	60.09^{c}	61.79^{c}	45.12^{a}	1.01
Weight gain (%)	32.93^{b}	34.09^{b}	41.37^{d}	75.58^{e}	37.60^{c}	40.33^{d}	45.90^{d}	4.66^{a}	1.04
MGR^{1}	4.03^{b}	4.16^{b}	4.91^{c}	6.37^{e}	4.52^{bc}	4.79^{c}	5.33^{d}	0.39^{a}	0.08
FCR^{2}	0.18^{a}	0.20^{a}	0.27^{b}	0.32^{c}	0.22^{ab}	0.24	0.27^{b}	-	0.03
PER^{3}	0.92^{a}	1.89^{b}	3.46^{c}	5.19^{e}	1.90^{b}	3.39	4.18^{d}	-	0.28

Figures in the same row having the same superscript are not significantly different (P 0.05)

MGR = Mean Growth Rate
FCR = Food Conversion Ratio
PER = Protein Efficiency Ratio

REFERENCES

Association of Official Analytical Chemists (AOAC) (1980) Official Methods of Analysis of the AOAC (W. Hortwitz, Ed). 13th Ed. AOAC, Washington DC 125, 291 858 Pp.

Coche, A.G. (1977) Preliminary results on cage rearing of Tilapia nilotica in Lake KOSOU, Ivory Coast. Aquaculture, 10: 109-140

Duncan, D.B. (1955) Multiple range and multiple F-test. Biometrics, 11: 1-42

Ezenwa, B.I.O. (1979) Supplementary diets in fish culture and feed formulation technology in Nigeria. Occassional Paper No 30, Nigerian Institute for Oceanography and Marine Research (NIOMR)

Ufodike, E.B.C. & Matty, A.J. (1983) Growth responses and nutrient digestibility in mirror carp (Cyprinus carpio) fed different levels of cassva and rice. Aquaculture, 30: 10 Pp

Ugwuzor, G.N. (1982) Effect of cowblood meal, fish meal and sorghum diets on growth and tissue composition of Sarotherodon niloticus under cage culture. M.Sc. Thesis. University of Jos, Nigéria.

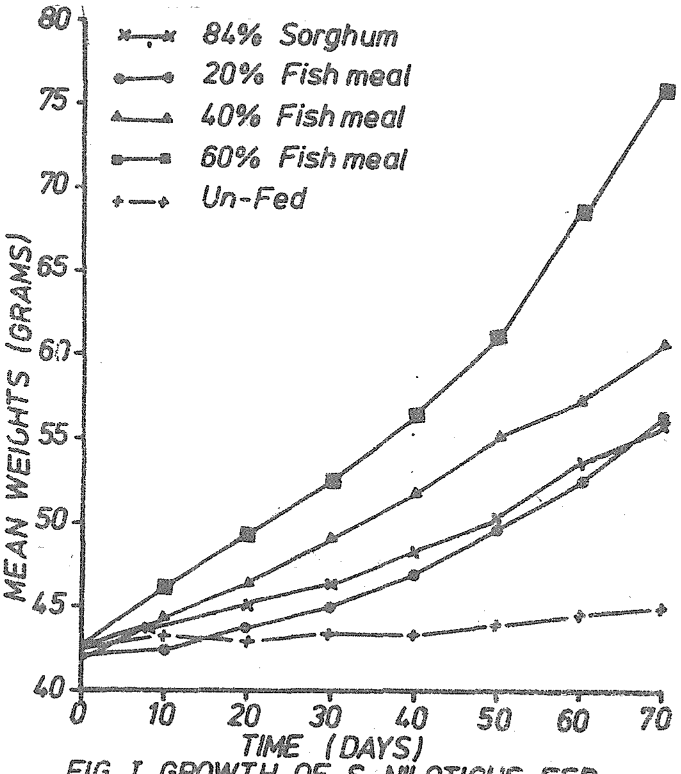

FIG I. GROWTH OF S. NILOTICUS FED SORGHUM AND FISH MEAL DIETS

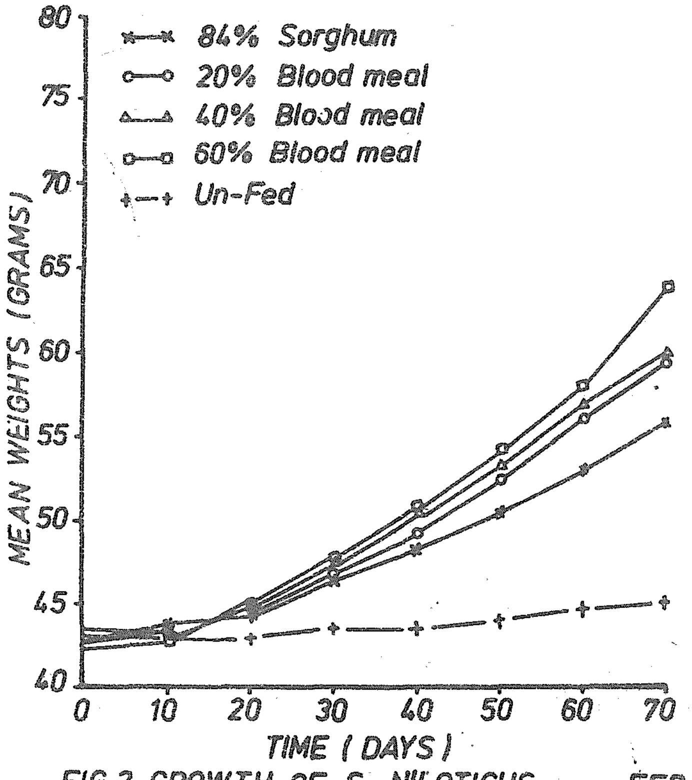

FIG.2 GROWTH OF S. NILOTICUS FED SORGHUM AND BLOOD MEAL DIETS