



The Growth and Survival of *Clarias Anguillaris* Fingerlings Fed on Various Lipid Sources.

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ABSTRACT: An experiment was conducted over 56 days to determine the effects of shea butter oil, parklard and palm oil on weight gain, food conversion ratio and survival of *Clarias anguillaris* fingerlings (mean weight of 1.28g). The results indicate that there was a significant difference ($P < 0.05$) in the growth of the fingerlings fed with various lipid sources but no statistical difference ($P > 0.05$) was observed in the survival. The fingerlings fed with shea butter oil showed the best mean weight gain and food conversion ratio (3.85g). The fingerlings fed with diet containing no lipid had the least growth performance. This clearly shows the importance of lipids in fish diet. @JASEM

Fish are known to digest and metabolise fat more efficiently as an energy source than some carbohydrates (Lee et. al. 1967). Since fat has a sparing effect on protein, it is very useful in the feeds for fry and fingerlings where protein needs for growth are very high. Fats are immediate source of energy for fish and as most studies have shown, fish can utilise 20-30% of the dry diet ingredients as fats provided adequate amounts of choline, methionine and tocopherol are present in the ration to prevent fatty acid oxidation, chain rapture and subsequent toxic reactions in the liver and spleen (Lee and Surinhuber, 1972).

Lipids also supply fatty acids, which have an additional role in providing a dietary source of essential fatty acids of the Omega - 3 series generally required by fish for maximum growth and tissue deposition. Experiments on essential fatty acid requirements of trout have shown the need for Omega 3 - fatty acids or the linolenic series of the Omega - 6 or linolic series which is required by warm blooded animals (Lee et.al. 1967; Castell et al. 1972). The Tilapias have been shown (Kanazawa, 1985; Okoye et al. 2001) to be exceptional in that they requires Omega - 6 fatty acids or linoleic series abundant in animal lipid and required by warm-blooded animals. In common carp, *Cyprinus carpio* Shinma et al. (1977) have demonstrated that dietary levels of 22: 6n - 3 significantly affected egg hatchability. Dupree and Halver (1970) and Lovell (1971) found that the substitution of marine fish oils, which contain relatively high amounts of Omega - 3 fatty acids with plant oils in catfish diets improved growth and survival of the fish.

This study therefore is aimed at formulating fish feed with locally available lipid sources predominant in the middle belt zone of Nigeria and testing their growth and survival on *Clarias anguillaris*, which is one of the major cultivable fish species, and readily accepted fish in the country.

MATERIALS AND METHODS

The experiments were conducted in twelve plastic bowls inside the hatchery complex of NIFFR, New Bussa. Each plastic bowl has a water holding capacity of 60 litres but water level was maintained at 40 litres. The experiments consisted of four treatments with three replicates each. A water flow-through device was maintained in the experimental unit to enable freshwater enter each bowl and excess water leave the system.

C. anguillaris fingerlings (average weight of 1.28g) which were produced from NIFFR indoor and outdoor hatchery complex were used for this study. During the period of acclimatisation, they were fed with pelleted feeds of 30% C.P at 5% body weight twice daily. After three days the fingerlings were randomly selected, weighed at stocked at 20 fingerlings per plastic bowl, fed with the experimental diet twice daily at 5% body weight and sampled every week to determine the survival and growth rates.

The feed ingredients used to prepare the experimental diet of 30% crude protein level were: Soya bean meal, Yellow maize, fish meal, groundnut cake, bone meal, lipid sources (Shea butter, parklard and palm oil). The ingredients were measured with a top loading weighing balance in grams as shown in their composition in Table 1. Three diets were prepared to contain all the essential nutrients except the lipid sources while the fourth diet (control) had no lipid. The feeds were fortified with mineral and vitamin premixes as shown in Table 2. Each experimental diet was thoroughly mixed in a plastic bowl with one litre of water added. The moist mixed ingredients were made into a dough and pelleted with a CORONA hand pelletizer. The pellets were sun dried, ground into smaller particles and preserved in specimen bottles.

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The fingerlings were fed twice daily for six days in a week at 5% body weight with the daily ration normally divided into two halves, one half given in the morning and other half in the evening. Cleaning of the plastic bowls was every other day to remove all the unconsumed food particles and faecal materials. This was done weekly by removing all the fingerlings out with a hand sieve and siphoning-out all the water in each bowl with a plastic hose. The bowl was thoroughly cleaned with good water and refilled to the normal level before re-introducing the fingerlings back to the bowls. Sampling was done weekly by siphoning all the water in each bowl and

removing all the fingerlings into another smaller bowl. The fingerlings were then weighed in an electronic sensitive weighing balance, (Mettler Model F200).

Physico-chemical parameters measured during the study include; temperature, dissolved oxygen and pH.

The temperature was taken daily with a mercury glass thermometer. The dissolved oxygen (D.O) was measured weekly by Wrinklers' method while the pH was measured weekly using pH calorimetric method and bromothymol blue as indicator.

Table 1: Composition of the Experimental Diets (g)

Ingredients	Diet 1	Diet 2	Diet 3	Control
Soya bean meal	289.0	289.0	289.0	289.0
Yellow corn	170.0	170.0	170.0	170.0
Corn bran	-	-	-	100.0
Fish meal	180.0	180.0	180.0	180.0
Groundnut cake	240.0	240.0	240.0	240.0
Shea butter oil	100.0	-	-	-
Porklard	-	100.0	-	-
Palm oil	-	-	100.0	-
Bone meal	10.0	10.0	10.0	10.0
Premix	10.0	10.0	10.0	10.0
Table salt	1.0	1.0	1.0	1.0
Total	1,000.00	1,000.00	1,000.00	1,000.0

RESULTS AND DISCUSSION

Table 3 shows the growth and feed utilisation of *C. anguillaris* fingerlings fed for 56 days with diets containing the following lipids: Shea butter oil, Porklard and Palm oil. The growth rate of the fingerlings in all the treatments as shown in the growth curve of Figure 1 during the first two weeks was almost the same. This could be attributed to their adaptation to the new environment and the experimental feed.

From the third week to the end of the experiment, the fingerlings fed with feed containing Shea butter (Treatment I) showed faster growth rate (Figure.1), followed by the fingerlings fed with porklard. The control diet (Treatment IV) gave the least growth rate (Table III, and Fig.1) Statistical analysis showed a significant effect ($P < 0.05$) of the treatments on the growth of the fingerlings. Further analysis showed significant difference between treatment I (Shea butter oil) and all other treatments on the growth of the fingerlings as shown in the

standard error in the final mean weight. The specific growth rate (S.G.R) was highest in Treatment I (Table 3) followed by Treatment II and least in the control. The food conversion ratio followed the same trend as the specific growth rate and was best in Treatment I, followed by Treatments II and III and least in the control. This shows that *C. anguillaris* fingerlings are capable of utilizing the compounded feed effectively as reflected by the generally low food conversion ratio (F.C.R) in all the treatments. The result of the water quality parameters monitored throughout the study is shown in Table 4. The temperature ranged from 28.5°C to 29.5°C. This is within the tolerable range as recommended by Boyd and Lichthoppler (1979). The dissolved oxygen ranged from 4.89mg/lit to 5.4mg/lit and this is within the range for fish culture purpose as recommended by Boyd (1982). The pH ranged from 7.40 to 7.55 and this is within the neutral range as recommended by Balarin (1979) and Boyd (1982).

Table 2: Mineral and Vitamin Composition Per kg of Premix.

S/No	Minerals And Vitamins	(Amount (I.U))
1	Vitamin A	4,000,000.00
2	Vitamin A3	400,000.00
3	Vitamin E	40,000.00
4	Vitamin K3	1,600.00
5	Vitamin B1	4,600.00
6	Vitamin B2	6,000.00
7	Vitamin B	2,400.00
8	Pantothenic acid	10,000.00
9	Biotin	160.00
10	Niacin	30,000.00
11	Vitamin B12	10.00
12	Folic Acid	800.00
13	Vitamin C	100,000.00
14	Chlorine Chloride	120,000.00
15	Inositol	40,000.00
16	Betaine	40,000.00
17	Cobalt	8,000.00
18	Iron	1,000.00
19	Iodine	6,000.00
20	Mangnanese	800.00
21	Copper	800.00
22	Zinc	40.00
23	Selenium	20,000.00
24	Lysine	20,000.00
25	Methionine	20,000.00
26	Anti-oxidant	20,000.00

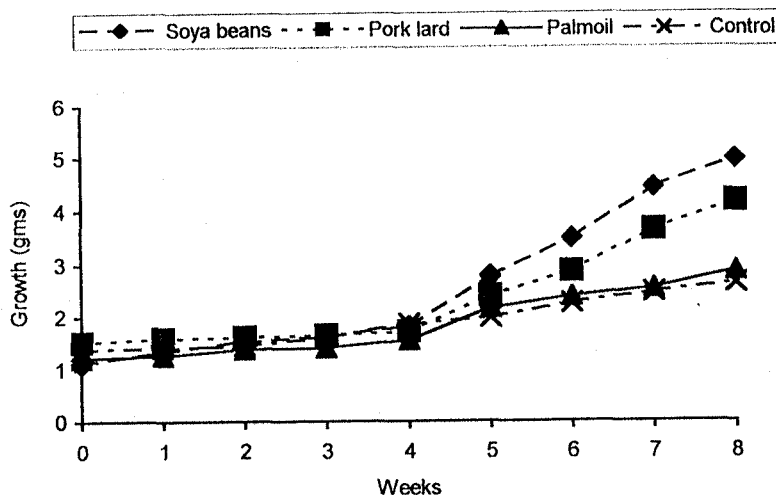
Table 3: Growth and Feed Utilization of *C. anguillaris* Fingerlings Fed with Various Lipid Sources for 56 Days.

S/No	Treatment	Initial mean weight (g)	Final mean weight (g)	Mean weight gain (g)	S.G.R	F.C.R	Survival Rate (%)	% age wt. Gain.
1	Shea butter oil	1.12±0.008	4.97±0.116	3.85	0.012	1.24	100	343.8
2	Porklard	1.52±0.049	4.16±0.46	2.64	0.008	1.81	100	173.7
3	Palm OIL	1.21±0.34	2.87±0.41	1.66	0.007	2.01	90	137.2
4	Control (No Lipid)	1.38±0.36	2.63±0.066	1.25	0.005	2.52	95	90.6

KEY: Significant at > 0.05
 Specific Growth Rate (S.G.R) = $100 \frac{(\ln W_2 - \ln W_1)}{T}$
 W_2 = Final Weight
 W_1 = Initial weight
 T = Period of experiment in days
 Ln - Natural logarithm
 Food Conversion Ration (FCR) = Feed Fed/Weight gain.

Table 4: Weekly Water Quality Parameters.

Weeks	pH	Temp.	D.O
Week 1	7.40	28.5	4.90
Week 2	7.45	29.0	4.89
Week 3	7.40	29.0	5.0
Week 4	7.40	29.0	4.95
Week 5	7.50	28.5	4.95
Week 6	7.50	29.5	5.0
Week 7	7.55	29.0	5.4
Week 8	7.50	29.5	4.95

Fig. 1: The growth pattern of *Clarias gariepinus* fingerlings fed on three different lipid sources and control for eight weeks

The mean weight gain in all the treatments which ranged from 1.25g in the control to 3.85g in the treatment with shea butter oil was higher than the mean weight gain (0.6g – 1.02g) obtained by Okoye *et al.* (2001) while working on hybrid *Oreochromis niloticus* fingerlings using the same lipid sources as in this study. Fish are known to require W3 fatty acids more than W6 fatty acids preferred by terrestrial animals with the exception of tilapia which require W6 fatty acids (Kanazawa, 1985). Dietary lipids act as a ready energy source for fish. *Clarias anguillaris* has in this study shown better preference to W3 fatty acid obtained in shea butter oil. The poor growth rate of the fingerlings fed with the control diet containing on lipid source shows the necessity for the inclusion of lipids in the diet of catfish.

The survival rate of the fingerlings in the treatments ranged from 90% in Treatment III to 100% in Treatments I and II. There was particularly no significant difference (at $P=0.05$) in the survival rate of all the treatments.

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REFERENCES

- Balarin, N.D. (1979): Tilapia, a guide to their Biology and culture in Africa, University of Stirling. Unit of Aquatic Pathology, Stirling, Scotland.
- Boyd, C.E. (1982). Water quality in Warm Water Fish ponds. Alabama Agricultural Experimental Station, Alabama, UST, P.220.
- Boyd, C.E. and Lichtkoppler, F. (1979). Water Quality Measurement in fish pond culture. Research and Development Series No.22. International Center for Aquaculture Experiment Station. Auburn. University of Auburn, Alabama. U.S.A. 30p.
- Castell, J.D., Sinnhuber, R.O., Wale, J.H. and Lee, D.J. (1972). Essential fatty acids in the diet of rainbow trout (*Salmo gairdneri*): Growth, feed conversion and some gross deficiency symptoms. *J. Nutr.* 102: 77-86.
- Dupree, H.K. and Halver, J.E. (1970): Amino acids essential for the growth of channel catfish, *Ictalurus punctatus*. *Trans Am. Fish. Soc.* 99: 90-92.
- Kanazawa, A. (1985): Essential fatty acids and lipid requirement of fish. In Nutrition and feeding in fish Academic Press. London.
- Lee, D.J., Roehm, J.N; Yu, T.C. and Sinnhuber, R.O. (1967): Effect of W3 fatty acid on the growth rate of rainbow trout, *salmo gairdneri* *J. Nutr.* 92: 93-98.
- Lee, D.J., and Sinnhuber, R.O. (1972): Lipid requirements. P.145-180. In: Fish Nutrition. (J. E. Halver ed). Academic Press New York.