COMPARATIVE EFFECT OF ALTERNATIVE FEED MATERIALS WITH ARTEMIA IN THE DIET OF *Clarias gariepinus* LARVAE

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Abstract

A 35-day feeding trial was conducted to compare and evaluate nine first feeds for *Clarias gariepinus*. The nine feedingstuff materials contained more than 40% crude protein. Artemia, coppens and fishmeal were used as single protein sources. Fish egg meal, cattle liver meal I and shrimp meal were supplemented with yeast alone or yeast combined with folic acid. Twenty fish larvae were kept in plastic bowls with replicate for each treatment inside the laboratory. Feeding commenced after yolk absorption. Each diet was fed to fry twice daily to apparent satiation. Percentage survival at the end of the experimental period ranged between 0% and 100% for fish on fish egg supplemented with yeast and folic acid and liver meal with yeast respectively. Fish fed artemia had the highest weight while those on shrimp meal supplemented with yeast had the least. Highest specific growth rate was in fish fed fish egg supplemented with both folic acid and yeast. The cost of rearing *Clarias gariepinus* larvae can be appreciably reduced by using non-conventional protein sources, which are locally available, for feed preparation.

Introduction

As catfish culture becomes more intensive with emphasis on high yield, dependence on natural food has decreased. Fish production has been enhanced by the addition of fertilizers to pond water stimulating the growth of natural food organisms while prepared feeds are used to supplement natural productivity. Thus feed quality and feed practices has became critical issues. Larval nutrition is very important because the first food determines the growth and survival rate of the fish. Larvae are very small, extremely fragile and not well developed especially the digestive system. Development of adequate feed period for larvae is one of the important essentials for hatchery production of fry and juvenile.

The African catfish *(Clarias gariepinus)* widely distributed throughout Africa, is an omnivore with preference for plankton diet. It also feeds on other types of food items such as insect, insect larvae, fish, fish remains and other unidentified food items. It shows preference for diatoms and flagellates over all food items (Ayinla, 1988). At all stages of development this fish is capable of filter feeding (Fagade and Olaniyan, 1972). *Artemia* is imported and may not be available on regular basis. Apart from the scarcity, the cost is very high and beyond the reach of an average fish farmer hence the need to find locally available alternative to *artemia*. This study determines the response of *Clarias gariepinus* larvae to various locally available feed materials

Materials and Methods

Newly hatched larvae of *Clarias gariepinus* were obtained for this study. At the time they start to feed and were transferred to circular bowls which were labeled and fed different diets. The post yolk sack larvae were fed to satiation in the course of this experiment.

Preparation of Diets Fed to the Fish

For Artemia, 8g of encapsulated *Artemia* was put in an enamel bowl. Bleach was added until the *Artemia* was covered; the mixture was stirred until a change of colour was observed. The mixture was drained and fresh bleach added and stirred until the colour changes from brown to orange. The Artemia was drained, washed with clean water, sun-dried and blended using a blender. This was designated as **"ARTMA"** Fish meal was purchased from a reliable feed mill in Akure: and designated FSHML; while **0.2-0.3mm** Coppens was procured from Durante Fish Farm in Ibadan and designated as **"CPPNS"**.

Cattle liver meal was prepared thus: a kilogram of liver was procured from an abbatoir, boiled for 45 minutes, cut into pieces and oven-dried (Xper) for 30 minutes. It was blended. 30% of dried yeast was added to 70% of liver and designated as "LVRMY". 10% dried yeast and 10% folic acid were added to 80% liver and designated as "LVFAY".

The fish egg meal was derived from *Clarias gariepinus* egg. The raw eggs of *Clarias gariepinus* were collected from women who sell and cut the fish for consumption. Usually the eggs are removed and discarded. The eggs were therefore collected free of charge. It was boiled with a little quantity of salt, oven-dried for 10 minutes and blend into powdered form. 30% of yeast was added to 70% of the ground fish egg and designated as "FSHEY" while 10% dried yeast and 10% folic acid was added to 80% of fish egg and designated as "FEFAY" respectively. Shrimp was purchased from Oja Oba market in Akure, sun-dried and blend into powder. 30% of dried yeast was mixed with 70% of the ground shrimp and designated as "SHMLY," while 10% dried yeast and 10% folic acid was added to 80% ground shrimp and designated as "SMFAY".

The protein content of feedstuffs were; ARTMA (43% CRUDE PROTEIN, CP); CPPNS (52%CP); FSHML (61%CP); LVFAY (53 % CP); FEFAY (66%CP), SMFAY (53% CP), LVRMFY (54% CP); FSHEY (55% CP), and SHMLY (64% CP)

Table 1: Percentage Composition of Experimental Diets (g/100g)

Decapsulated Artemia	100	-	-	-	-	-	-	-	-
(0.2-0.3mm) catco Coppens	-	100	-	-	-	-	-	-	-
Fishmeal	-	-	100	-	-	-	-	-	-
Fish egg	-	-	-	-	80	-	-	70	-
Liver meal	-	-	-	80	-	-	70	-	-
Shrimp meal	-	-	-	-	-	80	-	-	70
Yeast	-	-	-	10	10	10	30	30	30
Folic acid	-	-	-	10	10	10	-	-	-

Plankton Culture

A culture medium of planktons was set up and introduced into the diets of each treatment with the exception of Artemia. The plankton culture medium was prepared by filling a 20 litre bowl with loamy soil to about a centimeter in height, followed by single super phosphate at 0.31g per litre coupled with chicken manure at 4g per litre of water (Delbare and Dhert, 1996). The culture medium was stirred and left for three weeks with addition of a handful of chicken manure weekly to ensure rapid plankton population increase. Ostracods and cladocerans were identified in the culture medium when viewed with a Monocular Microscope (Olympus) at "x 100" magnification.

Clarias gariepinus larvae with average initial weight of 6 mg (0.006g) were stocked in a 200 cm^3 volume plastic numbering twelve, at the Limnology Laboratory of the Department of Fisheries and Wildlife. The frys were fed twice daily to apparent satiation for 35 days; with the plankton culture medium introduced into each of the treatments shortly after inoculation. Tetracycline was applied at the rate of 0.62g to a litre of water.

Water Quality

Water quality parameters observed were: Temperature, DO_2 (Dissolved Oxygen) and pH. The pH of each treatment was observed using a JENWAY 3015 pH Meter. Water temperature was monitored using a Mercury-in-glass Thermometer calibrated in degree Celsius (°C) in the morning and afternoon. Dissolved Oxygen was also taken periodically using HORIBA water checker U-10.

Dead fry were removed from the containers and recorded on a weekly basis. The fry were weighed biweekly using a METTLER PM 460 electronic weighing balance.

The proximate analyses of experimental diets were carried out at the Fish nutrition laboratory of the Department of Fisheries and Wildlife, Federal University of Technology Akure. Analyses were conducted on diet treatments, with crude protein, crude fat, moisture and ash contents of the diets determined according to AOAC (2000). Data collected were subjected to analysis of variance (Steel *et al.*, 1997)

The following growth parameters: were determined on the experimental fish:

Percentage Growth Rate Final weight- Initial weight X 100% = No of days

Daily Weight gain Final weight- Initial weight = No of days

Specific Growth rate Log_e final Log_e initial x 100% = No of days

% Survival Harvested no. of Individuals x 100 % = Initial no. of Individuals

Results

Table 2: shows the percentage proximate composition of various feed sources.
Diet containing shrimp meal "SHMLY" had the highest crude protein of 68.76% and ash content of 17.71% while fish egg "FEFAY" had the lowest ash of 8.04% and nitrogen free extract of 1.15%. Artemia "ARTMA", however, had the highest nitrogen free extract (23.58%) and lowest crude protein at 43.50% while Livermeal "LVFAY" had the highest crude fat of 27.78%.

Table 2: Proximate Composition of Feed Material on Dry Matter Basis (%)

Feedstuff	Fat	Ash	Crude Protein	Nitrogen Free Extract
Artemia ARTMA	18.09	14.82	43.50	23.58
Coppens CPPNS	22.28	15.10	52.66	9.95
Fishmeal FSHML	12.44	17.04	61.23	9.28
Cattle Liver LVFAY Folic acid + Yeast	27.78	9.47	53.70	9.04
Fish egg FEFAY Folic acid + Yeast	24.25	8.04	66.56	1.15
Shrimp meal SMFAY Folic acid + Yeast	23.50	12.55	53.45	10.50
Cattle Liver LVRMY + Yeast	17.25	11.25	60.3	11.16
Fish egg FSHEY + Yeast	15.55	4.71	59.9	19.83
Shrimp meal SHMLY + Yeast	11.56	17.71	68.76	1.97

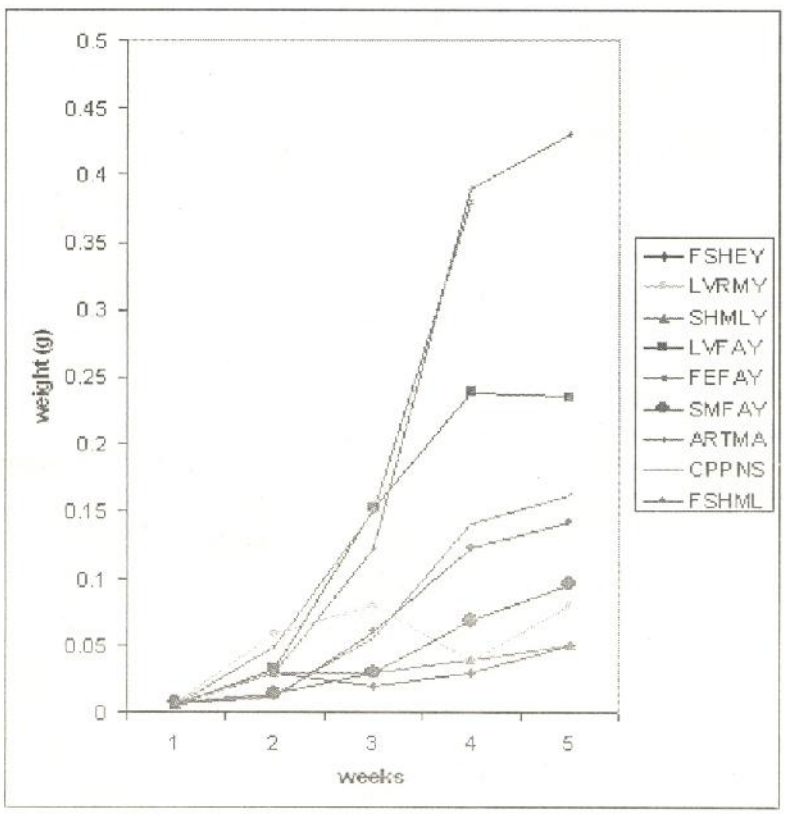

Fig.1 Growth Response in Fries Fed with Different Diets

FSHEY Fish egg + Yeas t (30%) FSHML Fishmeal.
LVRMY Livermeal + Yeast (30%)
SHMLY Shrimp meal + Yeast (30%)
LVFAY Livermeal + Folic acid (10%) + Yeast (10%)
FEFAY Fish egg + Folic acid (10%) + Yeast (10%)
SMFAY Shrimp meal + Folic acid (10%) + Yeast (10%)
ARTMA Artemia.
CPPNS Coppens.

Fig. 1 shows the growth response of fries fed different diets with "ARTMA" having the highest weight and "SHMLY", the lowest weight. During the first 2 weeks, similar increase in weight was observed in fries fed "CPPNS", "SMFAY", and "FSHML" respectively together with "LVFAY", "FSHEY", "ARTMA" and "SHMLY"; but a slight increase in weight of fries fed "LVRMY" over "FEFAY" was observed as well. However, fries fed "LVRMY" gave the highest weight, which was slightly higher than "FEFAY". This shows an advantage of non-conventional food materials used in feed formulation over conventional food materials at the early stage. At week 3, "CPPNS" and "FSHML" increased in weight and was a little above "SHMLY" while similar results was experienced with fries fed "ARTMA" and "LVFAY". At week 4, "ARTMA" and "FEFAY" overshot all other diets with "LVFAY" standing out as well. Variation in growth response is clearly shown during this week as nutritional factors are responsible. Analysis of variance carried out on the different feed treatments showed that there was significant difference ($p<0.05$) on the mean growth rates of the fry. A follow-up test was determined to detect the best feed treatment acceptable.

Table 3: Mean Values of Different Feed Treatments Fed on by *Clarias gariepinus* fries

FEED TREATMENTS	MEAN VALUES
SMFAY	0.0328^{a}
SHMLY	0.0349^{a}
FSHEY	0.0375^{a}
FSHMK	0.0540^{ab}
LVRMY	0.0556^{ab}
CPPNS	0.1022^{abc}
LVFAY	0.1094^{abc}
FEFAY	0.1456^{bc}
ARTMA	0.1540^{c}

Table 3 above shows that there is no significant difference in the effect of CPPNS, LVFAY, FEFAY, and ARTMA on the mean growth rate of fry; however, ARTMA is most recommendable because it gave the highest mean value of growth rate.

Table 4: GROWTH PARAMETERS

	ARTMA	CPPNS	FSHML	LVFAY	FE FAY	SMFAY	LVRMY	FSHEY	SHMLY
Initial Weight (g)	0.008	0.007	0.007	0.006	0.006	0.008	0.008	0.006	0.006
Final Weight (g)	0.430	0.161	0.141	0.234	0.390	0.096	0.080	0.080	0.050
Mean Weight Gain(g)	0.422	0.154	0.134	0.228	0.374	0.088	0.072	0.074	0.044
Weekly Weight Gain (g/week)	0.0	.030	0.020	0.040	0.090	0.010	0.010	0.014	0.008
% weight gain	5275.00	2200.00	1914.30	3800.00	6233.33	1100.00	900	1233.33	733.33
% survival	80	7.5	5	55	0	5	100	60	35
Specific Growth Rate	11.38	8.96	8.57	10.46	11.93	7.10	6.57	6.57	6.05

Discussion

All the feeding materials were above the 42% protein required for the rearing of the larvae of *Clarias gariepinus*. In feeding fish larvae crude protein and the fat contents of the feed materials are of crucial importance. Apart from the chemical availability of these parameters biological availability and amino acid profiles play a prominent role. Although prawn meal had the highest crude protein, fish fed on it had the least growth showing that the inherent crude protein may not be available to the larvae. Formulated feed do not contain large amount of free amino acids, oligopetides and enzymes which allows autolysis in live foods and thus result in poor growth and survival hence live food needs to be offered during the first-feeding period.

The diets supplemented with yeast, folic acid and zooplanktons were observed to achieve average weights greater than conventional feedstuff; fishmeal and formulated diet (Catco, COPPENS). The percentage composition of shrimp meal (53.45%) was similar to 52.97% obtained by Gerpacio and Castillo, (1979); Yamazaki *et al.* (1988).

This was also the same in dry matter contents. The fishmeal "FSHML" purchased was supposed to be 72% crude protein but when analysed, it was grossly lower. A similar occurrence was observed in "ARTMA". This shows variation in the proximate composition as the value in the packaging bag didn't reflect the one got from the laboratory. This could have been due to the effect of handling and storage. Percentage composition of fishmeal during study period (61.23%) was appreciably higher than values obtained by Gerpacio and Castillo (1979); Yamazaki *et al*, (1988). The high fat content in shrimp meal could be attributable to the supplementation of 10% yeast which is a rich source of Polyunsaturated Fatty Acids (N-3).

The crude protein content of *Artemia* obtained during proximate analysis was dissimilar to what was obtained from an unpublished data of SEAFDEC Central Analytical Laboratory. This may be due to loss of nutritive value during processing of encapsulated *Artemia*. However, dry matter content obtained was similar to that from SEAFDEC Central Analytical Laboratory. The fries had initial weight ranging from 0.006g-0.008g and after 5 weeks, they weighed between 0.05g-0.43g, differing with the observation of Olatunde (1983) that early growth in *Clarias gariepinus* proceeds faster at the early part of their life than their latter stages. Watanabe *et al.* (1978) demonstrated that the content of fatty acids in *Artemia* is the principal factor for determining its nutritive value for fish larvae and that Docosahexanoic acid (DHA) 25:6 N-3 and Eicosapentanoic acid (EPA) 20:5 N-3 influence on the brain and retina in early fish larvae making them very sharp in response with what was observed during the first 3 weeks of the study period. It is known that most fish species require plankton food during their earliest life stages of development.

The final weight of 4 weeks old fish fed on 40% CP was 0.43g which differes from results of Faturoti *et al.* (1986) who obtained a final weight of 2.93g within the same period. Results here also differed from those of Jauncey (1982) on juveniles of *Sarotherodon mossambicus* which showed that growth was proportional to the amount of protein in the diet.

Water quality parameters; dissolved oxygen (DO) and temperature fell within the normal range 5.7-6.1 mg/L and 26-27°C (Haylor, 1991; Naz *et al.*, 2005). However, the pH obtained by Naz *et al.* (2005) were lower than what was obtained in this study. The low fluctuation in the physico-chemical parameters also influenced the growth and survival of the fish. Haylor(1991) showed that *Clarias gariepinus* larvae growth rate increase between days 3 and 10 at 30°C which agrees with what was recorded in this study at the same average temperature.

The mortalities experienced in "FSHML", "FEFAY" and "SMFAY" could be attributed to over feeding of the fry, causing excess feedstuff along with decomposition of excreta, increasing concentration of ammonia (NH_3) in the water or the rate at which tetracycline was being introduced to the water for inoculation due to addition of culture medium. At the end of the study period, fry fed fish egg "FEFAY" all died and in other treatment "CPPNS", "FSHML", "FEFAY", and "SMFAY" percentage survival was extremely low.

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