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Comparative Study of Artemia and Liqui-Fry in the Rearing of *Clarias gariepinus* Fry

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Abstract: *Clarias gariepinus* fry with initial total length and mean total weight of 7.00 mm and 0.18 g respectively and initial condition factor of 0.052 were stocked in six glass aquaria measuring 60×30×30 cm each. There were two treatments with three replicates each. Treatment one (T1) (Artemia fed fry) and treatment two (T2) (liquid-fry fed fry). Each aquarium was stocked with 50 fry and reared for 42 days. The water quality parameters (Temperature, pH and Dissolved Oxygen) were monitored. At the end of the experiment, the final mean total length for T1 and T2 were 38.67 mm and 25.00 mm respectively while the final mean total weight were 35.25 and 0.63 for T1 and T2 respectively. The statistical analysis of the results showed that there were significant differences ($p<0.05$) in the mean total weight and survival rate of T1 and T2 fry. Also, there was no significant difference ($p>0.05$) in the mean total length of the two treatments. The Specific Growth Rates (SGR) were 12.56 day^{-1} and 2.98 day^{-1} for T1 and T2 respectively. The final condition factors were 0.061 and 0.004 for T1 and T2 respectively. Based on these findings it was concluded that fry fed on Artemia diet had better growth and survival rates.

Key words: *Clarias gariepinus*, fish larvae, Artemia, liquid-fry

Introduction

In Nigeria the national the demand for fish in Nigeria is estimated to be 1.18 million Metric Tons (MT) annually and the potential yield is estimated at 1.83 million MT. (Tobor, 1993). However, the actual fish supply in 1993 report was 619,211 MT with a decline to 515,135 MT in 1994 (FDF, 1995). These shortfall and decline in the fish supply have been attributed to inefficient fisheries management, development and poor post harvest technology in terms of handling, preservation, processing, storage and distribution and subsistence aquaculture.

Aquaculture, which promises the most renewable and sustainable option only, supplies 2% of national demand now (Oyero, 2006). This is because, aquaculture development in Nigeria has so far been constrained generally by inappropriate technologies on the production essentials especially in the area of aquaculture nutrition. The availability of cheap, balanced easily available fish feed and seeds of indigenous culturable species cannot be over-emphasized in aquaculture industry.

In Nigeria, *Clarias gariepinus* is a highly valued but expensive fish. However, its high cost has been attributed to the very low availability of its fingerlings which has been described as a major bottleneck for the development of a commercial culture of the African catfish (Hogendoorn, 1980). It does not breed rapidly in captivity and procurement of fry in the wild is usually very low, thus making fingerlings collection not only time consuming and labour intensive but also very unreliable. A reliable alternative would be their intensive production under hatchery management, but that is still presently hampered by their essential requirements of live food during the post larval stage (Brenda and Riley, 1981). According to Haylor (1991) fish larval feeding and nutrition have become a major aspect of study and research in aquaculture system operation.

Newly hatched fish (larvae) survive and grow best when raised on a diet of live feed notably *Artemia* nauplii which is not readily available and tend to be very expensive and not easily accessible to the fish farmers. Therefore it is imperative to seek cheaper but effective alternatives to *Artemia* nauplii.

The major focus of this work therefore was to determine which of the larval/fry feed (*Artemia* and liquid-fry) will give a better growth and survival rate of *Clarias gariepinus* fry cultured in aquarium tanks.

Materials and Methods

The fish larvae were sourced from the hatchery complex of the Federal University of Technology, Minna, Niger State. They were just two days into their endogenous feeding. The larvae absorbed their yolk on the third day after hatching and feeding commenced on the fourth day which is the start up of the experiment.

Fifty (50) fish larvae were kept in each of the six glass aquaria used for the experiment. The aquaria were divided into two treatments of three replicates based on *Artemia* and liqui-fry fed. The *Artemia* is a product of INVE Aquaculture Nutrition, INVE Aquaculture, Inc. Utah while the liquid-fry is a product of Interpet Ltd. Dorking

Table 1: Summary of Growth, Survival and Mortality Rates and Condition Factor of Clarias gariepinus fry fed Artemia and Liqui-fry diets for 42 days

Parameters	Artemia	Liqui-fry
Specific Growth Rate (%)	12.56	2.98
Survival Rate (%0	85.33	2.67
Final condition Factor	0.061	.004

Table 2: T-test analysis of weight-length relationship and survival of Clarias gariepinus fed Artemia and Liqui-fry diets for 42 days

	Treatment	
Parameters	Artemia	Liqui-fry
Weight	13.50 ± 4.80^b	0.24 ± 0.07^a
Length	22.10 ± 4.30^a	15.14 ± 2.60^a
Survival	88.76 ± 2.10^b	18.70 ± 4.00^a

Data in the same row carrying the same superscript do not differ significantly from each other (p>0.05)

Survey, England. Each aquarium measured 0.6m×0.3m×0.3m. and was filled with 30 litres of borehole water.

Feeding was done thrice daily. The *Artemia* was fed at 5% body weight while liqui-fry was fed at six-drops per meal for the second treatment. These feed were mixed in a petri-dish with water sourced from each tank. Feeding time was morning (7:00-8:00 am), afternoon (1:00-2:00 pm) and evening (6:00-7:00 pm).

Water quality parameters including Dissolved Oxygen (DO), pH and temperature were determined at regular interval of a week before the water was changed. The water quality parameters were taken for each of the three replicates in each treatment. The dissolved oxygen content was determined using the Winkler method as described by APHA (1991). The temperature was determined with the aid of mercury thermometer. The pH was determined with the aid of a pH meter (KENT EIL 7045/36).

The mean initial weight and total length of the stocks in each of the aquaria were measured using Metler electronic top loading balance of four digits and a divider and plastic ruler respectively. The weight and the total length of the larvae were taken at intervals of 7 days. At the end of the experiment, feeding was stopped and fry were starved for 24 hours before they were removed for weighing and measurement.

The survival and mortality rates were monitored on daily basis. Food remains and debris were siphoned along with 10% of the water on daily basis and the same quantity of water removed was replaced immediately. Total renewal of whole water took place every three days. This practice helped in maintaining the water quality of the cultured fish.

At the end of the experiment, the Specific Growth Rate (SGR), Percentage Survival Rate (S), Percentage Mortality Rate (M) and the Condition Factor (K) were determined as follows :-

$$(SGR)\% = \frac{\text{Log}_e W_f - \text{Log}_e W_i}{\text{Time (days)}} \times 100$$

$$(S)\% = \frac{Ni}{No} \times 100$$

$$(M)\% = \frac{N_0 - N_1}{N_0} \times 100$$

$$(K) = \frac{W}{L_3} \times 100$$

Where:

W_i = Initial weight (g) of fish.

W_f = Final weight (g) of fish.

Log_e = Natural logarithm

N_0 = Number of fry stocked at the beginning of the experiment.

N_i = Number of fingerling alive at the end of the experiment.

S = % survival

W = Weight of fish (g)

L = Length of fish (mm).

Computer package minitab version 14 was used to determine the statistical analysis. Graphical presentations were done using Microsoft Excel respectively.

The experiment, which lasted for 42 days, was conducted at the Fisheries Laboratory of the School of Agriculture and Agricultural Technology, in Federal University of Technology, Minna, Niger State.

Results

The growth responses (weight and length) of Clarias gariepinus fry fed Artemia and liqui-fry diets for 42 day are shown in Fig. 1 and 2 respectively. The analysis of Table 2 showed that there was a significant (p<0.05) in the total mean weight and no significant difference (p>0.05) in the mean length of *Clarias gariepinus* fry after 42 days. The regression analysis of measuring the dependence of weight of fry is shown in Fig. 3 and 4. The analysis indicated that there is a strong significance (p<0.05) of weight on length of fry fed Artemia diet while that of liqui-fry diet showed no significant difference (p>0.05) of weight on length. For Artemia diet, the regression equation was y = -6.77+2.90X while of the liqui-fry was Y = -4.00+0.89.

The survival rate of the fry on the two tested diets was 85.33% and 2.67% for Artemia and Liqui-fry respectively. From the daily percentage mean survival revealed that 92.67% survival occurred in the fry fed Artemia diet and 14.67% in fry fed liqui-fry diet within the first seven days. The cumulative percentage mortality of fry fed Artemia and liqui-fry diets were 14.67% and 97.33% respectively

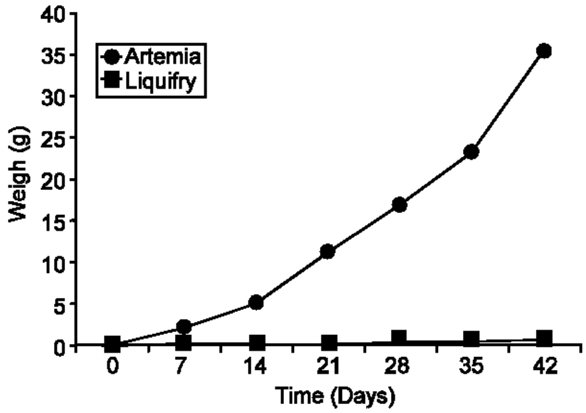

Fig. 1: Growth response (weight) of Clarias gariepinus fry fed Artemia and Liqui-fry diets for 42 days

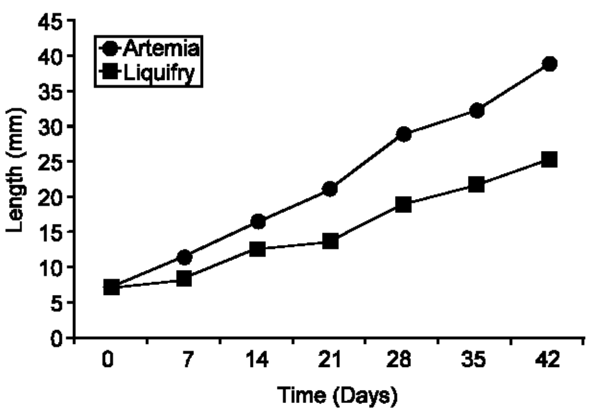

Fig. 2: Growth response (length) of *Clarias gariepinus* fry fed Artemia and Liqui-fry diets for 42 days

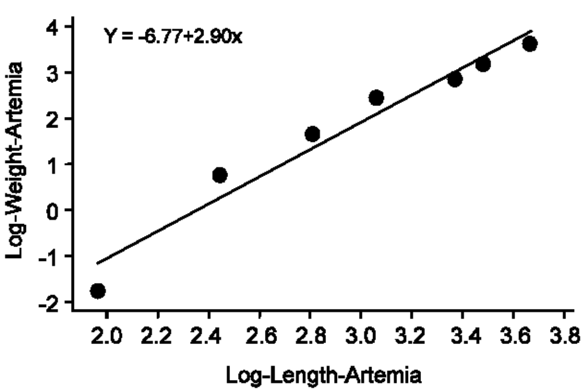

Fig. 3: Length-weight relationship of Clarias gariepinus fry fed Artemia sp

(Table 3). The result showed that fry fed liqui-fry diet had the highest mortality within the period of experiment. Mortality rate between days 0 to 7 was very high for fry fed liqui-fry diet and this continued till the 18th day before it stabilized at 97.33% on the 19th day. The mortality of fry fed Artemia stabilized at day 23 with 14.67% mortality.

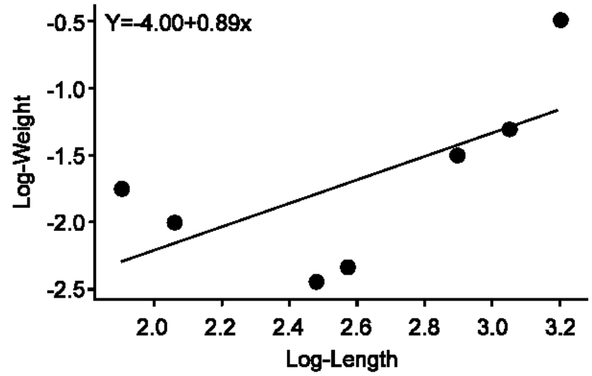

Fig. 4: Length-weight relationship of Clarias gariepinus fry fed lipuifry

Table 4 shows the mean Temperature, pH and Dissolved Oxygen content were 25.4°C 6.97 and 8.71 mg l^{-1} respectively for Artemia fed fry treatment. While the mean Temperature, pH and Dissolved Oxygen content for Liqui-fry fed fry were 25.2^0, 6.98 and 8.88 mg l^{-1} respectively.

Discussion

The results obtained from this study support previous observations that natural organisms enhance the growth of fish at their early stages of development by (Jhingram, 1983; Drouin *et al.*, 1986; Holm, 1987; Lamai, 1999).
This was shown by the significant ($p<0.05$) weight growth increase in *Clarias gariepinus* fry fed Artemia diet. The result also suggest that there were no significant difference ($p>0.05$) in mean length of *Clarias gariepinus* fry fed Artemia and liqui-fry diet after 42 days. This could be attributed to the fact that the fry were not able to digest the liqui-fry diet. The Length-weight relationship of *Clarias gariepinus* fry fed Artemia and Liqui-fry diets (Fig. 3 and 4) revealed that the length-weight relationship of fry fed Artemia diet was significant at ($p<0.05$) that is, an increase in length equally brought about increase in weight. The fry fed Liqui-fry diet was not significant ($p>0.05$). The regression analysis of the length-weight relationship corroborated these as shown by regression line equations as shown in Fig. 3 and 4. The highest mortality as observed in the first week of this study could be due to stress experienced during the transfer from the hatchery to the glass aquaria. This could also be attributed to the critical period of changing the feeding from yolk sac to preying on exogenous feed most especially for fry fed Liqui-fry diet. This was in agreement with Madu (1986) that the hatchling stage to the free swimming and feeding fry stage is regarded as the most delicate stage of fish breeding. The T-test analysis as shown in Table 2 indicated that there was significant difference (<0.05) in the survival rates of the two treatments. This agreed with the findings Jhingran (1983), Duray and Bagarino (1984) and Drouin *et al.*

Table 3: The mean total survival and mortality rates of Clarias gariepinus fry fed Artemia and Liqui-fry diets for 42 days

	Treatments							
	Artemia				Liqui-fry			
Days	Survival	%	Mortality	%	Survival	%	Mortality	%
0	150	100.00	0	0.00	150	100	0	0.00
7	139	92.67	11	7.33	22	14.67	128	85.33
14	130	86.67	9	13.33	8	5.33	14	94.67
21	129	86.00	1	14.00	4	2.67	4	97.33
28	128	85.33	1	14.67	4	2.67	0	97.33
35	128	85.33	0	14.67	4	2.67	0	97.33
42	128	85.33	0	14.67	4	2.67	0	97.33
Mean	133.14	88.76	5.5	11.24	28	18.67	48.67	81.33
SEM±	3.18	2.12	1.99	2.12	20.48	13.66	26.04	13.66

Table 4: The mean water quality parameters monitored for 42 days while feeding Clarias gariepinus fry with Artemia and Liqui-fry diets

	Treatments					
	Artemia			Liqui-fry		
Days	Temperature (0°C)	pH	Dissolved Oxygen (mg l^{-1})	Temperature	pH	Dissolved Oxygen (mg l^{-1})
0	26.0	6.93	8.20	25.3	6.94	9.10
7	25.7	6.87	8.93	25.3	6.98	8.70
14	25.3	6.97	8.40	25.2	6.98	8.87
21	25.2	7.09	8.27	25.3	7.00	9.00
28	25.0	6.98	9.13	25.5	6.97	8.50
35	25.0	6.96	9.00	25.0	7.01	9.00
42	25.0	6.97	9.07	25.0	6.98	9.00
Mean	25.4	6.97	8.71	25.2	6.98	8.88
SD	0.37	0.07	0.41	0.18	0.22	0.21
SEM±	0.14	0.02	0.15	0.07	0.01	0.08

(1986), that live organisms such as Artemia, reduces mortality thereby increasing survival rates of early stages of fish. The 85.33% survival rate for fry fed Artemia diet in this study was higher than 62.25% recorded by Lamai (1999). Ovie (2003), observed that the growth and survival of fish fry are enhanced when fed live forms of planktons. This is because of their easy availability, high reproductive potential, short generation time and high nutritional quality-capable of providing adequate essential amino and fatty acids to the young growing fish. Other qualities are suitable size, smaller than the mouth diameter of the fry to enable easy handling and ingestion.

The results of the water quality parameters monitored as shown in Table 4 were within desirable range for survival and growth of fishes when compared to (Adeniji, 1987), who recommended that temperatures of 25°-30°C is adequate for freshwater fish culture. Chakoff (1979) observed that fish grow best in pH of 6.5-9.0. and that a minimum constant value of 5 mg l^{-1} of dissolved oxygen is satisfactory for most species and stages of cultured fish. However, it was observed that after feeding with Liqui-fry diet, the water became cloudy and this created pollution and imbalance in nutrient content of the Liqui-fry, hence lowering the growth rates and increasing mortalities. This further explained the high mortalities in Liqui-fry fed fry.

In conclusion, the use Artemia nauplii despite its high cost of importation, showed that the survival and growth of *Clarias gariepinus* fry fed on Artemia were better than those fed on Liqui-fry diet. However, it is recommended that effective hatchery management techniques should be employed along with the usage of Artemia diet for low cost effectiveness.

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