GROWTH PERFORMANCE OF *CLARIAS GARIEPINUS* LARVAE FED WITH VARYING STARTER DIETS

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Abstract
Alternate to live feed for fish larvea is imperative due to its unavailability, high cost and technical know-how of its production at on-farm level. A feeding trial was conducted to evaluate the performance of Clarias gariepinus larvae fed different starter diets for 14 days. Four experimental diets comprised of one live diet and 3 inert diets designated as diet 1 (Brine shrimps-live diet), diet 2 (Decapsulated artemia-inert), diet 3 (German wean-inert) and diet 4 (Egg yolk-inert) were administered to larvae at satiation three times daily. Fifty Clarias garipepinus hatchlings were distributed in a complete randomised design in triplicate of 12 round tanks of 20 litres capacity (45cm x 23cm). The results obtained were significantly different ($p<0.05$) among treatments. Brime shrimps fed hatchling gave the best growth parameters in weight gain (0.26g), specific growth rate (10.24%/day) and survival (71.33%) while German wean fed larval exhibited a significantly ($p<0.05$) low weight gain (0.07g) and specific growth rate (4.48%/day) while the decapsulated artemia fed larvae had the lowest survival rate (29.33%). Therefore, for better growth and survival of Clarias gariepinus larvae, brine shrimps is thus, recommended as starter diets. Fish farmers should thus, learn the technique of hatching artemia cyst (live feed) at on-farm for efficient production of fish seeds.

Keywords: protein, feed, live feed, hatchling

Introduction

Fish is an important and cheapest source of animal protein which accounts for about 37% of the total Nigerian protein requirement (FAO, 2002) and 16% of the animal protein consumed by the world population (FAO, 1997). Fish demand has been estimated to be from 13.5%-18.5% million metric tons as a major source of animal protein, essential fatty acids and minerals in the diets (FAO, 2000 & Areola, 2008). Live feeds, including Artemia, rotifers, copepods, and ciliates are used in marine and freshwater aquaculture Kristine *et al*. (2013). Brine shrimps are classified in the kingdom Animalia, phylum Arthropoda, class Brachiopoda and scientific name *Artemia salina.* Many investors have shown that artemia represents an interesting food source for carnivorous larval and juvenile stages of many species which shown an absolute requirement for live prey during their early development (Koueta *et al*., 2002) and due to its high protein content, palatability and high digestibility for most freshwater and marine water fishes (Miles and Chapman, 2011). However, the increasing cost of larvae feed especially the decapsulated artemia mostly used by farmers is a constraint to fish larvae rearing in Nigeria. Similarly, the use of formulated microdiets is poorly accepted to larvae due to its inert nature and poor digestibility (Kristine *et al*., 2013 & Yufera *et al*., 2005) thus, the need for evaluating the performance of *Clarias gariepinus* larvae on live and inert microdiets in this research.

Materials and Methods

Location of study

This research was carried out at the Department of Water Resources Aquaculture and Fisheries Technology Laboratory which is located at the School of Agriculture and Agricultural Technology, Federal University of Technology Minna of latitude 9°31'57.84"N and longitude 6°27'7.96"E.

Materials used for breeding

Matured *Clarias gariepinus* of male and female broodstock were bought from reputable fish farm in Abuja. Hormone Ovaprim, dissecting set, pH meter, thermometer, dissolved oxygen meter, pipette and conical flask. aerator, weighing balance (MT300 Citizens:Model), bowls, bird feather, syringe and needle, towels, disinfectants, sponge, hose pipe and net were used for the breeding. The source of water for the breeding was the borehole in school of Agriculture and Agricultural Technology complex.

Pre-Breeding Preparations

The incubation tanks, rearing tanks, hapa net, bowls, buckets and other tools used in the breeding were washed and disinfected with salt water. The plastic tanks were arranged in preparation of the breeding activity and freshwater was pumped from the borehole into the overhead tank.

The Breeding Process

After the acclimation of the broodstocks, the breeding process was embarked upon by first weighing both the male and female broodstock using a weighing scale. The female was injected at the rate of 0.5ml of ovaprim hormone per kg of body weight. The female broodstock was injected intra-muscularly above the lateral line towards the dorsal section and pointed towards the ventral side.

The injection was administered to the female broodstock at 10pm after which it was kept at a safe and secured tank containing water and properly covered with net for 9 hours. The pH of the water was 6.52, the temperature was 28℃, the dissolve oxygen was 8mg/l, alkalinity and hardness was 60 ppm. The hapa net was laid inside the incubation tank filled with freshwater of optimum water quality parameter. After 9 hours, the female broodstock was checked for readiness for stripping by little pressure on the distended genital papillae region for flow of eggs. The male broodstock was dissected through the chest region in order to remove the sperm sacs which contained gonads that was used for fertilization of eggs.

The female broodstock was then striped by gently applying pressure on the stomach region, by gently pressing it downward towards the genital papillae. The eggs were collected into a clean and dried plastic bowl, the stripping process was stopped when the sign of blood was observed. The collected eggs were then fertilized with the milt from the male broodstock. The milt was spread on the stripped eggs in the bow which was then gently stirred with feather with no addition of water (dry fertilization) to ensure proper fertilization and avoid breaking of tender egg shell.

The fertilized eggs were laid on the hapa net inside the incubation tank. After 24 hours of fertilization the incubation tray was checked for hatchling. At the commencement of hatching,

the eggs were allowed to hatch for about 48 hours thereafter before the hapa net was finally removed to prevent water pollution.

Experimental design
Third day after hatching, 50 larvae were counted manually and transferred into twelve round plastic tanks of 20 litters capacity of 45cm x 23cm dimensions in triplicate of randomized design. where three larvae starter diets were administered.

Experimental diets
Four diets were administered one live diet and three inert diets; Brine shrimp (live), decapsulated artemia (inert), German wing (inert) and egg yolk (inert). The larvae were fed 3 times daily at satiation.

Daily and weekly routine management practices
Uneaten feeds and dead larvae were siphoned from all the plastic tanks periodically. The water in the plastic tanks was raised by 50% in the evening to allow for free swimming of larvea. The water was frequently changed by auto-recirculation for maintenance of water quality. Water quality parameters such as pH was monitored with pH meter, temperature was measured with mercury bulb thermometer, conductivity was measured with conductivity meter and dissolved oxygen was taken according to the Winkler method (APHA, 1999).

Biological evaluation of fish larvae
Biological parameters evaluated were as according to Maynard *et al.* (1979) and Halver (1989) as described below:

The weight of the larvae in each plastic stank were taken weekly to evaluate the following parameters;

Mean weight gain (g) = Mean final weigh – mean initial weight
Specific Growth Rate [SGR (%/day)] = $\frac{(\text{Log}_e W_2 - \text{Log}_e W_1)}{T_2 - T_1} \times 100$
Where, W_2 and W_1 represent – final and initial weight, T_2 and T_1 represent – final and initial time

Feed conversion ratio – Feed fed on dry matter/fish live weight gain (Brown, 1957)
Protein efficiency ratio (PER) =Mean weight gain per protein fed (Osborne *et al.*, 1919).
Percentage survival (%): $\frac{\text{no left}}{\text{no. stocked}} \times 100$

Statistical analysis
Data obtained was compared by one-way ANOVA to test the significant difference ($p>0.05$) while mean data were separated using Turkey with the aid of Minitab Release version 18. The bar charts were drawn using Microsoft excel office 2016 version.

Results
During the period of the experiment which lasted for 14 days, it was observed that larvae were in constant movement in all the plastic tanks, there was low cannibalistic behavior of larvae in

treatment 2 while treatment 4 was most turbid which thus required frequent refresh with clean water.

The mean initial weight of *Clarias gariepinus* larvae in all the treatments were not significantly different ($p>0.05$). The mean weight gain for larvae in diets 1, 2, 3 and 4 showed significant differences ($p<0.05$). Fish larvae fed with brine shrimps (diet1) has the best mean weight gain of (0.26g) followed by decapsulated artemia [(diet 2) (0.17g)], followed by egg yolk, [(diet 3, (0.12g)] and the least mean weight gain was observed with German wean fed larvae [(diet 4 (0.07)] (Table 1 and figure 2).

The feed conversion ratio (FCR) in diet 1(1.38) was significantly ($p<0.05$) different from others diets while diet 2 (1.82) and 3 (2.0) were not significantly different ($p>0.05$) from each other. Diet 1 gave the best SGR value (10.24 %/day) which is significantly different ($p>0.05$) from other diets while diet 3 had a significantly low ($p<0.05$) value (4.48 %/day). The PER values were significantly different ($p<0.05$) for the diets. Diet 2 exhibited best PER value (2.48) while diets 3 gave a significantly low ($p<0.05$) value.

The percentage survival was significantly ($p<0.05$) highest for fish larvae fed with brine shrimps (71.33%), followed by German wean (55.33%), egg yolk (48.%) and the least was the decapsulated artemia (29.33%) (Table 1 and figure 1). The water quality parameters ranged from 25.30℃- 28.20℃ for temperature, 5.90 - 10.0mg/l for dissolved oxygen, 5.61 - 6.61 for pH and 239µs/cm-279µs/cm for conductivity respectively.

Table 1: Growth parameters of Catfish larvae fed with different starter diets for 14 days

Growth parameters	Diet 1 (Brine shrimp)	Diet 2 (Decapsulated artemia)	Diet 3 (German wean)	Diet 4 (egg yolk)
Mean initial weight (g)	0.08 ± 0.00^{a}	0.08 ± 0.00^{a}	0.08 ± 0.00^{a}	0.08 ± 0.00^{a}
Mean final weight (g)	0.34 ± 0.05^{a}	0.25 ± 0.13^{b}	0.15 ± 0.02^{ab}	0.20 ± 0.06^{c}
Mean weight gain (g)	0.26 ± 0.05^{a}	0.17 ± 0.13^{b}	0.07 ± 0.02^{c}	0.12 ± 0.06^{ab}
Mean feed fed (g)	0.36 ± 0.12^{a}	0.31 ± 0.13^{b}	0.14 ± 0.03^{c}	0.02 ± 0.10^{ab}
FCR	1.38 ± 0.44^{a}	1.82 ± 2.19^{ab}	2.00 ± 0.99^{ab}	0.16 ± 0.44^{c}
PER	1.39 ± 0.38^{b}	2.48 ± 1.41^{a}	2.08 ± 0.36^{a}	1.35 ± 0.30^{b}
SGR (%/day)	10.24 ± 0.97^{a}	7.52 ± 3.60^{b}	4.48 ± 0.97^{c}	6.12 ± 2.08^{b}
Survival (%)	71.33	29.33	55.33	48.0

Table 2: Water quality parameters of catfish larvae fed with different starter diets for 14 days

Water quality parameters	Lowest	Highest
Temperature (℃)	25.30	28.20
Dissolved oxygen (mg/l)	5.90	10.00
pH	5.61	6.61
Conductivity (µs/cm)	239	279

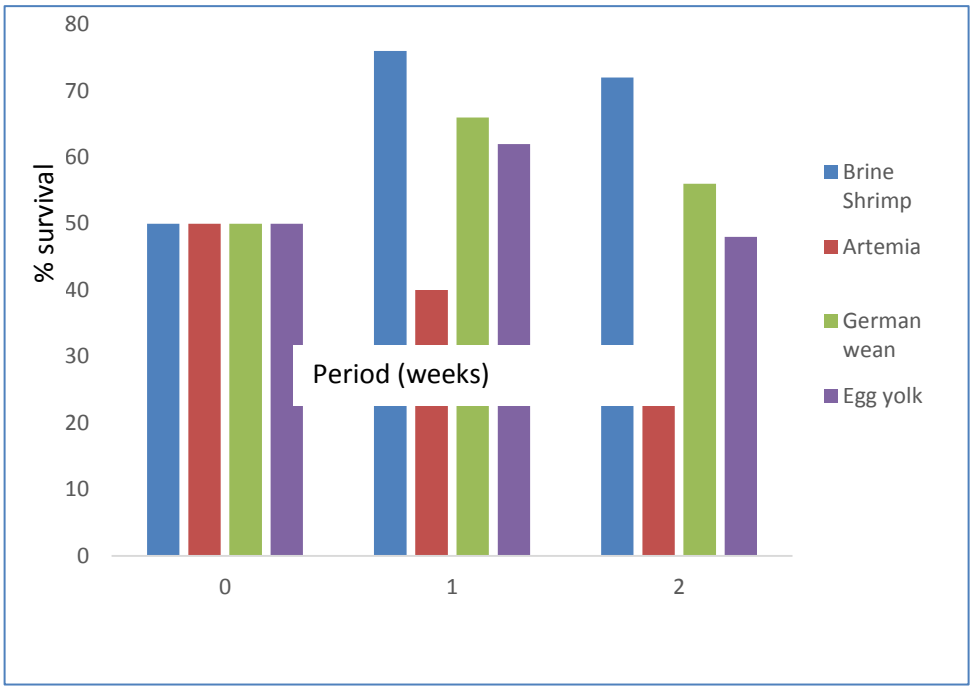

Figure 1: Percentage survival of *Clarias gariepinus* larvae fed with different starter diet

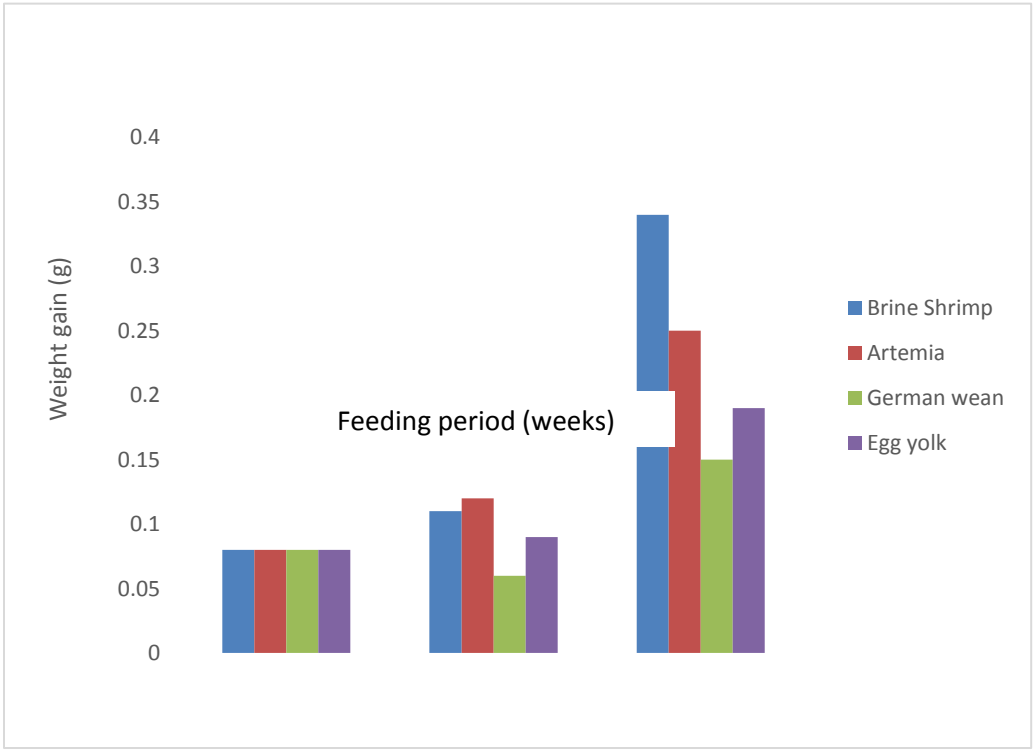

Figure 2: Growth performance of *Clarias gariepinus* larvae fed with different starter diets for 2 weeks

Discussion

The growth performance of *Clarias gariepinus* larvae was significantly affected by different starter diets. Fish larvae fed with brine shrimps had the best mean weight gain, specific growth rate and highest percentage survival contrary to the report of Qin *et al*. (1997) and Adewolu (1998) who reported that *Heterobranchus bidorsalis* larvae fed with decapsulated artemia cyst showed superior growth and survival over those fed with other diets. This may be due to species differentiation. However, *Clarias gariepinus* larvae fed with brine shrimps has significantly lower mortality rate compared with those fed with other diets in agreement with the report of Akbary *et al*. (2008).

At the end of week one, the mean weight gain of fish larvae fed with egg yolk was significantly lower than those fed with brine shrimp and decapsulated artemia diets but better than German wean diet. This is contrary to the finding of Genkel (1979) who reported that *Coregonus fera* fry fed with homogenized egg yolk registered no growth in the first three weeks of trial. In week two, fish larvae fed with brine shrimps has the highest mean weight gain than those fed with other diets. This shows that fish larvae accepted live feed better than inert diets because of its balanced nutritional composition (Lavens & Sorgeloose, 2000), feeding habit and under developed gut (Kristin *et al*., 2013).

Ovie (2002) and Ibrahim (2008) also established that most fish larvae require live food at the onset of their exogenous feeding. This is in agreement with Rønnestad *et al*. (2013) who reported that fish larvae use movement to identify prey, with neuromasts on their body detecting the water motion and frequencies emitted by plankton, while their eyes recognise appropriate movement patterns. Furthermore, the poor growth recorded for larvea fed with inert diets could be attributed to the texture of the dry feed (German wean), digestibility and nutrient leach in water especially the egg yolk (Kristin *et al*., 2013). Also, it could be related to lack of functional stomach and absence of proteolytic enzymes during the first few weeks of exogenous feeding (kerdchun and Legendre, 1994; Mills *et al*., 1996) and under-stimulation of larvae (Matthew *et al*., 2020)

Conclusion

Growth performance of *Clarias gariepinus* larvae fed with brine shrimps was better than inert diets including the decapsulated artemia in weight gain and survival respectively.

Recommendation

Brine shrimp is therefore recommended for *Clarias gariepinus* larvae rearing for better weight gain and survival.

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