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Full Length Research Paper

Larval rearing of African catfish, *Clarias gariepinus* fed decapsulated *Artemia*, wild copepods or commercial starter diet

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A feeding trial was conducted on *Clarias gariepinus* larvae using three diets: decapsulated *Artemia,* wild copepods or commercial starter diet. On the fourth day post hatch, larvae were randomly distributed into nine plastic tanks at a density of 80 fish per tank, using a completely randomized design, and each treatment condition was triplicated. Survival was highest in fish fed decapsulated *Artemia,* and least in fish fed commercial starter diet. Growth rate , specific growth rate and final weight were highest in fish fed decapsulated diet, while the least growth were observed in fish fed commercial starter diet. Growth performance and survival were intermediate in fish fed copepods. The same trend for survival and growth performance was observed for length measurements ($p<0.05$). It is concluded that inert diet may not be suitable for first feeding of *C. gariepinus* larvae.

Keywords: *Clarias gariepinus*, larval nutrition, growth, survival, inert diets, live diets.

INTRODUCTION

Knowledge of the nutritional requirements of fish is necessary to ensure healthy and optimal growth particularly in the larval stage. Nutritionally deficient diets can lead to poor growth; induce disease conditions ultimately leading to death. Under aquaculture conditions, poorly fed fish become runted and do not attract good market price. Understanding the unique nutritional needs of larval fish can improve the efficiency and quality of cultured fish.

Brine shrimps *(Artemia*) nauplii and decapsulated cysts have remained the first choice for the first feeding of fish larvae, under intensive culture(Sorgeloose *et al*., 2001; Conceicao *et al*., 2010). However, the increasing cost of *Artemia* is a constraint to fish farming among resource poor farmers particularly in the developing world, which has necessitated the need for alternative feeds.

Several workers have used rotifers (Hagiwara *et al*., 1997; Yufera, 2001; Lubzens and Zmora, 2003), cladocerans (Adeyemo *et a*l., 1994), and copepods (Shansudin *et al*., 1997; Payne *et al*., 2001; Evjemo *et al*., 2003), in fish larviculture, with some measure of success.

Copepods are highly nutritive compared with rotifers and brine shrimp (Naess and Lie, 1998; McKinnon *et al.,* 2003). However, there is still a preference for rotifers and *Artemia* because of the relative ease of mass culture of these organisms.

Attempts have also been made to use inert diets solely (Appelbaum and Damme, 1988), or in combination with live foods for fish larval rearing (Chang *et al*., 2006). Most studies using inert diets have not given satisfactory results (Govoni *et al*., 1986; Petkam *et al*., 2001).

Clarias gariepinus is a popular choice for aquaculture because of its fast growth rate, hardiness, air breathing characteristics, attractive market price and ease of breeding in captivity. Its increasing importance as a culture species has made it a subject of intensive investigations. These include studies on its nutrition (Yong-Sulem *et al*. 2006 a; Adewolu *et al*., 2008),

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Table 1. Proximate analysis of decapsulated *Artemia* and commercial diet.

	Decapsulated *Artemia*	Commercial diet
Protein (%)	54	58
Lipid (%)	9	12
Ash (%)	4	10.5

production of fingerlings (Yong-Sulem *et al*. 2006 b; Toko *et al*., 2007) among others.

The present study was aimed at determining the effects on growth and survival of feeding *C. gariepinus* larvae on decapsulated *Artemia*, copepods and commercial starter diet.

MATERIALS AND METHODS

Fish larvae were obtained through the hypophysation technique. On the fourth day after hatching, the larvae were randomly distributed into nine plastic tanks(36cm x 26cm x 25cm) containing 15l of water in a flow through system at a density of 100 fish per tank under natural photoperiod regime. At the onset of the experiments, twenty fish were removed from each tank and batch weighed to determine the average initial weight of fish, leaving 80 fish per tank and length measurements were determined for ten fish each using a calibrated dissecting microscope. Larvae in triplicate tanks were fed each of the experimental diets : decapsulated *Artemia* (control), wild copepods, and commercial starter diet , twice a day ad-libitum in the morning and in the evening for 12 days. Table 1 shows the nutrient analysis of decapsulated *Artemia* and commercial diets.

The copepods used in this study were obtained from a laboratory culture. Green water was prepared by suspending dry cow dung in a jute bag in a container of well water with hay, to which baker's yeast was added. After two days, copepods obtained in the morning from a pond without fish were introduced into the green water. The green water was filtered after two weeks at intervals of two days, for copepods and fed to the fish. Filteration was done using plankton net of mesh size 100 microns.

Tanks were cleaned daily before feeding and dead larvae were siphoned and counted to estimate survival.

At the end of the experiment, 20 larvae were removed from each tank and batch weighed, while lengths of ten individual fish were measured to determine average length.

Growth indices

Growth parameters were determined using both length and weight.

Growth rate (%/day) =100(final wt (mg)-initial wt(mg)/time(days)x initial wt(mg).
Growth rate (%/day) =100(final length (mm)-initial length(mm)/ time(days)x initial length(mm).
Specific growth rate (mg/day) =ln (final wt(mg)-ln(initial wt(mg)/time(days).
Specific growth rate(mm/day) =ln(final length(mm)-ln(initial length(mm)/time(days).
Survival(%)=100x no. of survivors/no. of initial fish.

Statistical Analysis

Data were analysed using one way analysis of variance (Steel and Torrie, 1981) and differences in means were compared using Least Significance Difference at P=0.05. Analysis was done using a statistical software programme (SPSS version 15).

RESULTS

Mortalities occurred in all the treatment tanks (Tables 2 & 3). Survival was highest in fish fed decapsulated *Artemia* and least in larvae fed commercial starter diet ($p<0.05$).

Table 2 shows the results of the different diets on the final weight, growth rate and specific growth rate (body weight). The diets had a significant effect on growth performance ($p<0.05$).The highest values were obtained in fish fed decapsulated *Artemia,* while the least values were found in fish fed inert diet. Growth was intermediate in values in fish fed wild copepods.

The result of final length, growth rate and specific growth rate (length) is shown in Table 3. A similar trend found for weight measurements was also observed for length measurements.

DISCUSSION

In previous studies on *C. gariepinus* larval nutrition, decapsulated *Artemia* also gave the best growth performance (Verreth and DenBiema,1987; Verreth *et al.,*1987; Olurin and Oluwo, 2010). Decapsulated *Artemia* cysts have also been reported as a good starter diet for freshwater and marine fish (Pector *et al*., 1994; Lavens and Sorgeloos, 2000; Lim *et al.,*2002; and Harzevilli *et al.* 2004), because of its balanced nutritional composition.

Table 2. Growth and survival (means ±S.E) of *Clarias gariepinus* larvae fed decapsulated *Artemia,* copepod or a commercial starter diet

Parameter	Diet		
	Decapsulated *Artemia*	**Copepod**	**Commercial diet**
Initial wt (mg)	2.57	2.57	2.57
Final wt (mg)	5.03±0.15[a]	4.70±0.06[b]	4.13±0.03[c]
Growth rate (%/day)	7.99±0.47[a]	6.91±0.19[b]	5.07±0.11[c]
Specific growth rate (mg/day)	0.560±0.002[a]	0.050±0.001[b]	0.040±001[c]
Survival (%)	40.4±1.5[a]	29.6±4.2[b]	25.4±1.1[c]

Means in a row with the same superscript are not significantly different (p>0.005)

Table 3. Growth and survival (means ± S.E.) of *Clarias gariepinus* larvae fed decapsulated Artemia, wild copepod or commercial starter diet

Parameter	Diet		
	Decapsulated *Artemia*	**Copepods**	**Commercial diet**
Initial length(mm)	6.0	6.0	6.0
Final length(mm)	10.53±0.12[a]	8.33±0.20[b]	7.23±0.15[c]
Growth rate(%/day)	6.3±0.17[a]	3.24±0.28[b]	1.71±0.20[c]
Specific growth rate(mm/day)	0.047±0.001[a]	0.027±0.002[b]	0.016±0.002[c]
Survival(%)	40.4±1.5[a]	29.6±4.2[b]	25.4±1.1[c]

Means in a row with the same superscripts are not significantly different (p≥0.05)

An advantage of *Artemia* cysts is that they can be kept for considerable periods of time.

Growth performance of *C. gariepinus* larvae fed on copepods was intermediate between those fed on *Artemia* cysts and inert diet. Various workers have used live feeds for fish larval nutrition with success. These include the use of *Artemia* nauplii, (Sorgeloos *et al*., 2001), rotifers (Polo *et al*,, 1992), cladocerans (Adeyemo *et al*., 1994), and wild zooplankton (Naess *et al.,* 1995). Fish larvae are attracted to live food by their movement, and the success of the use of live foods depend on a number of factors which include the nutritional composition of the live foods as well as the size of the live foods in relation to the mouth gape of the fish larvae. Small fish larvae tend to prefer prey of small size.

Some workers have recorded positive results with copepods especially in marine fish larval culture (Grageda *et al*., 2008). Copepods are reported to be of better nutritional value (higher essential fatty acids) compared to other live foods such as rotifers and *Artemia* (Nanton and Castell, 1998; Evjemo *et al*., 2003; Stottrup and McEvoy, 2003). The lack of protocol on the mass production of copepods has limited its usage in first feeding of fish larvae.

The inert diet gave the least performance in terms of growth performance and survival. Similar observations have been made with respect to its usage. Various reasons adduced for its poor performance include poor nutritional status of diet ,the diet not being well adapted for the larvae and the fact that most larvae have not developed the required enzymes and digestive systems required to digest formulated diet (Cahu and Zambonino Infante, 1999). However, Uys and Hecht (1985) observed that C. gariepinus larvae fed on an optimal dry feed gave better performance compared to those fed live organisms.

It is concluded that diet of animal origin is best suited for first feeding of *C. gariepinus* larvae.

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