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Comparative Growth Performance and Survival of African Catfish (Clarias gariepinus) Fed with Artemia and Acartia Live Feeds

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ABSTRACT

The comparative growth performance and survival in Clarias gariepinus fed with Acartia tonsa and Artemia was carried out. Two hundred forty-eight hours old larvae were fed with these live feeds for three weeks. The fish were assessed for growth performance and survival on weekly basis. The result obtained indicated that the final length, specific growth rate and survival were higher in fish fed with Acartia than the one fed with Artemia. However, notable increase in final weight and condition factor was observed in the fish fed with Artemia at the end of the experimental period. An indication that Acartia tonsa can serve as a starter feed for C.gariepinus larvae.

Key words: *Aquaculture, Live feeds, Acartia tonsa, Artemia , Clarias gariepinus*

INTRODUCTION

Fish larvae require live food in their early life stage. Despite their high nutritional value, live foods are mobile, easily detected and captured by the larvae. Live food eases digestion because of their high water content [1]. The size, density and motion of the live food determine how they are selected by the larvae [2], and large preys are preferred as the size and age of larvae increases [3]. Using the live food with the right size and the right nutritional composition, depending on the larval size and developmental state, is crucial for survival, optimal growth and development of fish larvae in aquaculture [4]. Live food like zooplankton, brine shrimp (*Artemia nauplii*), unicellular algae etc are better as starter diets for larvae, as dry diets are not easily digested [5].

In rearing of larvae, live foods are very important because they promote the survival of fish larvae at early stage [6]. Larvae react to the availability of prey within the first week of exogenous feeding [7]. Though live foods are appropriate as food for larvae, it can still be used as alternative foods when frozen. Ojutiku [8] reported that frozen Daphnids were successfully used as supplements in place of live daphnids as food for larvae. Though there have been series of success stories in the formulation of diets for the production of fish fry especially in the fresh water fish species, co-feeding artificial diet and live food have done better compared to artificial diet only [9].

Although *Artemia* has been known to man for centuries, its use as a food for the culture of larval organisms apparently began only in the 1930's, when several investigators found that it made an excellent food for newly-hatched fish larvae [10]. In the late seventies, when many fish and shrimp hatcheries started to go commercial, switching from one source of *Artemia* to another, very significant difference in production yields were even obtained with distinct *Artemia* batches of the same geographical origin [11]. *Artemia* is still the most preferred and reliable live food in rearing fish and crustacean larvae [12]. However, *Artemia* is not cost-effective in most developing countries. So many works have been done on several feeds to look at their suitability as alternative to *Artemia* in fish larvae, with respect to survival and growth. This paper therefore focused on comparative growth and survival of *C.gariepinus* larvae fed with *Artemia* and *Acartia* in the hatchery.

Materials And Methods

Study Area

The project work was carried out in the hatchery unit of the University of Port Harcourt, Choba Campus, Rivers State, Nigeria. Port Harcourt the capital of Rivers State lies between longitude 4^o and 6^o East at Greenwich median and 7^o and 8^o of the Equator.

Stock Density

A total of 200 larvae of 4.8 ± 0.16mg weight and 6.16 ± 0.30mm length were transferred to each of the experimental tanks (40 x 25x 25cm^3) that were properly labeled. The weight was obtained by the use of a Rohr sensitive electric weighing balance (Model no 3002N, by Want Instrument Co Ltd, Shanghai, China). A wet filter paper was placed in the balance and reduced to zero, twenty five larvae were collected randomly from the hatchery at the end of endogenous feeding and placed at the zero weight filter paper, and the weight was taken, and its average determined. This was repeated five times, and the average of the results of the five sets was taken as the weight of the individual larvae in the hatchery. Five set of five larvae each was measured using a transparent millimeter calibrated ruler and a magnifying hand lens. The average lengths of each of the sets were taken and the mean of the various set was taken as length of each larva in the hatchery. Feeding commenced 12 hours after stocking.

Physico-Chemical Parameters

The temperature was taken by the use of mercury in glass thermometer calibrated in degree centigrade (0-100^{o}C). The thermometer was immersed in the experimental water column and was allowed to stand for five (5) minutes. The reading was taken immediately the thermometer was removed from the water. An average of three (3) measurements was taken per tank, during reading. The pH value of the water was determined by the use of a pH meter, pocket pen pH meter model 700, made in Japan. The dissolved oxygen (D.O), ammonia and Nitrite were determined using a 9-series multi-parameter water quality meter (Bante 980 Precision Meter, Bante Instruments, Beijing China) Version Number: 2009070200. The ammonia, nitrate and nitrite test was conducted using La Motte Aquaculture test kit MODEL AQ-4, CODE 3635-04, chester town, Maryland, 21620. USA.

Feeding

The larvae were fed 10% of their body weight of feeds per day. They were fed six times daily.

Growth Parameters

Length

The length was measured by the use of a transmitted millimeter calibrated ruler and a magnifying hand lens. The initial larva length was 6.16 ± 0.30mm and measurements were done at days 7, 14 and 21.

Weight

The weight was determined by the use of an electric sensitive weighing balance (model: 3002N, No.110628014, made in Shangai, China by Wart Instrument Co. Ltd). The initial larva weight before stocking was 4.8 ± 0.16mg, and weighing was done at 7, 14 and 21day.

Survival

The survival rate was determined using the formular

$$\% \text{ survival rate} = \frac{\textit{final number of larva}}{\textit{initial number stocked}} x100$$

Specific Growth Rate (SGR)

Specific Growth Rate (SGR): This was calculated using:

$$SGR = \frac{InW_t - InW_o}{t},$$

Where: W_1 = Final body weight

W_o =Initial body weight

t = Time (days)

Condition Factor (K)

The Condition Factor (K): this was calculated using the formular:

$$K = \frac{W}{L^3} \times 100\%$$

W= Weight (g) and L = Length (cm)

$$\frac{\textit{Final wt - Initial wt}}{\textit{Growth Period}}$$

Statistical Analysis of Data

Statistical analysis was carried out on all data using the SPSS VERSION 12 for windows. Data was pooled by treatment and presented as mean ± standard deviation (SD) and standard error (SE).Data was analyzed for treatment effect by one way analysis of variance (ANOVA). The Turkey Post hoc test was used to 95% confidence level to produce specific information on which means are significantly different from each other.

RESULTS

Physiochemical Parameter of Water in Experimental Tanks

The result of the physicochemical parameters of water in experimental tanks is shown in Table 1. There were no significant difference (P > 0.05) in the values of temperature, pH and dissolved oxygen of the water in all the experimental tanks. While ammonia, nitrate and nitrite were 0.00 (zero) in all the experimental waters.

Growth Response in C.gariepinus Fed Experimental Diets

The growth responses of larvae to the experimental diets are shown in Figures 1 to 5. The fish fed with *Artemia* consistently had higher values final weight than that of *Acartia* within the experimental period (Figure 1). While in final length, the fish fed with *Acartia* had higher values in all the experimental weeks (Figure 2). The larvae of *C.gariepinus* survived more under exposure to *Acartia* diet than *Artemia*. The survival rate in *C.gariepinus* larvae fed with these two diets decreased as the experimental period increased (Figure 3). The specific growth of *C.gariepinus* larvae obtained in this study fluctuated in both diets as the experimental period increases. However, the highest values for both feeds were observed in experimental period of week 2 (Figure 4). The condition factor differs among the larvae fed with *Artemia* and *Arcatia* feeds. The condition factor in the fish fed with *Acartia* rose steadily and peaked at week 2, later it declined at week 3. While the fish fed with *Artemia* were within the same range in all experimental period (Figure 5).

Table 1: *Values of Physiochemical Parameters of Water in the Experimental Containers (Mean ±SD)*

Parameters	Experimental Weeks		
	Week 1	**Week 2**	**Week 3**
Temperature (^{0}C)	27.85 ± 1.15	27.49 ± 1.29	27.96 ± 1.34
pH	6.11 ± 0.45	6.13 ± 0.48	6.26 ± 0.19
Dissolved Oxygen (mg/l)	6.32 ± 0.16	6.37 ± 0.16	6.09 ± 0.11
NH_3	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Nitrate	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Nitrite	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

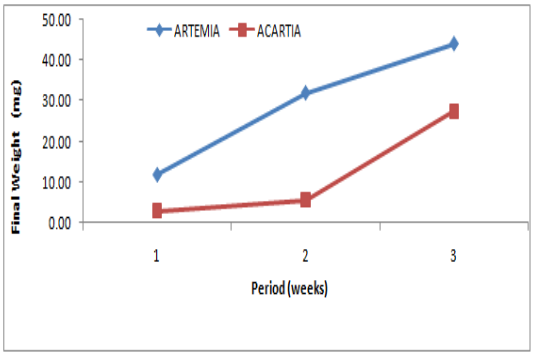

Fig. 1: *Changes in Final weight of C.gariepinius fed with Artemia and Acartia*

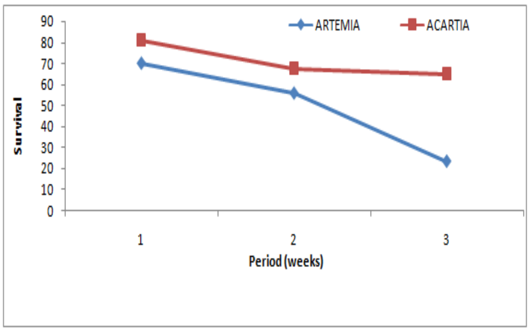

Fig. 3: *Changes in survival of C.gariepinius fed with Artemia and Acartia*

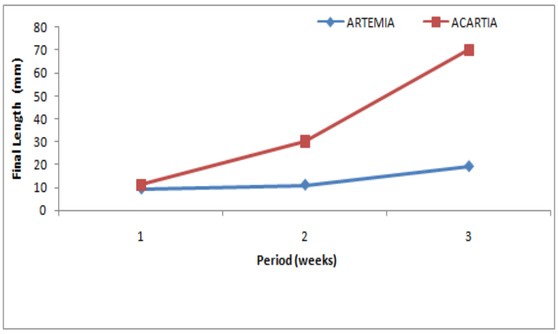

Fig. 2: *Changes in Final Lenght of fed with Artemia and Acartia*

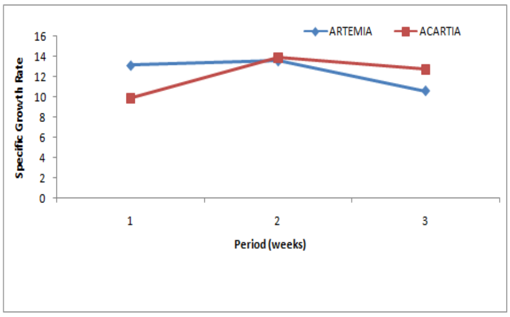

Fig. 4: *Changes in Specific Growth Rate of C.gariepinius fed with Artemia and Acartia*

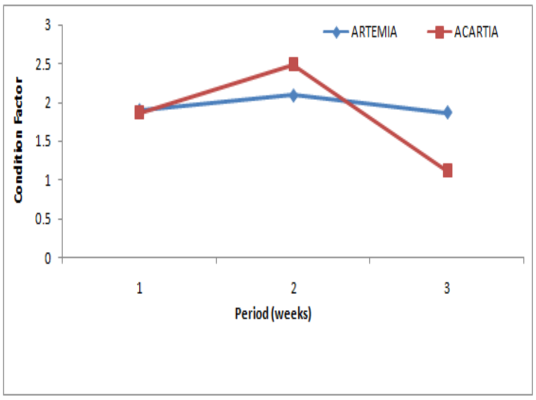

Fig. 5: *Changes in Condition Factor of C.gariepinius fed with Artemia and Arcatia*

Discussion

The feed administered to the larvae of fish affects it in different ways. While some do well in the length increase of the larvae, others do well in the weight gain and survival rate. After two weeks of treatment period with three different feed on *C. gariepinus* larva, it was observed that the different feed *Arcatia* and *Artemia* affected the growth and survival rates differently within the experimental period [13]. Fish feed including the larval feed has different components; one of the crucial components is protein. The protein level of any given feed affects the fish growth differently, with the best tilting towards increase in the protein level of the feed. Though feeds be it live or artificial have different effects on fish larva with respect to growth response [14].

Growth performance of *C. gariepinus* larvae fed on copepods, *Acartia* was better those fed on *Artemia* cysts in terms of length increase and specific growth rate. Various workers have used live feeds for fish larval nutrition with success. These include the use of *Artemia* nauplii, [15], rotifers [16], cladocerans [17], and wild zooplankton [18]. 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 [18]. Some workers have recorded positive results with copepods such as Acartia, especially in marine fish larval culture [19]. Copepods are reported to be of better nutritional value (higher essential fatty acids) compared to other live foods such as rotifers and *Artemia* [20],

At the end of the trial, increase in length and survival obtained in fish fed with *Acartia* was higher, indicating that the feeding of *Acartia* increased larval development, as corroborated by advanced morphological changes and strong pigmentation. The same trend was observed by Russo *et al.*, [21], in a study of dusky grouper (*Epinephelus marginatus*) fed with *Acartia*. The low growth was probably associated with an insufficient quantity or nutritional composition of the nauplii fed to the larvae. This is because the high survival of larvae fed with Acartia likely reduced the availability of copepods per larvae as the experimental period increased. Hence, the reduction in growth of these larvae when compared to the fish fed with Artemia. The copepods were nutritionally beneficial to the development of the *C.gariepinus* larvae, but due to the high quantity of live feed required in this stage, it is understood that the enriched *Artemia* nauplii provided better results in terms of weight increase than *Arcartia*.

Conclusion

This trial is one of the first reports in intensive feeding of Artemia and Acartia in the larvae of *C.gariepinus* larvae. Incorporating copepods into a live feeds regime for *C.gariepinus* resulted in increased length and survival, which further optimizes current methods for *C.gariepinus* fingerlings production. Our results suggest a benefit of feeding Acartia to *C.gariepinus* larvae during the initial feeding phase, which would reduce the quantity of copepod nauplii needed in the hatchery.

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