EFFECTS OF VARYING DURATION OF WEANING (*Clarias gariepinus* (♀) *X Heterobranchus longifilis (♂))* HYBRID FRY OFF DECAPSULATED *ARTEMIA*

***BAMAIYI[1], C., [1] SULEIMAN, B. [1]ABDULLAHI, A. I., [2]NASIRU S S. and R. UMAR[2]**
[1]Department of Biology, Faculty of Life Sciences, Ahmadu Bello University, Zaria-Nigeria
[2]National Agricultural Extension and Research Liaison Services (Naerls),
Ahmadu Bello University, Zaria-Nigeria
*Corresponding Author's e-mail: *bamaiyichaka@gmail.com*

ABSTRACT
The effects of varying duration of weaning (C. gariepinus (♀) XH. longifilis (♂))hybrid fry off decapsulated Artemia were tested. Five treatments (Treatment I was control fed Artemia for 14 days; T II Artemia fed nine days; T III: Artemia fed six days; T IV: Artemia fed three days; T V multi-feed 14 days) in three replicates were arrayed in a complete randomized design. A total of 100 swim-up fry were stocked in fifteen (15) experimental units fed for two weeks. Data collected were subjected to analysis of variance and New Duncan's Multiple Range Test was used to separate means significantly different (P<0.05). The result revealed that treatment II had the highest of 51.00±16.03 and lowest in treatment I with 20.00±12.10 in terms of growth performance, treatment I showed apparently lower Mean weight gain (230.56±83.25^{c}g), specific growth rate (25.80±0.27), and mean standard length increase (10.89±1.06^{c}) while treatment IV higher growth performance though the observed differences were not statistically significant (P>0.05). There was no significant difference (P>0.05) in condition factor among the treatments although treatment I fared relatively less in terms of condition factor but showed allometric growth. Therefore, decapsulated Artemia can be substituted with dry feed concentrate based diet between day 3 and 9 C. gariepinus (♀) XH. longifilis (♂) hybrid fry for optimize survival rate and growth performance in hatchery operations.

Keywords: Aquaculture, dry feed concentrate based, growth performance, survival rate, weight gain.

INTRODUCTION

Aquaculture is one of the fastest growing food sectors of the world (FAO, 2018). In Africa, Nigeria is said to be among the largest fish consumers in the world with over 2.7 million tonnes of fish consumed annually (FAO, 2016).World per capita fish supply reached 20 kg in 2014, due to vigorous growth in aquaculture, adducible to improvement in the state of fish s tocks due to improved fisheries management (FAO, 2018). Consumption of fish and other aquatic products globally is predicted to reach 186 million tonnes by the year 2030 (FAO, 2014).Even though Nigeria wields great potentials in both marine and freshwater fisheries, the demand for fish mostly outstrips its production (Ozigbo *et al.,* 2014). This increasing demand must be met by additional fish production from aquaculture sector and capture fisheries sectors to cushion the deficit created by increased demand for fish and fisheries products (FAO, 2016).Fish is a chief source of easily digestible, high quality among animal proteins containing all essential amino acids, provide essential fatty acids (e.g. long chain omega-3 fatty acids), vitamins (A, B and D) and vital minerals, particularly if eaten whole (FAO, 2016).

African Catfish *Clarias* spp. and *Heterobranchus* spp. production accounts for 85% total aquaculture production in Nigeria (Umaru *et l.*, 2016). In Nigeria, about 90% of fish farmers are catfish farmers; almost all hatcheries and grow-out infrastructures have been exclusively targeted towards catfish production (Atanda, 2009). Aquaculture is in the increase in Nigeria, but the industry is faced with the challenges of insufficient seeds production and supply (Achionye-Nzeh *et al.,* 2012). Early fry stage have poorly developed digestive system which could lead to inability to ingest feed effectively (Adeyemo *et al.,* 1994), fragile nature of fry, inappropriate diets for weaning fry (Abubakar *et al.,* 2013) contribute to high mortality in hatcheries. The transition from endogenous to exogenous feeding is a critical stage in the life of a fish (Abowei and Ekubo, 2010).

In Nigeria, high mortality of African Catfish hybrid fry is being recorded after a successful artificial spawning into hatchlings because of little or no information on a suitable time to substitute decapsulated *Artemia* and diet supplement that ensure larval survival and growth, and reduce wastage of resources (Achionye-Nzeh*et al.,* 2012). Therefore, this research focuses on determining the most suitable duration of weaning *C. gariepinus* (♀) *XH. longifilis (♂)* hybrid fry off decapsulated *Artemia* to dry feed concentrate base for optimum survival rate and growth rate.

Study Area

The study was conducted at the fish hatchery, Fisheries Department, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto on latitude 13º 07' 78" N and longitude 05º 12' 25" E, at 275m above sea level Northern

Nigeria between July and August (Mamman *et al.*, 2000).

MATERIALS AND METHODS

Experimental Design

Three days post-hatchery fry were used with the initial mean weight 0.2g and mean standard length 7.33mm. The experimental design constituted five treatments and three replicates arrayed in a complete randomized design. A total of fifteen (15) plastic bowls (30litre capacity) were two-thirds filled stocked with 100 fry each. Aerator (Model ACO-008 Resun Air Pump) with hoses connected to air-stones in each unit was fixed to increase dissolved oxygen (DO). Daily mortality was recorded in each unit. Electronic weighing balance (Model BW22KH) of 22kg Electronic Equip in Japan, and ruler (30cm) capacity were used monitoring growth performance during the experiment. Water quality parameters temperature (°C), dissolved oxygen (DO) and, pH were recorded daily using Mercury-in-glass thermometer, DO meter, and pH meter (Model Jenway, 2016), respectively. The experiment lasted for 14 days.

Experimental Diets

Decapsulated *Artemia* manufactured by Ocean Nutrition EuropeTH Belgium LTD and Multi-feed of 0.2mm with crude protein54% and >50%, lipids 9% and 12%, ash 4% and 11.5%, fibre content 6% and 2.5%, moisture content 9% and nil%, calcium nil% and 2.2%, phosphorus nil% and 1.6%, CuSO4 nil and 18mg/kg, respectively, were used (Source: Product Labels).

Treatments Annotations

Treatment I was control fed *Artemia* for 14 days; T II *Artemia* fed nine days; T III: *Artemia* fed six days; T IV: *Artemia* fed three days; T V multi-feed 14 days.

Survival rate and growth performance were assessed by adopting the following procedures:

Survival and Growth Performance of *C. gariepinus* fingerlings

Survival Rate:

Survival Rate (%) = $\frac{Ni-Nf}{\text{Ni}}$× 100 (Achionye-Nzeh *et al.*, 2012).

Where Ni and Nf is initial stocking and final number of fry survived at the end of the experiment respectively.

Growth Performance

Weight gain (WG)

Weight gain (g) recorded will be computed according to (Adebayo and Popoola, 2008)

Weight gain (WG) = $\frac{WGf-WGi}{}$

Where WGf and WGi is the final and initial weight gain in grams

Percentage Weight Gain (PWG)

This was calculated according to the method described by Owodeinde and Ndimele (2011).

PWG (%) = $\frac{MWGf-MWGi}{MWGi}$ × 100

Where mWGf and mWGi is final and initial mean weight gain respectively, and initial body weight at the end of the experiment.

Specific Growth Rate (SGR)

According to (Adebayo and Popoola, 2008), specific growth rate is computed thus:

SGR (%) = $\frac{LogeWf-LogeWi}{Time\ (Days)}$ × 100

Where Loge = Natural logarithm, Wf and Wi is final and initial weight hatchlings during the Experiment.

Mean Standard Length Increase (MLI)

The Mean Length Increase (MLI) was calculated by adopting the method by Abubakar *et al.* (2013)

MLI (mm) =$\frac{MLf-MLi}{}$

Where mLf and mLi is mean final and initial length of the fry

Condition Factor (K)

Condition Factor was computed according to the method described by (Achionye-Nzeh *et al.*, 2012).

K = $\frac{100w}{L3}$ × 100

Where W = weight of fry in g, L = length of fry in mm

Data Analyses

Data collected were subjected to One-way analysis of variance (ANOVA) to test for significant difference ($P<0.05$) among treatments using IBM SPSS Version 2013. Mean separation was carried out by using New Duncan's Multiple Range Test (DMRT) (Adebayo and Popoola, 2008).

RESULTS

The lowest mean percentage survival rate was observed in Treatment I 20.00 ± 11.50^{c} which was fed *Artemia* throughout the experiment. While the highest mean percentage survival rate was in Treatment II 51.00 ± 16.09^{ab} which was fed Multi-feed as from day 3 of the experiment and was not significantly different ($P>0.05$) from the other treatments (Table 1).

Treatment IV had the highest mean weight gain (g) of 0.71 ± 0.07^{ab} which was fed *Artemia* until day 9 of the experiment while Treatment I fed *Artemia*14 days showed the least mean weight gain 0.42 ± 0.02^{bc}. The highest mean percentage weight

gain was recorded in treatment IV 396.67±38.23^{ab} which was fed *Artemia* until day 9 of the experiment, although it was not significantly different (P>0.05) with the other treatments. Treatment I fed *Artemia*14 days showed the lowest mean percentage weight gain 230.56±83.25^{bc} during the study.

There was no significant difference (P>0.05) in all the treatments in terms of mean specific growth rate. The highest mean final length was recorded in Treatment IV 14.44±1.18^{ab}which was fed *Artemia* until day 9 of the experiment, although it shows no significant difference (P>0.05) from the other treatments. Treatment I fed *Artemia*14 days was the lowest 10.89±1.06^{c}. There was no significant difference (P>0.05) in all the treatments in terms of mean condition factor.

The mean temperature (ºC), mean dissolved oxygen (ppm), and mean pH 26.23±0.22, 4.56±0.91, 7.76 respectively were the water quality indices recorded during the experiment.

Table 1. Effects of varying duration of weaning *C. gariepinus* (♀) *X H. longifilis (♂)* hybrid fry off decapsulated *Artemia*

Indices	TI *Artemia* (14days)	TII *Artemia* (9days)	TIII *Artemia* (6days)	TIV *Artemia* (3days)	TVMulti-feed (14days)
MSR (%)	20.00±11.50^{c}	39.33±18.34^{b}	37.00±5.03^{ab}	51.00±16.09^{ab}	44.33±20.22^{ab}
MWG (g)	0.42±0.02^{bc}	0.71±0.07^{a}	0.63±0.05^{ab}	0.63±0.01^{ab}	0.50±0.01^{bc}
M(%)WG	230.56±83.25^{c}	396.67±38.23^{ab}	370.19±22.06^{ab}	347.60±30.93^{ab}	276.11±49.18^{bc}
MSGR (%)	25.80±0.27	26.27±0.08	26.22±0.05	26.17±0.07	25.99±0.14
MIL (mm)	7.33	7.33	7.33	7.33	7.33
MFL (mm)	10.89±1.06^{c}	14.44±1.18^{ab}	13.89±1.60^{ab}	13.55±0.30^{ab}	14.28±2.40^{ab}
CF (K)	0.0044±0.0001^{ab}	0.0032±0.0007^{ab}	0.0036±0.0009^{ab}	0.0033±0.0004^{ab}	0.0031±0.0014^{ab}

NB: Means with the same superscripts across the rows are not significantly different (P>0.05)
Keys: MSR = Mean Survival Rate (%); MWG = Mean Weight Gain (g); M (%) WG = Mean Percentage Weight Gain; MSGR = Mean Specific Growth Rate; MIL = Mean Initial Length (mm); MFL =Mean Final Length (mm); CF = Condition factor (K)

DISCUSSION

General mortality that led to below average mean survival rates among the treatments may be due to stress associated with handling during weekly data collection, tenderness and fragile nature of fry as also observed by Abubakar *et al.* (2013). The highest mean survival rate recorded in Treatment II 51.00±16.09^{ab} which was weaned at day 3 of the experiment maybe due early replacement, this agrees with the findings of Abubakar *et al.* (2013) who reported 59.67% survival rate for *C. gariepinus* fingerlings fed 3% body weight with compounded feed mixed zooplankton. Sanaye *et al.* (2014) observed higher mean survival rate of 95.23% fed *C. anguillaris* larvae/fry fed with commercial feed and mixed zooplankton. The lower mean survival rate of 20.00±11.50^{c} recorded in Treatment I could probably be attributed to dietary composition of decapsulated *Artemia* in terms of essential amino acids and low essential fatty acids available to the fry ingested and digested as observed by Sanaye *et al.* (2014) and Oyero *et al.* (2009), dry feed concentrates may contain high critical or limiting amino acids e.g. lysine and methionine and high essential fatty acids added during formulation (Adeyemo *et al.*, 1994). The highest mean weight and mean specific growth rate values of 0.71 ± 0.07^{a} gand 396.67±38.23^{ab}respectively recorded in Treatment IV were higher than the findings of Oyero *et al.* (2009) who observed 10.57±0.835mg and 13.70±0.167 in exotic *Clarias* spp. Fingerlings for 15 days respectively.

The values obtained throughout the study on condition factor were not at any time up to the value of 1. These observations were in line with the findings of Ekelemu (2010) that condition factor less than 1 does not necessarily portray poor wellbeing of the fish but rather mean that such fish exhibited allometric growth pattern.

The mean temperature (26.23±0.22ºC), mean dissolved oxygen (4.56±0.91) and mean pH (7.76) recorded during the experiment were within the acceptable range of 25 to 32ºC for *Clarias* spp. as recommended by Boyd and Lichtkoppler (1979); Ovie and Adeniji (1990); FAO (1993).

CONCLUSION AND RECOMMENDATION

Hybrid fry of *C. gariepinus* (♀) *X H. longifilis (♂)*fed dry feed concentrates replaced between day 3 and 9 had better mean survival rate, mean weight gain (g), mean percentage weight gain, and mean specific growth rate. Therefore, hybrid fry of *C. gariepinus* (♀) *XH. longifilis (♂)* should be replaced with dry feed concentrates to decapsulated *Artemia* between day 3 and 9 of weaning period. Further research should be carried out to ascertain the duration of weaning from decapsulated *Artemia* to other compounded feed high survival and growth performance. Therefore,

decapsulated *Artemia* should be substituted with diet supplement between day 3 and 9 to *C. gariepinus* (♀) *XH. longifilis (♂)* fry for optimum survival rate and growth performance in hatchery operations.

ACKNOWLEDGEMENT

We are grateful to the Department of Fisheries and Aquaculture, Usmanu Danfodiyo University, Sokoto for providing necessary facilities required for the research.

REFERENCES

Abowei, J. F and Ekubo, A. T. (2010). A review on conventional and unconventional feeds of fish nutrition. *British Journal of Pharmacology and Toxicology, 2(4). 179-191*

Abubakar, M. Y., Ipinjolu, J. K. Hassan, W. A. and Alegbeleye, W. O. (2013).survival and growth of *C. gariepinus* (Burchell, 1822) fry on cultured zooplankton and decapsulated*Artemia'. Scientific Journal of Zoology* 2(6): 54-63.

Adeyemo, A. A., Oladosu, G. A., and Ayinla, A. O. (1994). Growth and survival of fry of *C. gariepinus, H. longifilis,* Heteroclarias reared on *Moina dubia* in comparison with dry feed/ formulated diets. *Aquaculture,* 119:41-45

Achionye-Nzeh, G. C, Olumuji, K., Bello, N (2012).effect of *artemianauplii* and formulated diets on growth and survival of larvae and post-larvae of*C. Gariepinus* (L.). *International Journal of Life Science and Pharmacology Research* 2 (2): 29 -34.

Adebayo O.T, Popoola O.M (2008) Comparative evaluation and efficacy and cost of synthetic and non-synthetic hormones for artificial breeding of African catfish *(Clarias gariepinus*). *Journal of Fish Aquatic Science* 3: 66-71.

Atanda, A. N (2009).Freshwater fish seed resources in Nigeria. *In Fisheries Society of Nigeria Publication* 5(4): 26-32

Boyd, C. E. and Lichtkoppler, F. (1979).*Water quality management in fish ponds, research and development.*Series No. 22.International Center for Aquaculture, agricultural experiment station, Auburn University, Auburn, Alabama.

Ekelemu, J. K. (2010). Differential growth pattern of *C. gariepinus, H. bidorsalis,* and hybrid Heteroclariasfed commercially prepared diets.*Agricultural and Biological Journal of North American, ISSN online: 2151-75252.*

Food and Agricultural Organization (FAO), (2018)."The state of world fisheries and aquaculture. Rome. *[Cited March, 2018]*.*www.fao.org/e/fisheries/proc.htm*

Food and Agricultural Organization (FAO). (2016). The state of world fisheries and aquaculture 2016. Rome. 223 pp. *(also available at www.fao.org/3/a-i5555e/index.html).*

Food and Agricultural Organization (FAO), (2014).Water quality and fish health. *EIFAC Technical paper No: 54.* Rome 1993, 7-25 pp.

Food and Agricultural Organization (FAO) (1993). Water Quality and Fish Health. *FAO 1993 Rome, EIFAC Technical Paper No. 24: 7-25.*

Mamman, A. B., Oyebanji, J. O. and Peters, S. W. (2000).*Nigeria assured* (survey of states). Vol: 2. Gabumo Publishing Co. Ltd Calabar.

Ovie, S.I and Adeniji, H. A. (1990).A simple guide to water quality management in fish ponds. *National Institute for Freshwater Fisheries Research Technical Paper,* 23.

Owodeinde, F.G and P.E Ndimile, (2011). Survival, growth and feed utilization of two clariid catfish (*Clarias gariepinus* and Burchell 1822 and Heterobranchus bidorsalis, Geoffroy, 1809) and their reciprocal hybrids. *Journal of Applied Ichthyology, 1249-1253.*

Oyero, J. O., Awulu, T.E. and Sadiku, S. O. (2009).Comparative study of *Artemia* and liquifry in the rearing of *C. gariepinus* fry. *Journal of Nutrition* 8: 176 – 180.

Ozigbo, E. Anyadike, C. Kolawole, P (2014). Review of aquaculture production management in Nigeria. *American Journal of Experimental Agriculture,* 4(10):1137 – 1157

Sanaye, S. V., Dhaker, H.S., Tibile, R.M., and Mhatre, V. M. (2014). Effects of green water and mixed zooplankton on the survival and growth performance of neon tetra, *Paracheirodoninsnensi* (Myers, 1936) during larval and early fry rearing. *International Journal of Biology, Food, Veterinary, and Agricultural Engineering,* 8(2).

Umaru, J., Auta, J., Oniye, S. J., and Bolorunduro, P. I. (2016). Growth and economic performance of African catfish *C. gariepinus* (Burchell, 1822) juveniles to imported and local feeds in floating Bamboo Cages. *International Journal of Fisheries and Aquactic Studies,* 4 (2):221-226.