HYBRIDIZATION OF SNOUT MOUTH DEFORMED AND NORMAL MOUTH AFRICAN CATFISH *CLARIAS GARIEPINUS*

AWE, Emmanuel Temitope
Department of Cell Biology and Genetics, University of Lagos, Lagos State, Nigeria.
Email: topeawela@gmail.com **Phone:** +234 8160533163

ABSTRACT

This study was conducted to investigate the effect of head deformity on the growth and development of catfish (Clarias gariepinus). The obvious increasing market for fish protein calls for evaluation of factors that influences the yield of fish. Fertilization was carried out among Clarias gariepinus with snout mouth (a form of cephalic abnormality) and normal Clarias obtained from Ado-Ekiti, in Ekiti State together with a control study involving fertilization among non-cephalic abnormality or normal Clarias. The highest hatchability rate of 64.44 % was recorded in the control study and the least of 38.02 % was recorded in crosses where both parents were cephalically deformed. In growth performance of the offspring, the crosses involving the deformed parents (SM x SM) had the highest mean weight and mean length of 3.941 ± 0.56 g and 4.84 ± 0.89 cm, while the least of 2.477 ± 0.16 g and 3.34 ± 0.5 cm was recorded in crosses involving normal parent and deformed head parent (SM x NM), after 12 weeks of raising the offspring. There was no occurrence of snout mouth deformity among the progenies of all the crosses. However there were few occurrences of other forms of deformities; four cases of albinism and one case of inwardly bent trunk among the fries.

Keyword: African catfish, *Clarias,* Hybridization*,* Cephalic abnormality, Snout mouth

INTRODUCTION

The rearing of *Clarias gariepinus* started in the early 70s in central and western African countries. It received wide acceptance when it was realized to be a very suitable species for aquaculture and of high economic value. It has since been the most widely cultured fish in Nigeria and even in Africa (Adewunmi and Olaleye, 2001). It matures quickly and has a wide range of tolerance to climatic conditions (Huisman and Richter, 1987).

The increasing popularity of catfish among fish consumers has created an overwhelmingly increased demand for *Clarias* and conventional can no longer meet up with this high demands. The application of genetics and biotechnology to fish farming have been playing significant role in meeting the high and increasing demands for fish protein. Nevertheless, factors such as poor nutrition (Fagbuaro, 2009), hazardous effect of environmental contamination (Olatunji-Akintoye *et al*., 2010), oxygen deficiency, salinity and temperature changes (Mancini *et al*., 2006), as well as pollution that threatened the ecosystem have proffered impediment to meeting the increasing demand for catfish in the market (Fagbuaro and Oso, 2011). These conditions cause diseases and anatomical malformations in catfish (Osman *et al*., 2006; Lawanson and Ishola, 2010). Mancini *et al*. (2006) had also described unfavourable environmental conditions during embryonic development as factor that causes deformities in fish. There are past studies also linking genetic cause (Bengtsson, *et al*., 1975) and parasitic infection (Tresure, 1992) to morphological deformities in fish.

Various forms of deformity have been reported in *C. gariepinus*, some of which are taillessness (Lien *et al*., 1997; Alarape *et al*., 2015), pectoral fin deformity (Aluko *et al*., 2001). Big head deformity (Subba, 2004) and mouth deformity have also been reported by Fagbuaro and Oso (2011). The type of deformity at the centre of this study is a snout mouth deformity. Although, it is called snout mouth, in description, it is a form of head deformity in which there is a skeletal depression on the parietal part of the head which makes the mouth to bend upward as shown in Figure 1.

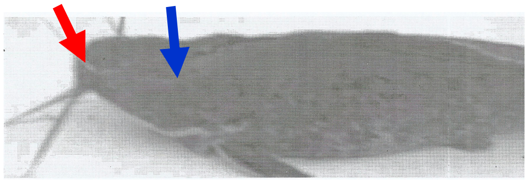

Figure 1: *Clarias gariepinus* with snout mouth deformity (red arrow) shown as cephalic abnormality involving skeletal depression (blue arrow) on the parietal part of the head

The aim of this study was to evaluate the effect of this deformity on yield of fingerlings by studying its effect on the hatchability, growth performance and development of the progenies.

MATERIALS AND METHODS

Normal and deformed parent stocks of *C. gariepinus* were procured from Fedak Fish Farm in Ado-Ekiti, Ekiti State, Nigeria and transported to the Research Laboratory of the Zoology Department of Ekiti State University. The samples were then sorted into sexes and into deformed and normal i.e. Female Normal Mouth (FNM), Male Normal Mouth (MNM), Female Snout Mouth (FSM) and Male Snout Mouth (MSM). The fish were then acclimatized for about 25 hours. The female brooders were injected intramuscularly just below the dorsal fin with synthetic ovaprim hormone, at a dosage of 0.5 ml/kg of fish body weight. The injected fish were left in the tank for a latency period of 10 hours. The male were sacrificed and dissected to remove the gonad from where the milt were released into an already prepared physiological saline solution containing 9 g of salt in 100cl of water. Ovulated eggs were stripped off the female genitalia by applying gentle pressure on the abdomen into another sets of labelled petri dishes and fertilised.

The incubation tanks containing reasonable amount of clean water and strands of sack or kakaban. Fertilization was carried out by selectively pouring the milt on the eggs and gently mixing together using quill feathers. The intraspecific crosses were carried out in duplicates as follows: Snout Mouth x Snout Mouth; Snout Mouth x Normal Mouth; and Normal Mouth x Normal as control. Commencement of hatching was noticed after 28 hours of fertilization. 24 hours later, eggs were sorted as dead eggs which were characterised by whitish colour were carefully removed from the abdomen. Larvae were not fed for about three days while they fed on the yolk sac attached to their abdomen. Later feeding with Artemia commenced and was fed to the larvae twice daily until the yolk sac was absorbed. The daily survival rate of the larvae was recorded.

The fry were later sorted and redistributed for the commencement of weekly monitoring of growth and development. Artemia feed was replaced with Raanan feed (Bnot Harel Limited, Israel) containing 56 % crude protein, on the second week of fry rearing. Weekly monitoring continued for the next twelve weeks and data on the growth parameters were recorded. Waters were changed thrice a week, and in few occasions, more than thrice, whence water was too dirty or foaming.

Statistical Analysis: Data collected were processed and analysed. The means were computed and level of significance tested based one way analysis of variance (ANOVA), using Microsoft Excel program.

RESULTS

The crosses between the normal parents (NM x NM), had the highest hatchability rate of 64.44 %, while the cross between the deformed parents (SM x SM) had the least rate of 38.02 % (Table 1). Equally presented on the table were the types of deformity observed among the progenies of the three crosses. There was no snout deformity in all the three crosses.

Table 1: Total number of eggs fertilized, percentage hatchability and hatchability rates recorded in each cross

Crosses	Number of Fertilized Eggs	Number of Hatchlings	Hatchability Rates (%)
Snout mouth x Snout mouth	4316	1641	38.02
Snout mouth x Normal mouth	6200	2790	45.00
Normal mouth x Normal mouth	5582	3597	64.44

At the end of the ten days of monitoring the survival rate, fry from the normal parent crosses had the highest rate of survival of 78.27 ± 2.95 %, while those from the crosses involving a deformed and normal parent had the least survival of 69.92 ± 3.32 % significant at $p<0.05$. The progression in the survival rate over the course of the ten days of monitoring is presented in Figure 2.

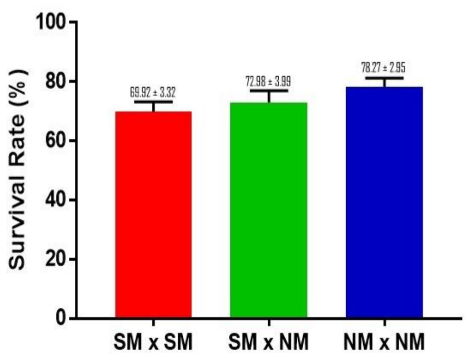

Figure 2: Percentage daily survival rate of progenies from the three crosses of *Clarias gariepinus*. *Key:* *SM x SM = Snout mouth x Snout mouth, SM x NM = Snout mouth x Normal mouth and NM x NM = Normal mouth x Normal mouth*

The weight and length monitoring yielded a different result as the progeny from the deformed parents had the best growth performance with mean weight and length of 3.941 ± 0.56 g and 4.84 ± 0.89 cm at the end of the twelfth week (Figure 3). The least value was observed in the crosses between deformed and normal parents which recorded 2.477 ± 0.16 g and 3.34 ± 0.50 cm respectively, though close with the value of 2.612 ± 023 g and 3.50 ± 0.66 cm respectively recorded from the progenies of parents without cephalic deformity (Figure 4).

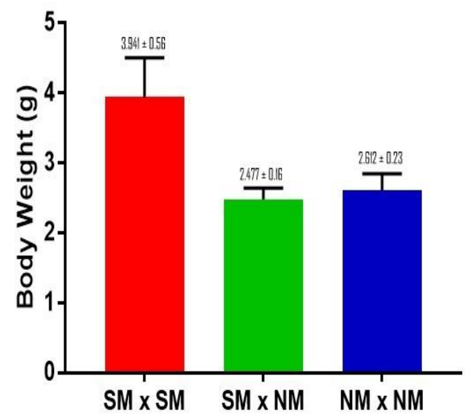

Figure 3: The mean body weight (g) from the three crosses of *Clarias gariepinus* for twelve weeks. *Key:* *SM x SM = Snout mouth x Snout mouth, SM x NM = Snout mouth x Normal mouth and NM x NM = Normal mouth x Normal mouth*

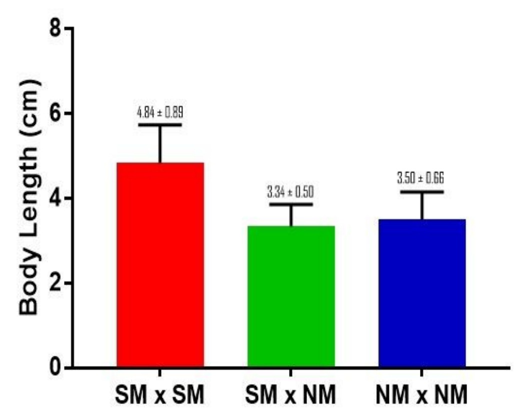

Figure 4: The mean body length (cm) from the three crosses of *Clarias gariepinus* for twelve weeks. *Key:* *SM x SM = Snout mouth x Snout mouth, SM x NM = Snout mouth x Normal mouth and NM x NM = Normal mouth x Normal mouth*

DISCUSSION

The difference in the hatchability rate between the groups suggested that snout mouth deformity might have an effect on the hatchability rates, since the only group with relatively high hatchability rate of 64.44 % was from the crosses involving normal parents. The deformity probably had slowed the rate of recovery from stress of transportation in the cephalic abnormal parents which had an effect on the viability of some eggs. Pottinger *et al.* (1995) had reported that degree of stress in female affect the quality of eggs in induced spawning. Snout mouth deformity, according to the results obtained from this work did not have lethargic or limiting effect on the growth rate of *C. gariepinus*. In fact, the growth rate in the fry from deformed parents were high with an average weight and length of 3.941 ± 0.56 g and 4.84 ± 0.89 cm compared with other crossing groups in this study, that one may be quick to say that deformity may have played an advantageous role in their growth. However, higher than in the control group, the data is inferior compared to previous studies (Nguenga *et al.*, 2000; Adebayo, 2006; Ataguba *et al*. 2009). This may be due to seasonal difference as this study was carried out during the dry harmattan period. Ataguba *et al*. (2009) had earlier highlighted breeding season as one of the factors that influence the hatchability, survival and growth performance of *C. gariepinus*. The lack of occurrence of cephalic abnormality in the progenies from all the crosses suggested that, the deformity is not genetic. The few instances of deformity may have been as a result of physically and/or environmentally induced. Environmental causes can be from fluctuation in temperature (Lawanson and Ishola, 2010). Exposure of brood stocks to stress can also leads to deformities in their progenies (Jensen, 1996).

Conclusion: Though, Snout Mouth deformity in brood stocks may have affected factor on the hatchability rate and probably the survival rate of young fry, it doesn’t have a limiting influence on the growth performance of the progenies. However, low hatchability will lead to low yield for fish farmers and inadequacy for the consumers.

REFERENCES

ADEBAYO, O. T. (2006). Reproductive performance of African clariid catfish *Clarias gariepinus* brood stock on varying maternal stress. *Journal of Fisheries International*, 1(1-2): 17 – 20.

ADEWUNMI, A. A. and OLALEYE, V. F. (2011). Catfish culture in Nigeria: progress, prospects and problems. *African Journal of Agricultural Research,* 6(6): 1281 – 1285.

ALARAPE, S. A., HUSSEIN, T. O., ADETUNJI, E. V. and ADEYEMO, O. K. (2015). Skeletal and other morphological abnormalities in cultured Nigerian African Catfish (*Clarias gariepinus,* Burchell 1822). *International Journal of Fisheries and Aquatic Studies*, 2(5): 20 – 25.

ALUKO, P. O., AWOPETU, J. I. and ADEOLA, A. O. (2001). Genetic basis of pectoral fin deformities in the African catfish *Clarias gariepinus* (Burchell, 1822), *Heterobranchus longifilis* (Valenciennes 1840) and their hybrids. *Aquaculture Research*, 32(1): 21 – 27.

ATAGUBA, G. A., ANNUNE, P. A. and OGBE, F. G. (2009). Induced breeding and early growth of progeny from crosses between two African clariid fishes, *Clarias gariepinus* (Burchell) and *Heterobranchus longifilis* under hatchery conditions. *Journal of Applied Biosciences*, 14(1): 755 – 760.

BENGTSSON, B.E., BENGTSSON, Å. and HIMBERG, M. (1985). Fish deformities and pollution in some Swedish waters. *Ambio*, 14: 32 – 35.

FAGBUARO, O. and OSO, J. A. (2011). Skeletal malformations among the *Clarias* species from fish mongers in Ekiti State. *Continental Journal of Fisheries and Aquatic Science*, 5(2): 32 – 37.

FAGBUARO, O. (2009). Inbreeding of mouth malformed and crocked back *Clarias gariepinus*. *Journal of Agriculture*

Science and Technology, 3(12): 44 – 50.

HUISMAN, E. A. and RICHTER, C. J. J. (1987). Reproduction, growth, health control and aquacultural potential of the African catfish, *Clarias gariepinus* (Burchell 1822). *Aquaculture*, 63(1-4): 1 – 14.

JENSEN, A. L. (1996). Beverton and Holt life history invariants result from optimal trade-off of reproduction and survival. *Canadian Journal of Fisheries and Aquatic Sciences*, 53(4): 820 – 822.

LAWSON, E. O. and ISHOLA, H. A. (2010). Effects of cold shock treatment on the survival of fertilized eggs and growth performance of the larvae of African mud catfish, *Clarias gariepinus* (Burchell, 1822). *Research Journal of Fisheries and Hydrobiology*, 5(2): 85 – 91.

LIEN, N. T. H., ADRIAENS, D. and JANSSEN, C. R. (1997). Morphological abnormalities in African catfish (*Clarias gariepinus*) larvae exposed to malathion. *Chemosphere*, 35(7): 1475 – 1486.

MANCINI, P. L., CASAS, A. L. and AMORIM, A. F. (2006). Morphological abnormalities in a blue shark *Prionace glauca* (Chondrichthyes: Carcharhinidae) foetus from Southern Brazil. *Journal of Fish Biology*, 69: 1881 – 1884.

NGUENGA, D., TEUGELS, G. G. and OLLEVIER, F. (2000). Fertilization, hatching, survival and growth rates in reciprocal crosses of two strains of an African catfish *Heterobranchus longifilis* Valenciennes 1840 under controlled hatchery conditions. *Aquaculture Research*, 31(7): 565 – 573.

OLATUNJI-AKIOYE, A. O., ADEYEMO, O. K. and AKOMOLAFE, O. T. (2010). Photographic and radiographic study of osteological abnormalities of the head of adult African catfish (*Clarias gariepinus*). *International Journal of Morphology*, 28(3): 719 – 722.

OSMAN, A. G., WUERTZ, S., MEKKAWY, I. A., EXNER, H. J. and KIRSCHBAUM, F. (2007). Lead induced malformations in embryos of the African catfish *Clarias gariepinus* (Burchell, 1822). *Environmental Toxicology*, 22(4): 375 – 389.

POTTINGER, T. G., BALM, P. H. M. and PICKERING, A. D. (1995). Sexual maturity modifies the responsiveness of the pituitary-interrenal axis to stress in male rainbow trout. *General and Comparative Endocrinology*, 98(3): 311 – 320.

SUBBA, B. R. (2004). Anomalies in bighead carp *Aristichthys nobilis* and African catfish *Clarias gariepinus* in Biratnagar, Nepal. *Our Nature*, 2(1): 41 – 44.

TRESURE, J. (1992). Vertebral anomalies associated with *Myxobolus* sp. in perch, *Perca fluvialitis* L., in a Scottish loch. *Bulletin of European Association of Fish Pathologist*, 12(2): 63 – 66.