Nigerian Journal of Fisheries and Aquaculture 4(1): 22 – 27, May 2016

Department of Fisheries, Faculty of Agriculture, University of Maiduguri, Nigeria
Available on line: http://www.unimaid.edu.ng
ISSN-2350-1537

Growth and Survival of Normal Coloured and Albino *Clarias gariepinus* and their Reciprocal Hybrids

*[1]Onyia, U. L. [2]Ochokwu, I. J and Akume, [1]C. P.
Department of Fisheries, Modibbo Adama University of Technology, Yola Adamawa State, Nigeria.
Department of Fisheries and Aquacultural Technology, Federal University, Dutsinma, Katsina State Nigeria.

Received April 6, 2016 Accepted March 25, 2016

ABSTRACT
The study was carried out to evaluate growth, survival, and condition factors of normal colour *Clarias gariepinus* (NCg), albino *Clarias gariepinus* (ACg) and their reciprocal hybrids. Broodstock of normal and Albino *C. gariepinus* (1000g and 5000g, respectively) were collected from Department of Fisheries Teaching and Research fish farm and Wisdom Farm in Yola Adamawa, respectively. The hatchlings were randomly selected and stocked at 20 hatchlings/tank (50litres capacity) and reared for six weeks. At the end of the experiment, the cross between NCg x ACg had the highest (488.00±73.60mg) final weight followed by the reciprocal hybrids (ACg x NCg) with 421.00±64.79mg, the ACg x ACg 385.67±54.26mg and NCg x NCg with 366.33±55.94mg. There was no significant difference ($p>0.05$) in final weight among the entire crosses. The offspring of ACg x NCg had the best length (26.57±2.99mm), followed by ACg x ACg (26.67±2.90mm), NCg x NCg (25.53±2.65mm) and ACg x NCg (22.13±2.36mm). The normal *C. gariepinus* had the highest (55.00±6.89%) percentage survival, followed by ACg (50.00±6.94%). Both hybrids had better condition factor than two parent stock. Based on result of this study, albinos *Clarias gariepinus* appear to have the growth characteristics with normal coloured *Clarias gariepinus*. The likely set back could be with the survival rate of albino *Clarias gariepinus*.

Key words: Albino, normal colour, *Clarias gariepinus*, hybrids, growth and survival

INTRODUCTION

Variation in phenotypes for qualitative traits can be discrete, all or none type expression, black or white. For example, an individual is either albinistic or normal coloured. These traits are usually a result of gene expression from a single or only a few loci. Coloration and deformities are examples of qualitative traits. Qualitative traits such as changes in colour, finnage, scale pattern or deformities can be desirable or detrimental in aquaculture. Obviously, qualitative traits are important and the primary basis for the ornamental aquaculture industry (Dunham, 2011).

Albino African catfish are like all other animal albinos that is as a result of a genetic anomaly that causes the fish to lack pigment and thereby appear white (Sazima and Pombal Jr, 1986). There exist albino specimens of all Channel and African catfish species in the wild but the light coloration makes them easier to spot by predators and it is therefore uncommon with adult albino Channel catfish in the wild. Albinism results from discontinuous genetic variation generated by the inability of or absence of genes that determine the production of the dark pigment melanin in in human or fish skin cells (Griffiths *et al.*, 2002). In most fish, the absence of colours is related to mutations of the tyrosinase genes, where the skin of Channel catfish albinos lack melanin and eye development is affected (Wang *et al.*, 2007). There are also cases of albinism that are as a result of chromatic anomalies with total or partial depigmentation (Sazima and Pombal Jr, 1986). There are several reports of instances of albinism in Rainbow trout, Cory catfish, Toadfish and *Tanakia signifer* (Sazima and Pombal Jr, 1986; Teixeira and Arau´jo, 2002; Bottaro *et al.*, 2005; Brito and Caramaschi, 2005; Reum *et al*., 2008; Delgado *et al*., 2009).

According to Dunham 2011, coloration, deposition of melanin in fish, is a series of biochemical processes. Blocking the process with a homozygous recessive genotype early in the pathway has

*Corresponding Author: email: luconyia@gmail.com, Tel: +2348062086695

maximum phenotypic alteration; for example, albinism in rainbow trout. If the reaction passes that step, the phenotype changes, green coloration, but if a homozygous recessive disrupts the catalysis at the next step, green is the final product. If there is at least one dominant allele at each locus, all steps of the pathway are completed resulting in the normal dark phenotype. Epistasis is the basis of some colour types in fish. For instance, it is the explanation for some red and black colour variants in tilapia. Scale pattern in common carp is also influenced by epistatic gene action (Tave, 1993).

Albino Channel catfish are much more common in captivity where this trait is not negative for their survival. They are to the contrary often very appreciated as albino Channel catfish and in many ways are valued as superior to normal coloured Channel catfish in captivity. There are several reasons behind the fact that albino Channel catfish are appreciated when breeding catfish commercially. Albino African catfish is not common in the wild but occasionally could occur in artificial production of fingerlings in the hatcheries. There is no known record presently in literature of albino African catfish *Clarias gariepinus.* It therefore becomes necessary to multiply and evaluate the performance of available albino African catfish *Clarias gariepinus.* The objectives of this study are to investigate the growth and survival of normal colour, albino and their hybrids; as well as its influence on albinism and hybridization.

MATERIALS AND METHODS

Study of area

The study was conducted in the fish hatchery of Department of Fisheries, Teaching and Research farm, Modibbo Adama University of Technology Yola, Adamawa State, Nigeria. Adamawa State is in North Eastern part of Nigeria; it is one of the largest states in Nigeria and occupies land size of about 36,917 square kilometres. It is bordered by the states of Borno to the northwest, Gombe to the west and Taraba to the southwest. Its eastern border forms the national eastern border with Cameroon. Adamawa is a mountainous land crossed by the large river valleys Benue and Gongola. It is located on latitude 9.20 – 9.33^0N, longitude 12.30 – 12.50^0E and an altitude of 185.9m. It has an average annual rain fall of about 759mm with maximum temperature of 39.7^0C. The rainy season run from May through October, while the dry season commences November and ends in April. The driest months of the year are January and February when the relative humidity drops to 13% (Canback Global Income Distribution Database, 2014).

Source of broodstock

Male and female Albino brood fish weighing 3000g each were purchased from Tiva Fish Farm Nigeria Limited, Numan road Yola while the normal pigmented male and females weighing 1000g each were collected in the Department of Fisheries, Teaching and Research Fish, Modibbo Adama University of Technology Yola. The Albino broodstock were acclimatized for one week in concrete tanks of 2m x 1.5 m. During the period of acclimatization, they were fed with 35% crude protein diet twice daily at 3% body weight.

Induce breeding

The broodstock were induced by injecting with Ovaprim at 0.5ml/kg fish. After latency period the eggs from the females were stripped into dry receptacle. The males were sacrificed and testes collected to fertilize the eggs. The crosses were done in triplicates: Normal male x Normal female (♂NCg x ♀ NCg), Albino male x Albino female (♂ACg x ♀ ACg), Normal Male x Albino female (♂N x A♀ Cg)) Albino male x Normal female (♂A x N♀ Cg).

Feeding of hatchlings

Twenty-four (24) days old hatchlings were randomly selected and stocked in each plastic bowl containing 30ml of water in triplicates. Hatchlings were fed ad-libitum five times daily with Artemia diet at 7% of body weight after three days when the yolk sac has been completely absorbed for two

weeks. Thereafter, they were fed with 0.2mm, 0.8mm 1.5mm and 2mm Coppens feed as the weight increased for six weeks. The feed quantity was adjusted based on the weekly random sampling of the weight of 5 fry from each treatment and multiplied to give the total weight of the fish as well as the quantity of feed required.

Growth parameters

At the end of the rearing period the final weight (g), length (mm) and feed consumed were recorded for each treatment. Analytical balance with precision of 0.01 g (model: Scout Pro SPU123, Ohaus Corporation, USA). was used to record body wet weight. Growth indices were estimated using the following formulae:

(i) % Fertilization = Total number of fertilized eggs/total number incubated x 100
(ii) % Hatchability = Total number of hatched egg/ Total number of incubated eggs
(iii) Weight gain = Final weight minus (-) Initial weight
(iv)Mean daily weight gain = Final weight – Initial weight/Culture period in days
(v) Relative growth rate (RGR) = Log_e (Final weight) – Log_e (Initial weight)/ Culture period
(vi) Specific growth rate (SGR) = Log_e (Final weight) – Log_e (Initial weight)/ Culture period days×100
(vii) Condition factor (K) = $W \times 100/ L^3$, Where, W=weight of fish (mg), L=Length of fish (mm).
.(viii) Feed conversion ratio (FCR) = Total feed (mg)/ final gain (mg)
(I) Survival Rate = Final number of fish/ Initial number of fish × 100

Statistical analysis

Statistical software SPSS 20 was used for the analysis. Data obtained from the experiment were subjected to one-way analysis of variance (ANOVA). The difference between the means were determined using Least Significant Difference (LSD) at 95% confidence level ($P<0.05$).

RESULTS

The results of fertilization and hatchability of ACg x ACg, NCg x NCg, ACg x NCg and NCg x ACg crosses in *Clarias gariepinus* is shown in Table 1. The highest percentage fertilization was in NCg x ACg (79.95±3.30) while other were ACg x NCg (76.65±6.65), NCg x NCg (68.35±1.65) and ACg x ACg(68.3±5.00). There was significant variation ($p<0.05$) in the fertilization of the respective treatments. The highest percentage hatchability was recorded in ACg x Acg (81.0%) while Ncg x NCg,ACg x NCg and NCg x ACg had 80.0%,72.0% and 76% respectively. There was significant variation ($p<0.05$) in the hatchability of the respective treatments.

Table 1: Mean Hatchability and percentage fertilization of albino, normal colour *C. gariepinus* and their hybrids

Parameters	**Cross combinations**			
	♂ACg x ♀ACg	**♂NCg x ♀Ncg**	**♂ACg × ♀NCg**	**♂NCg × ♀ACg**
Hatchability (%)	1.00±11.00[a]	80.00±2.00[a]	72.00±12.00[c]	76.00±16.00[b]
Fertilization (%)	68.3±5.00[c]	68.3±1.65[c]	76.65±6.65[b]	79.95±3.30[a]

Means with the same superscript in the same row are not significantly different ($p>0.05$)

Table 2 shows the growth performance and survival rate. The highest final weight was recorded in NCg x ACg culture tank (488.00±73.60 mg), followed by ACg x NCg (421.00±64.79 mg), ACg (385.67±54.26 mg) and NCg (366.33±55.94 mg). There was no significant difference ($p>0.05$) in the final weight among the entire treatments. Final length in NCg x ACg were higher (26.57±2.99 mm), followed by those of Acg (26.47±2.90 mm), Ncg (25.53±2.65 mm) and ACg x NCg (22.13±2.36 mm). There was a significant variation ($p<0.05$) in final length in the entire genetic mating. The condition factors (K) were higher in ACg, followed by NCg, ACg x Ncg and NCg x ACg with2.07±0.89, 2.20±0.39, 3.68±0.56 and 2.60±0.31. Significant variation ($p<0.05$) was observed between the K of ACg x NCg compared to the rest treatments. Mean daily weight gain (MDWG) was higher

(11.82±1.82mg) in NCg x ACg followed by those of ACg x NCg (9.87±1.65 mg), ACg (9.03±0.96mg) and the least was observed in NCg with (8.57±1.36mg). Mean daily weight gain was significantly ($p>0.05$) different in crosses between NCg x ACg values compared to the rest of the treatments. The relative growth value among the entire mating were not significantly ($p<0.05$) different from each other. The specific growth rate was highest in the ACg 14.50±1.86 %/day, followed by NCg 12.17±1.05 %/day, NCg x ACg 12.00±1.12 %/day and ACg x Ncg (10.33±1.26 %/day). The survival rate was highest at the NCg culture tank (55±6.89 %/day), followed by ACg (50±6.94 %/day), NCg x ACg (30±9.87 %/day) and ACg x NCg (20±11.22 %/day). No significant difference ($p>0.05$) was observed in the feed conversion ratio value among the entire treatments.

Table 1: Growth Parameters and survival rate of albino, normal colour *C. gariepinus* and their hybrids

Growth indices	Cross combination			
	♂ACg x ♀ACg	**♂NCg x ♀NCg**	**♂ACg x ♀NCg**	**♂NCg x ♀ACg**
Initial weight (mg)	6.33±0.00	6.33±0.00	6.33±0.00	6.33±0.00
Final weight (mg)	385.67±54.26^a	366.33±55.94^a	421.00±64.79^a	488.00±73.60^a
Initial length (mm)	4.97±0.05^a	5.87±0.08^a	5.90±0.05^a	5.67±0.05^a
Final length (mm)	26.47±2.90^a	25.53±2.65^a	22.13±2.36^b	26.57±2.99^a
Condition factor (K)	2.07±0.89^a	2.20±0.39^a	3.68±0.56^c	2.60±0.31^a
MDWG (mg/day)	9.03±0.96^a	8.57±1.36^a	9.87±1.65^a	11.82±1.82^b
RGR (g/day)	0.15±0.02^a	0.12±0.01^a	0.10±0.01^a	0.12±0.01^a
SGR (%/day)	14.50±1.86^a	12.17±1.05^b	10.33±1.26^c	12.00±1.12^b
FCR	0.155±0.05^a	0.147±0.07^a	0.140±0.06^a	0.118±0.04^a
SR (%/day)	50±6.94^a	55±6.89^a	20±11.22^c	30±9.87^b

Means with the same letters within a row are not significantly different ($p>0.05$

Table 3 shows the water quality parameters recorded during the experiment. The dissolved oxygen (DO) level recorded were: ACg x ACg 6.32±0.43, NCg x Ncg 5.65±0.40, ACg x NCg 6.87±0.48 and NCg x ACg 7.08±0.73. There was no significant ($p>0.05$) difference observed among the parameters. The pH of all the culture tanks was slightly acidic: ACg x ACg (6.63±0.21), NCg x NCg (6.42±0.15), ACg x NCg (6.20±0.24) and NCg x ACg (6.43±0.17) with no significant difference ($p>0.05$). The temperature recorded in all the culture tanks during the study was very low, 19^0C in tanks used for rearing ACg x Acg, while that of NCg x NCg and ACg x NCg has 18.88^0C and 18.53^0C respectively.

Table 3: Water Quality Parameters during the experiment

Parameters	**Cross combination**			
	ACg	**NCg**	**ACg x NCg**	**NCg x ACg**
Dissolved Oxygen (mg/l)	6.32±0.43^a	5.65±0.40^a	6.87±0.48^a	7.08±0.73^a
pH	6.63±0.21^a	6.42±0.15^a	6.20±0.24^a	6.43±0.17^a
Temperature (°C)	19.00±0.45^a	18.88±0.43^a	18.53±0.53^a	19.00±0.37^a

Means with the same letters within a row are not significantly different ($p>0.05$)

DISCUSSION

The higher growth performance Albino *Clarias gariepinus* in the study differed from the work of Karatas and Kocaman (2014), who reported that normal coloured Rainbow trout had the highest growth in weight(19.3±0.02g) among the albino(17.2±0.03g) and mixed albino and normal coloured(15.3±0.05g). However, the result of this present study that revealed that albino *C. gariepinus* fry had higher growth than the normally coloured, agree with the work of Bondari (1984), who reported that normal coloured Channel catfish were not superior in growth to albino fish in growth. Bridges and Von Limbach (1972) suggested that the albinos were not substantially different from normally coloured cousins in qualities such as fecundity, survival and growth rate. Okumus *et al*. (2001) stated that growth was similar in both albino and normally pigmented Rainbow trout in the first four months but normally

pigmented surpassed the albino. However, Prather, (1961) revealed that there were no significant variations in the growth rate between Albino and Normal channel catfish. The differences in growth performance of albino and normal color specimen can be attributed to pigmentation and its possible pleiotropic effect (Okumus *et al*., 2001). The high feed conversion ration recorded in this study, varied with the findings of Karatas and Kocaman (2014) in their work on Rainbow trout. The survival rate (SR) in this study tend to agree with the work of Prather (1961), who worked on Albino and normal coloured Channel catfish. He observed that Albino catfish had lower survival rate in comparison to normal Channel catfish. This higher mortality rate is a distinct disadvantage of the albinos.

Conclusion

Based on result of this study, albinos *Clarias gariepinus* appear to have the growth characteristics with normal coloured *Clarias gariepinus*. The likely set back could be with the survival rate of albino *Clarias gariepinus*. The Albinism influenced the colour of the reciprocal hybrids and this could further lead to consumers' preference. Production of albino fingerlings could serve as a variety that fish farmer will appreciate to culture because of its scarcity.

REFERENCES

Bondari, K. (1984). Comparative of albino and normal pigmented Channel catfish in tanks, cages and ponds. *Aquaculture* 37:293-301.

Bottaro M., Ferrando S., Gallus L., Girosi L. and Vacchi M. (2005). First record of albinism in the deep water shark *Dalatias licha.* JMBA Biodiversity Records, published on-line.

Bridges, W. R. and Von Limbach (1972). Inheritance of albinism in rainbow trout. *The Journal of Heredity*, 63:152-153.

Brito, M.F.G. and Camaraschi E.P. (2005) An albino armored catfish *Schizolecis guntheri* (Siluriformes: Loricariidae) from an Atlantic forest coastal basin. *Neotropical Ichthyology*, 3:123- 125.

C-GIDD, (Canback Global Income Distribution Database), (2008). Canback Dangel. Retrieved on 29, May 2016.

Delgado J., Carvalho D., Sousa R., Ferreira S. and Aveiro M.J. (2009). First record of albinism in the Deep water black scabbard-fish *Aphanopus carbo* (Trichiuridae) off Madeira. *Journal of Applied Ichthyology*, 25:483–484.

Dunham, R.A (2011). Aquaculture and Fisheries Biotechnology: Genetic Approaches, 2nd Edition CABI Nosworthy Way Wallingford Oxfordshire OX10 8DE UK.

Griffiths A. J.F., Miller J. H., Suzuki D.T., Lewontin, R.C. and Gelbart, W.M. (2002). An Introduction to Genetic Analysis. 7th edition. New York: W.H. Freeman and Co.

Karatas, T. and Kocaman, E. M. (2014). Growth and feed conversion ratios of Albino and Normal pigmented Rainbow Trout (*Oncorhynchus mykiss*). *International Journal of Fisheries and Aquatic Studies* 2(2):64-66.

Okumus, I., Degirmenci, A., Bascinar, N. and Celikkale, M. S. (2001). Comparative, Approximate Biochemical Composition and Consumer preference of Albino and Normally pigmented varieties of Rainbow Trout (*Oncorhynchus mykiss*). *Turkish Journal of Fisheries and Aquatic Sciences* 1:23-28.

Prather, E. E. (1961). *A Comparison of Production of Albino and Normal Channel Catfish.* Auburn University Agricultural Experiment Station Auburn, Alabama. 1- 4.

Reum J. C. P., Paulsen C. E., Pietsch T.W. and Parker-Stetter S. L. (2008). First record of an albino Chimaeriform fish, Hydrolagus colliei.Northwestern *Naturalist* 89: 60–62.

Sazima I. and Pombal, J. Jr (1986) Um albino de Rhamdella minuta, com notas sobre comportamento (Osteichthyes, Pimelodidae). *Revista Brasileira de Biologia*, 46:377– 381.

Tave, D. (1993). *Genetics for Fish Hatchery Managers.* 2nd edition, Van Nostrand Reinhold, New York, 415Pp.

Teixeira S.F. and Arau´jo M. L. G. (2002). First record of albinism in the dogfish Mustelus schmitti

Springer, 1939 (Carcharhiniformes–Triakidae) from southern Brazil. *Brazilian Archives of Biology and Technology* 45: 241–243.

Wang J., Hou L., Zhang R., Zhao X., Jiang L., Sun W., An, J. and Li, X. (2007). The tyrosinase gene family and albinism in fish. *Chinese Journal of Oceanology and Limnology* 25:191- 198.