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Comparative studies on growth potentials of parents and hybrids of *Clarias gariepinus* (African mud catfish)

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Abstract

This study examines the growth potentials of *Clarias gariepinus* (African catfish) with normal and snout mouth deformities under controlled indoor hatchery conditions in three senatorial districts of Ekiti State, Nigeria. Sixteen cross-breeding combinations of parental and hybrid strains were analyzed for body weight, body length, and deformities over 13 weeks. Results indicate that normal mouth strains, particularly from Ado-Ekiti, demonstrated the highest growth rates, reaching 50.64 g in body weight. Hybrids displayed intermediate performance, while snout mouth deformities hindered growth potential. The findings emphasize the importance of selecting genetically sound broodstock for aquaculture to enhance productivity and profitability

Keywords: *Clarias gariepinus* (Cat fish); Growth potentials; Hybrids; Hatchery conditions

1. Introduction

The rearing of *Clarias gariepinus*, which was reported to have started in the early 1970s in central and western African countries, has been reported to have received wide acceptance because of its suitability for aquaculture and its high economic value (Awe, 2017). For these reasons, it has gained popularity amongst fish farmers, and it is said to be the most widely cultured fish in Nigeria and even in Africa (Adewumi and Olaleye, 2011; Awe, 2017) because of its hardiness in the face of harsh climatic condition, disease resistance and its maturity (Huisman and Richter, 1987; Awe, 2017).

Genetic abnormalities (Bengtsson, *et al*., 1985), parasitic infection (Tresure, 1992), traumatic injury (Leary, *et al.* 1991) deformities (Tave and Handwerker, 1992) have also been reported to be caused by non-inheritable congenital defects which has also been implicated by researchers to be the causes of morphological deformities in fish (Awe, 2017).These limiting factors has not only limited aquaculture production but has also been reported to cause diseases and physical deformations in catfish (Osman *et al.,* 2007; Lawanson and Ishola, 2010; Awe, 2017).

Studying growth potentials of fish species, such as *Clarias gariepinus*, holds significant implications for aquaculture management, genetic improvement, and conservation efforts. Studying the relationship between genetic variations and growth potentials helps in identifying genetic markers associated with these traits. This enables the use of molecular tools, such as genetic markers or genomic selection, to facilitate the identification and selection of superior individuals for breeding, accelerating the genetic improvement of the species.

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Comparative studies on growth potentials provide insights into the health and vitality of fish populations. By monitoring these parameters, conservationists can assess the population dynamics of the species. This information is crucial for identifying population declines, implementing conservation measures, and developing effective management strategies for sustainable exploitation.

Several factors have however been proposed to explain skeletal deformities in hatchery reared fish larvae because of the high frequencies of deformities, often associated with reduced growth and viability (Hilomen-Garcia, 1997; Kitajima *et al.,* 1994). However, the most probable cause seems to be the existence of unfavourable abiotic and rearing conditions (Daniel *et al*., 2020) but nutritional deficiencies (Cahua *et al*., 2003), have also been implicated. Aquaculture has a lot of untapped potentials in Nigeria, it is therefore expedient that stocks be taken to ensure the sustainability of aquaculture development. Additionally, for continued aquaculture promotion and profitability, reduction of abnormalities in hatchery-reared fish is very important (Daniel *et al*., 2020). Hence the aim of this study is to determine the growth rates of normal and affected offspring of *Clarias gariepinus*

2. Material and methods

2.1. Study Areas

The study areas consists of ABUAD Fish Farm in Ado-Ekiti representing Ado Local Government Area, Ayenco Farm in Ido-Ekiti representing Ido Osi Local Government Area and Owoeye Farm in Ikere Ekiti representing Ikere Local Government Area.

Ado-Ekiti is a city in Southwest Nigeria and it is the capital of Ekiti State. It is the headquarters of Ado Local Government Area of Ekiti State. Ado-Ekiti is located in Ekiti Central Senatorial District of Ekiti State.

Ido-Ekiti is the headquarters of Ido/Osi Local Government Area of Ekiti State and it is located in Ekiti North Senatorial District of Ekiti State.

Ikere-Ekiti is the headquarters of Ikere Local Government Area of Ekiti State and it is located in Ekiti South Senatorial District of Ekiti State.

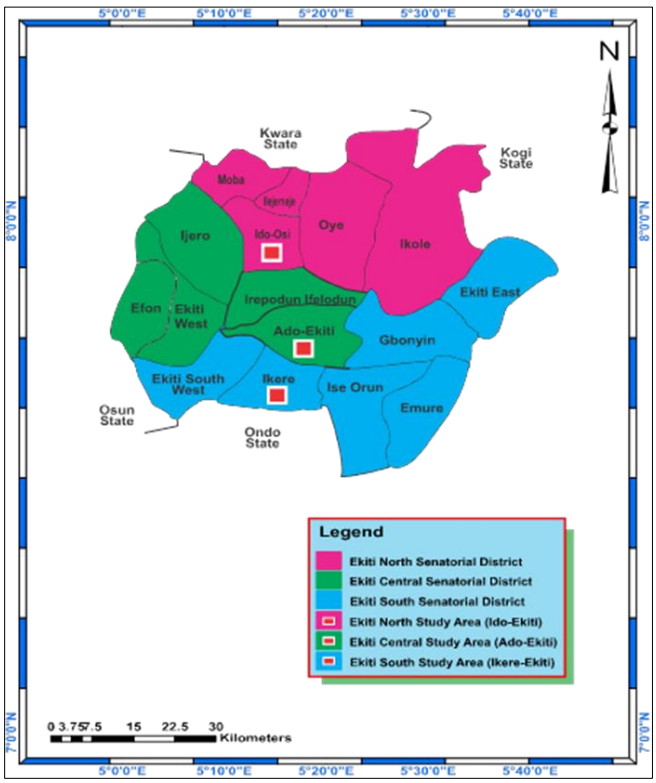

Figure 1 Study Areas in the three Senatorial Districts of Ekiti State, Nigeria (Source: Survey and Geoinformatics Department, Federal Polytechnic, Ado-Ekiti)

2.2. Experimental Site

The research was conducted at the Fish Hatchery Section, Department of Fisheries Technology, Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria.

2.3. Collection of Fish Samples

Matured Normal and deformed parent stocks of *Clarias gariepinus* were collected from the three sites above as the study area. The fish samples were transported in plastic kegs from the sites of collection to the experimental site at the Fish Hatchery Section, Department of Fisheries Technology, Federal Polytechnic, Ado-Ekiti, Ekiti State.

2.4. Fish Sorting

The fish samples were sorted according to sexes 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 acclimatized for 25 hours as described by Fagbuaro (2009).

2.5. Collection of Water Samples and Determination of Water Quality Parameters

Water samples were collected from the ponds at the three (3) Study Areas into three labelled sample bottles and were firmly corked. The key water quality parameters were tested and recorded with the following equipments in the Laboratory at room temperature: Temperature was measured with clinical thermometer; Dissolved Oxygen (DO_2) measured with Dissolved Oxygen met and Hydrogen Ion Concentration (pH) with a pH meter.

2.6. Fish Breeding

Preparation of incubation tanks and fish breeding were done following the methods described by Awe (2017). This involved female brooders being injected intramuscularly just below the dorsal fin with synthetic ovaprim hormone, at a dosage of 0.5 ml/kg of fish body weight. Afterwards, injected fish were left for a latency period of 8-10 hours. The male was sacrificed and the gonads were removed, the sperm sac was severed so as to release the milt into a saline solution containing 9 g of salt in 100cl of water. After the expiration of the latency period, the ovulated eggs were stripped off the female genitalia into another set of labelled petri dishes by applying slight pressure on the abdomen.

2.7. Fertilization and Incubation of Eggs

After the ovulated eggs were stripped, it was mixed with the milt released from the male gonad using a quill feather. In a bid to activate the sperms for maximum contact with the eggs, 10ml of saline water was added to the mixture (Daniel *et al.,* 2020). The fish samples collected were crossed for fertilization in the following sixteen (16) ways;

Table 1 Cross fertilization of collected fish samples

AD (♀) x AD (♂)	IK (♀) x ID (♂)	ID (♀) x AD (♂)	IK (♂) x NM (♀)
AD (♀) x IK (♂)	IK (♀) x AD (♂)	AD (♂) x NM (♀)	ID (♀) x NM (♂)
AD (♀) x ID (♂)	ID (♀) x ID (♂)	AD (♀) x NM (♂)	ID (♂) x NM (♀)
IK (♀) x IK (♂)	ID (♀) x IK (♂)	IK (♀) x NM (♂)	NM (♀) x NM (♂)

(AD = Ado-Ekiti; IK = Ikere-Ekiti; ID = Ido-Ekiti; NM = Normal Mouth; ♂ = Male: ♀=Female).

2.8. Fish Nursing/Rearing

The fry were sorted and redistributed into plastic tanks for the commencement of weekly monitoring of growth and development. Artemia feed was replaced with floating Aler Aqua feed containing 40 % crude protein, on the second week of fry rearing. Weekly monitoring continued for the next twelve weeks and data on the growth parameters (weight gain) were recorded. Water in the tanks was changed every 2 days to avoid accumulation of waste and foaming. Growth rate was recorded using the formula of Awe (2017).

Weight gain (WG) = Final weight of fish – Initial weight of fish

$$\text{Growth Rate} = \frac{\text{Weight Gain}}{\text{Number of days}} \times 100$$

2.9. Statistical Analysis

All data collected during the monitoring were processed and analyzed using Microsoft excel package (2016). The means were computed and levels of significance were tested based on one-way Analysis of Variance (ANOVA) at 5% significance level. The means were separated using Duncan's Multiple Range System

3. Results and discussion

Table 2 shows the mean body weight (g) from the sixteen mating groups of *Clarias gariepinus* with Snout and Normal Mouth obtained from three Senatorial Districts of Ekiti State after thirteen weeks of maintenance under indoor hatchery. The sixteen groups almost had uniform value in term of growth rate at the initial distribution for growth maintenance. By the seventh week of growth maintenance, the mating group of Ado and Ikere has the least growth performance (17.79g) compared with the growth performance of normal mouth strain with weight of 22.74g. At the end of the thirteenth week of growth performance, the normal mouth strain out grown other groups with 50.64g.

Table 3 shows the mean body length (cm) from the fry of sixteen mating groups of *Clarias gariepinus* from the three Senatorial Districts of Ekiti State with snout and normal mouth reared for thirteen weeks under indoor hatchery. The growth pattern record in the lengths of the sixteen groups corroborate the results recorded in the weights of the groups. Table 4 shows the water quality parameters of the three sample ponds and the indoor hatchery borehole of the experimental site. All the recorded values were within World Health Organisation Permissible Limits.

Table 5 shows the number of deformities recorded during the study. Figures 2 and 3 further shows the body weight (g) and body length (cm) of the fry of the sixteen mating groups of *Clarias gariepinus* with snout mouth and normal mouth and their intraspecific hybrids from three senatorial districts of Ekiti State reared for thirteen weeks under indoor hatechery

Table 2 Mean body weight (g) from the sixteen mating groups of *Clarias gariepinus* with snout and normal mouth obtained from three differentSenatorial Districts of Ekiti after thirteen weeks of maintenance under indoor hatchery

WEEKS	AD(♀) x AD(♂)	ID(♀) x ID(♂)	IK(♀) x IK(♂)	NM(♂) x NM (♀)	AD(♀) x ID(♂)	AD(♀) x IK(♂)	ID(♀) x AD(♂)	ID(♀) x IK(♂)	IK(♀) x AD(♂)	IK(♀) x ID(♂)	AD(♂) x NM (♀)	ID(♂) x NM (♀)	IK(♂) x NM (♀)	AD(♀) x NM (♂)	ID(♀) x NM (♂)	IK(♀) x NM (♂)
1	9.28 a	9.25 b	9.25 b	9.29 c	9.28 a	9.27 a	9.25 b	9.26 a	9.27 a	9.28 a	9.25 b	9.28 a	9.26 a	9.26 a	9.26 a	9.25 b
2	10.50 b	10.52 a	10.47 b	11.03 c	10.96 c	10.53 a	10.85 a	10.54 a	10.89 a	10.87 a	10.69 a	10.55 a	11.13 c	10.60 a	10.80 a	10.70 a
3	11.43 a	11.43 a	11.38 a	12.38 c	11.76 a	11.43 a	11.66 a	11.42 a	11.41 a	11.49 a	11.41 a	11.49 a	12.03 c	11.43 a	11.33 a	11.40 a
4	12.38 a	12.08 a	11.65 a	14.66 c	12.30 a	12.03 a	12.01 a	11.65 a	11.95 a	12.34 a	13.95 c	12.22 a	12.30 a	12.80 a	12.08 a	13.83 c
5	16.71 a	16.56 a	16.46 b	19.52 c	16.97 a	16.53 a	17.73 a	16.58 a	16.65 a	16.69 a	19.26 c	18.71 a	18.93 c	18.71 a	18.61 a	18.17 a
6	17.12 a	17.23 a	17.01 a	20.68 c	17.32 a	17.01 a	17.73 a	17.10 a	17.25 a	17.37 a	20.25 c	20.03 b	20.09 a	20.53 c	20.53 c	20.35 c
7	18.11 b	20.62 a	20.84 a	22.74 c	19.37 b	17.79 b	20.92 a	20.84 a	20.89 a	20.94 a	21.89 a	21.66 a	20.49 a	23.11 c	21.11 a	21.39 a
8	19.31 b	23.51 a	22.94 a	23.92 a	21.82 a	18.78 b	23.56 a	23.22 a	23.23 a	23.81 a	23.23 a	23.34 a	21.19 a	23.31 a	23.01 a	23.10 a
9	20.46 b	25.08 a	24.21 b	27.64 c	26.62 a	19.48 b	25.10 a	24.98 a	24.47 a	25.35 a	27.47 a	26.96 c	25.49 a	26.16 a	26.76 a	26.67 a
10	22.65 b	27.60 a	27.90 a	32.55 c	28.52 a	21.58 b	27.52 a	27.37 a	27.37 a	28.63 a	31.37 a	31.45 a	31.19 a	31.35 a	31.61 a	31.54 a
11	24.80 b	31.38 a	30.36 a	38.43 c	30.92 a	23.96 b	30.99 a	31.21 a	30.91 a	31.32 a	36.91 c	36.60 a	35.91 a	36.23 a	36.80 a	36.20 a
12	26.01 b	32.84 a	31.10 a	42.58 c	32.64 a	25.25 b	32.98 a	32.54 a	32.60 a	34.19 a	39.60 a	39.20 a	39.01 a	39.41 a	39.39 a	39.36 a
13	28.43 b	37.72 a	36.73 a	50.64 c	37.08 a	26.91 b	38.03 a	37.33 a	37.24 a	38.39 a	42.24 a	42.32 a	40.13 a	45.43 a	43.44 a	47.65 c

Note: The mean values in the same row but with different superscript are significantly different from each other (P≤ 0.05); **Key:** AD(♀) x AD(♂) Ado female x Ado Male, AD(♀) x IK(♂) Ado female x Ikere male, AD(♀) x ID(♂) Ado female x Ido male, IK(♀) x IK(♂) Ikere female x Ikere male, IK(♀)x ID(♂) Ikere female x Ido male, IK(♀) x AD(♂) Ikere female x Ado male, ID(♀) x ID(♂) Ido female x Ido male, ID(♀) x IK(♂) Ido female x Ikere male, ID(♀) x AD(♂) Ido femalex Ado male, AD(♂) x NM (♀) Ado male x Normal female, AD(♀) x NM (♂) Ado female x Normal male, IK(♂) x NM (♀) Ikere male x Normal female, IK(♀) x NM (♂) Ikere female x Normal male, ID(♂) x NM (♀) Ido male x Normal female, ID(♀) x NM (♂) Ido female x Normal male and NM(♂) x NM (♀) Normal male x Normal female

Table 3 Mean body length (cm) from the sixteen mating groups of *Clarias gariepinus* from three Senatorial Districts of Ekiti State with snout and normal mouth reared for thirteen weeks under indoor hatchery

WEEKS	AD(♀) x AD(♂)	ID(♀) x ID(♂)	IK(♀) x IK(♂)	NM(♂) x NM(♀)	AD(♀) x ID(♂)	AD(♀) x IK(♂)	ID(♀) x AD(♂)	ID(♀) x IK(♂)	IK(♀) x AD(♂)	IK(♀) x ID(♂)	AD(♂) x NM (♀)	ID(♂) x NM (♀)	IK(♂) x NM (♀)	AD(♀) x NM (♂)	ID(♀) x NM (♂)	IK(♀) x NM (♂)
1	1.28 [a]	1.35 [a]	1.37 [a]	1.40 [c]	1.30 [a]	1.25 [b]	1.33 [a]	1.24 [b]	1.29 [a]	1.36 [a]	1.38 [a]	1.30 [a]	1.26 [a]	1.36 [a]	1.36 [a]	1.40 [a]
2	2.38 [a]	2.08 [a]	1.76 [b]	2.77 [c]	2.30 [a]	2.03 [a]	2.01 [a]	1.76 [b]	1.96 [a]	2.35 [a]	2.96 [c]	2.22 [a]	2.23 [a]	2.38 [a]	2.08 [a]	2.83 [c]
3	2.71 [a]	2.67 [a]	2.31 [a]	3.77 [c]	2.93 [a]	2.23 [b]	2.63 [a]	2.31 [a]	2.06 [b]	2.79 [a]	3.06 [a]	2.71 [a]	2.93 [a]	2.71 [a]	2.71 [a]	2.17 [b]
4	3.63 [a]	3.23 [a]	3.17 [a]	5.16 [c]	3.32 [a]	2.93 [a]	3.92 [a]	3.10 [a]	3.26 [a]	3.37 [a]	3.26 [a]	3.03 [a]	3.09 [a]	3.63 [a]	3.63 [a]	3.36 [a]
5	6.11 [c]	3.72 [a]	3.85 [a]	6.01 [c]	3.37 [b]	3.09 [b]	3.73 [a]	3.85 [a]	3.89 [a]	3.95 [a]	5.89 [c]	5.77 [c]	3.59 [a]	6.11 [c]	5.11 [a]	5.39 [a]
6	6.31 [a]	5.61 [a]	4.95 [a]	6.37 [c]	4.82 [a]	3.59 [b]	5.00 [a]	4.67 [b]	5.23 [a]	5.81 [a]	6.23 [a]	6.35 [c]	5.19 [a]	6.17 [a]	6.01 [a]	6.10 [a]
7	7.17 [c]	6.08 [a]	5.21 [b]	7.91 [c]	5.72 [a]	5.19 [b]	5.52 [a]	5.02 [b]	5.57 [a]	6.28 [a]	6.57 [a]	6.97 [a]	5.59 [a]	6.31 [a]	6.77 [a]	6.77 [a]
8	7.76 [c]	6.70 [a]	5.67 [b]	7.80 [c]	6.62 [a]	5.59 [b]	6.12 [a]	5.27 [b]	6.37 [a]	6.83 [a]	7.37 [a]	7.11 [a]	6.19 [a]	7.23 [a]	7.71 [c]	7.65 [c]
9	7.80 [a]	7.38 [a]	6.37 [b]	8.29 [c]	6.92 [a]	6.19 [b]	6.99 [a]	6.90 [a]	6.91 [a]	7.19 [a]	7.91 [c]	7.70 [a]	7.91 [c]	7.34 [a]	7.80 [a]	7.20 [a]
10	8.01 [a]	7.72 [a]	7.10 [b]	9.05 [c]	7.58 [a]	6.91 [b]	7.58 [a]	7.15 [b]	7.70 [a]	7.32 [a]	8.70 [c]	8.20 [a]	8.01 [a]	8.51 [a]	8.39 [a]	8.37 [a]
11	8.53 [a]	7.84 [a]	7.33 [b]	10.75 [c]	7.84 [a]	7.01 [b]	7.98 [a]	7.33 [b]	7.92 [a]	8.39 [a]	9.25 [a]	9.32 [a]	9.13 [a]	9.53 [a]	9.55 [a]	9.76 [c]
12	9.89 [a]	8.66 [b]	8.67 [b]	12.01 [c]	9.01 [a]	8.21 [b]	10.00 [a]	8.39 [b]	9.32 [a]	9.91 [a]	10.69 [a]	10.23 [a]	10.14 [a]	10.91 [a]	10.82 [a]	10.99 [c]
13	10.09 [a]	10.60 [a]	9.87 [a]	14.56 [c]	10.32 [a]	9.56 [b]	11.21 [a]	9.34 [b]	10.78 [a]	10.67 [a]	11.89 [a]	11.50 [a]	11.78 [a]	12.43 [a]	12.88 [c]	12.83 [c]

Note: the mean values in the same row but with different superscript are significantly different from each other (P≤ 0.05) **Key:** AD(♀) x AD(♂) Ado female x Ado Male, AD(♀) x IK(♂) Ado female x Ikere male, AD(♀) x ID(♂) Ado female x Ido male, IK(♀) x IK(♂) Ikere female x Ikere male, IK(♀) x ID(♂) Ikere female x Ido male, IK(♀) x AD(♂) Ikere female x Ado male, ID [a] (♀) x ID(♂) Ido female x Ido male, ID(♀) x IK(♂) Ido female x Ikere male, ID(♀) x AD(♂) Ido female x Ado male, AD(♂) x NM (♀) Ado male x Normal female, AD(♀) x NM (♂) Ado female x Normal male, IK(♂) x NM (♀) Ikere male x Normal female, IK(♀) x NM (♂) Ikere femalex Normal male, ID(♂) x NM (♀) Ido male x Normal female, ID(♀) x NM (♂) Ido female x Normal male and NM(♂) x NM (♀) Normal male x Normal female

Table 4 Water Quality Parameter of the three Sample ponds and the indoor hatchery borehole

Water Sample Location	**Temperature (^{O}C)**	**Dissolved Oxygen (DO_2)**	**Hydrogen Ion Concentration (pH)**
	Clinical Thermometer	**Dissolved Oxygen Meter (Mg/L)**	**pH Meter**
ABUAD Farm, Ado-Ekiti	25.5	7.50	7.70
Ayenco Farm, Ido-Ekiti	26.05	6.65	7.16
Owoeye Farm, Ikere-Ekiti	27.52	6.28	7.12
Fish Hatchery, Federal Polytechnic, Ado-Ekiti	25.99	6.30	7.30

WHO Permissible Limits: Temperature= 20 - 50^{O}C; Dissolved Oxygen (DO_2)= 6.0 - 8.0; Hydrogen Ion Concentration (pH)= 6.5 – 8.5

Table 5 Number of deformities recorded during the study

Crosses	**Broken Dorsal Fins**	**Absence of Pelvic Fins**	**Snout Mouth Deformities**
AD(♀) x AD(♂)	___	___	1
ID(♀) x ID(♂)	1	___	___
IK(♀) x IK(♂)	___	1	___
NM (♀) x NM(♂)	___	___	___
AD(♀) x ID(♂)	___	___	___
AD(♀) x IK(♂)	___	1	1
ID(♀) x AD(♂)	___	___	2
ID(♀) x IK(♂)	1	___	3
IK(♀) x AD(♂)	___	___	___
IK(♀) x ID(♂)	___	1	___
NM (♀) x AD(♂)	___	___	___
NM (♀) x ID(♂)	___	___	___
NM (♀) x IK(♂)	___	___	___
AD(♀) x NM (♂)	___	___	1
ID(♀) x NM (♂)	___	___	___
IK(♀) x NM (♂)	___	___	___

Key: AD(♀) x AD(♂) Ado female x Ado Male, AD(♀) x IK(♂) Ado female x Ikere male, AD(♀) x ID(♂) Ado female x Ido male, IK(♀) x IK(♂) Ikere female x Ikere male, IK(♀) x ID(♂) Ikere female x Ido male, IK(♀) x AD(♂) Ikere female x Ado male, ID(♀) x ID(♂) Ido female x Ido male, ID(♀) x IK(♂) Ido female x Ikere male, ID(♀) x AD(♂) Ido female x Ado male, AD(♂) x NM (♀) Ado male x Normal female, AD(♀) x NM (♂) Ado female x Normal male, IK(♂) x NM (♀) Ikere male x Normal female, IK(♀) x NM (♂) Ikere female x Normal male, ID(♂) x NM (♀) Ido male x Normal female, ID(♀) x NM (♂) Ido female x Normal male and NM(♂) x NM (♀) Normal male x Normal female

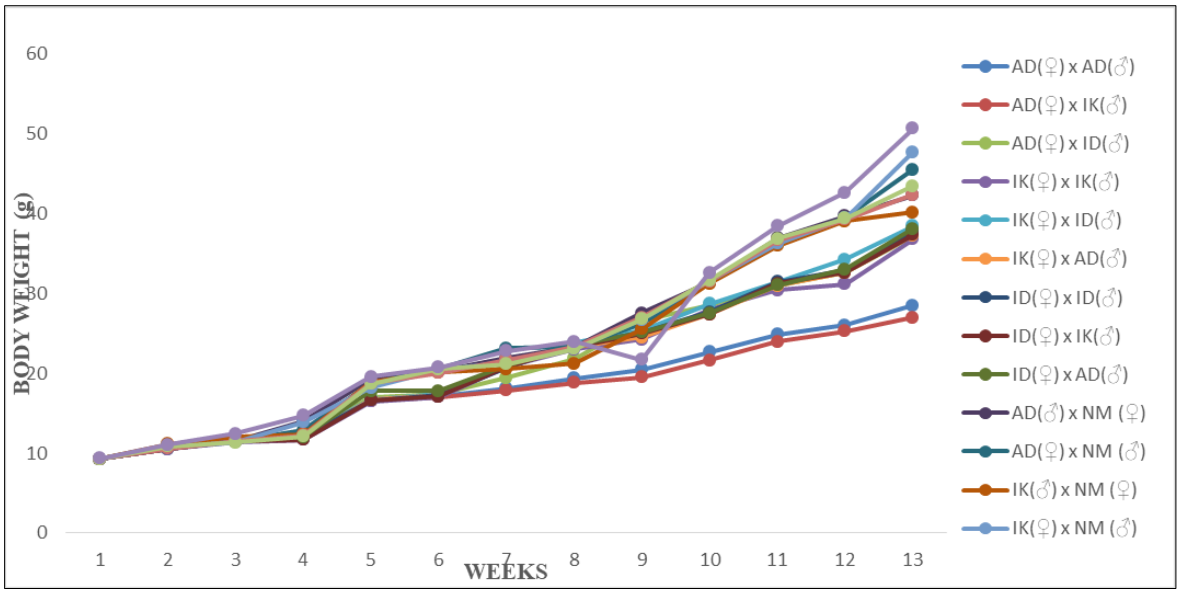

Figure 2 Body weight (g) from the sixteen-group mating of *Clarias gariepinus* with snout and normal mouth maintained for thirteen weeks under indoor hatcher

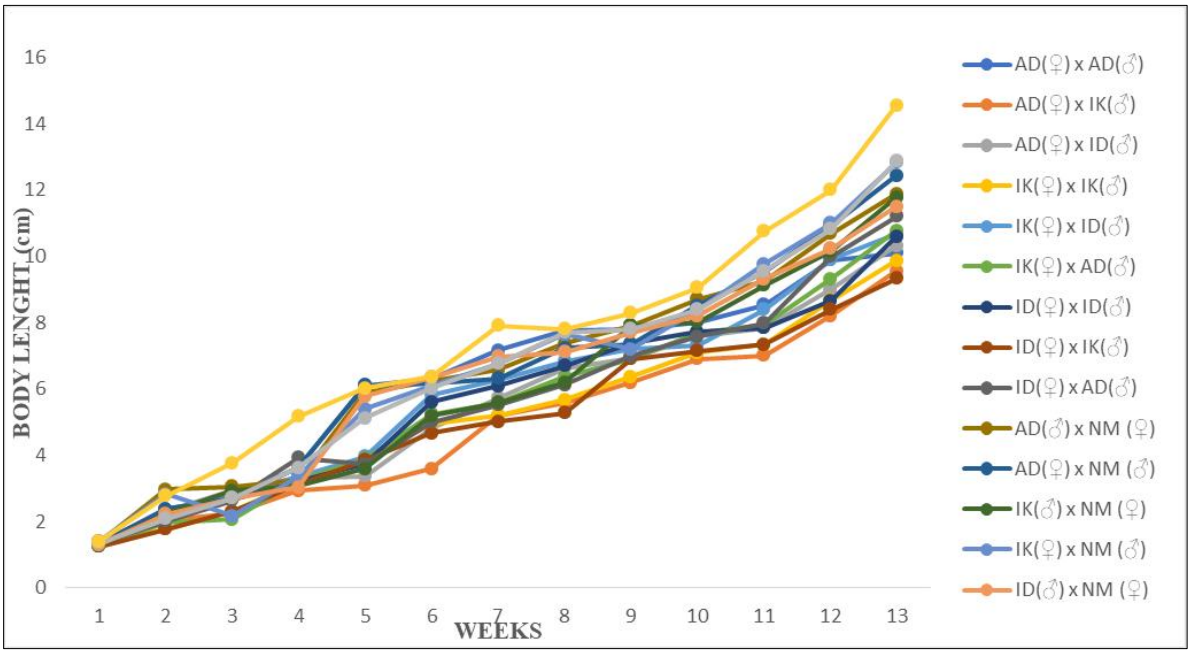

Figure 3 Body length (cm) from the sixteen-group mating of *Clarias gariepinus* with snout and normal mouth maintained for thirteen weeks under indoor hatchery

4. Discussion

The findings of this study highlight the significant influence of morphological deformities on the growth potentials of *Clarias gariepinus*. Normal mouth strains consistently exhibited superior growth performance, corroborating findings by Awe (2017), who reported that normal morphological structures enhance feeding efficiency and growth rates. For instance, the normal mouth strain from Ado-Ekiti achieved the highest final body weight (50.64 g) after 13 weeks, outperforming all hybrids and snout mouth strains. This growth advantage is attributed to the wider gape and efficient food intake mechanisms of normal mouth strains.

Hybrids showed intermediate growth performance, which aligns with Ataguba *et al*. (2009), who noted that crossbreeding could enhance certain growth traits but may not outperform pure strains under optimal conditions. The

reduced growth rates observed in snout mouth deformities are consistent with earlier studies (Fagbuaro, 2009), suggesting that deformities affect feeding efficiency and metabolic rates.

Environmental factors, such as water quality, were controlled and maintained within World Health Organization (WHO) permissible limits, eliminating their potential influence on observed differences. This aligns with previous research by Daniel *et al*. (2020), which highlighted the critical role of optimal hatchery conditions in achieving high growth rates and survivability.

The study also observed a lower prevalence of deformities in normal mouth strains compared to hybrids, supporting findings by Hilomen-Garcia (1997) and Kitajima *et al*. (1994), which linked deformities in hatchery-reared fish to genetic and environmental factors. The implications for aquaculture are clear: prioritizing the breeding of normal mouth strains will maximize yield and profitability.

5. Conclusion

Clarias gariepinus with normal mouth parental strains, particularly from Ado-Ekiti, demonstrated superior growth potentials compared to hybrids and snout mouth deformities under uniform hatchery conditions. The study underscores the importance of selecting normal mouth broodstock for sustainable aquaculture practices, as these strains provide optimal growth rates, reduced deformities, and enhanced profitability. For continued aquaculture development, it is recommended that future research focus on mitigating deformities in hybrids to improve their viability as alternative broodstock options

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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