Research Article

Inter-Relationship of Various Body Measurements with Regard to Length in *Clarias gariepinus*, Reared in Cemented Ponds

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Abstract | The inter-relationship of various body measurements with regard to length in *Clarias gariepinus*, reared in cemented ponds was initiated from March–September 2021 by using 200 individuals (110 males and 90 females).These specimens of experimental fish ranged from 14.4 to 37.0 cm in length and from 44.7 to 985 g in weight and were obtained from the stock marinated in the cemented ponds of the University of Sindh, Jamshoro. At 5cm intervals, samples of fish were separated into groups. Fish body dimensions, including fish head length, fin measurements and the diameter of fish eyes and mouth gape were examined. No significant difference between male and female was noted; though, there was a small variation in the percentages of lengths such as standard and anal fin, which were greater in females (85.0 and 15.3 percent, respectively) than in males (83.2 and 10.6 percent, respectively). The length of the head, the width, the pectoral fin, the pelvic fin, and the dorsal fin were all bigger in males (90.76, 70.31, 11.28, 11.97, 4.95, and 4.51%) than in females (90.68, 25.64, 62.71, 10.73, 8.8, 35, and 3.3%), but the dorsal fin was smaller in both sexes. eye diameter was shown to be greater in females (3.88%) than in males (2.08). The dorsal, pectoral, pelvic, anal, and caudal rays of five distinct fins of both sexes were counted (male and female). The meristic counts of male and female *Clarias gariepinus* from cement ponds did not differ significantly (P>0.05). Finally, it was concluded from the inter-relationship of various body measurements and meristic analysis that there was a single homogenous population of *Clarias gariepinus*, available in ponds. The culture of this species may produce a significant role in generating revenue in the country.

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Introduction

Clarias gariepinus is regarded as a fast-growing aquaculture species for large-scale and small-scale farming in African nations because it provides a partial solution to the rising protein needed (Ajani and Awogbade, 2012). According to them, the practices of its culture in recent years closely resemble those

of tilapia culture a few years ago. Morphometrics is continuous traits because they relate to body form characteristics. Meristic characteristics are the number of stable, distinct, constantly repeating, and countable structures found in embryos or larvae. Studies on the physical differences across populations will continue to play a significant role in stock identification (Lashari *et al*., 2004). It uses a continuous data set of measurements of the size and shape variation of a population to define fish stocks and assess the evolutionary adaptability of a species to its environment (Khan *et al*., 2015). In addition, the examination of morphometrics may be used often to evaluate fish resources with reference to the stock origin, identification, and separation of highly valued food fish (Lashari *et al*., 2004). Taxonomists and systematizations utilized morphological data to characterize and diagnose species. However, a lack of knowledge about fisheries resource can result in drastic changes to the ecological characteristics and productivity of a species (Narejo, 2010). There are about 2600 species of catfish belonging to 33 families (Khan *et al*., 2015). This group is adaptable, occurring in practically all freshwaters of the world as well as warm, shallow, and saltwater environments. However, catfish almost occupy every habitat type in lakes, ponds, rivers, and streams, as well as still and moving waterways (Thebo *et al*., 2019). Catfishes are one of the most important fisheries and aquaculture resources, and they have adapted in a variety of morphological, physiological, and ecological ways, particularly to shallow depths, low oxygen levels, and high turbidity (Jalbani *et al*., 2018). For this reason, the current study was carried out to provide fundamental information on the interrelation of several body measures of *Claris gariepinus* grown in cemented ponds, as there is a dearth of literature on any aspect of the biology of this commercially significant fish from Pakistan.

Materials and Methods

Collection of the fish samples

The fish under investigation was procured from the stock maintained in cemented ponds of the department of Fresh Water Biology and Fisheries, University of Sindh, Jamshoro for six months starting from March-September 2021by using 200 specimens out of which 110 were male and 90 were female. These specimens of experimental fish ranged from14.4 to 37.0 cm in length and from 44.7 to 985 g in weight. Fish samples were divided into groups at the interval of 5cm each on monthly basis throughout the investigations. Fish were fed 35% crude protein diet containing soybean meal, rice bran and mustard oil cake.

The inter-relationship between various body parameters and their counts (meristic) of *Clarias gariepinus* was determined by using a measuring tape and a digital vernier caliper. In total 09 body parameters were like total length, standard, head length, dorsal, pectoral, caudal and anal fin lengths, girth, and eye diameter measured at different length groups. The counts of five meristics were made as dorsal, pectoral, pectoral anal, and caudal fin rays of the experimental fish through hand magnifying glass.

Results and Discussion

Body measurements

The inter-relationship of various body measurements in relation to length in *Clarias gariepinus*, reared in cisterns was initiated from March –September 2021 by using 110 male and 90 female presented in (Tables 1 and 2), respectively. There was no significant (P>0.05) difference between female (85.0% and 15.3%) than male (83.2% and 10.6%). While head, girth, dorsal fin, pectoral fin, and pelvic fin lengths were found to be larger in males than females and the diameter of eye remained higher in females than males.

Meristic characters

Dorsal, pectoral, pelvic, anal, and caudal rays of five distinct fins of both sexes were counted (Table 3). Meristic counts of male and female *Clarias gariepinus* from cemented ponds showed no statistically significant (P>0.05) difference between the sexes. From the measurements of numerous body metrics and meristic analysis, it was found that there was a single homogeneous population of *Clarias gariepinus* in cemented ponds.

Regression analysis

The regression study demonstrated a positive linear association between total length and fork, standard, and head lengths, as well as dorsal, pelvic, and anal fin measures (R^2: 0.99, 0.99, 0.97, 0.90, and.96) in males. But measurements of the second dorsal and pectoral fin revealed a positive relationship with total length (R^2: 0.84, 0.87) and a positive relationship between eye diameter (R^2: 0.71) and head length in only the pectoral fin length, on the other hand, shows a significant positive relationship (R^2: 0.87), while all

other factors, like the standard and head lengths, eye girth diameter, etc., show no significant relationship. However, in females, there are statistically significant positive correlations between dorsal fin, pelvic fin, and anal fin lengths and total length (R^2: 0.99, 0.99, 0.99, 0.98, 0.95, 0.97), and eye diameter (R^2: 0.92 with head length Table 4).

Table 1: *Inter-relation between various body parameters and their percentages in relation to the total length of male Clarias gariepinus from cemented ponds.*

Length group cm	Mean TL cm	Mean SL cm	% SL	Mean HL cm	% HL	Mean ED	% ED	Mean Gir cm	% girth	Mean DFL cm	% DFL	Mean Pec. FL cm	% Pec. FL	Mean Pel. FL cm	% Pel FL	Mean Anal FL cm	% An FL
10.1-15.0	14.4 ±1.2	11.7 ±1.4	81.2	3.8 ±0.3	26.3	0.3 ±0.01	7.8	10.1 ±0.9	70.1	6.8 ±0.6	47.2	0.68 ±0.01	4.1	3.5 ±0.6	24	1.2 ±0.3	8.6
15.1-20.0	17.9 ±1.5	14.5 ±1.3	81.5	4.4 ±0.2	24.5	0.3 ±0.01	6.8	11.0 ±0.7	61.9	7.0 ±0.4	39.1	0.6 ±0.03	3.3	0.6 ±0.3	3.8	1.9 ±0.1	10.6
20.1-25.0	23.1 ±2.0	19.2 ±1.8	83.2	5.9 ±0.8	25.8	0.33 ±0.01	6.0	14.2 ±1.3	61.7	7.8 ±0.9	40.0	0.8 ±0.02	3.6	0.96 ±0.1	4.1	2.3 ±0.2	9.9
25.1-30.0	27.8 ±1.8	22.2 ±1.5	80.6	6.7 ±1.0	24.2	0.32 ±0.02	5.8	15.2 ±1.7	55.4	8.2 ±0.5	39.0	0.85 ±0.01	3.0	1.0 ±0.3	3.9	2.5 ±0.2	9.0
30.1-35.0	33.7 ±2.4	27.4 ±2.1	81.4	8.1 ±1.2	24.2	0.4 ±0.01	4.9	20.3 ±1.9	59.3	8.5 ±0.8	38.9	0.83 ±0.02	4.0	0.93 ±0.2	2.76	2.4 ±0.1	7.21

TL= Total Length; SL= Standard Length; HL= Head Length; ED= Eye Diameter; Gir= Girth; DFL= Dorsal Fin Length; Pec. FL = Pectoral Fin Length; Pel. FL = Pelvic Fin Length.

Table 2: *Inter-relation between various body parameters and their percentages in relation to total length of female Clarias gariepinus from cemented ponds.*

Length group cm	Mean TL cm	Mean SL cm	% SL	Mean HL cm	% HL	Mean ED	% ED	Mean Gir cm	% girth	Mean DFL cm	% DFL	Mean Pec. FL cm	% Pec. FL	Mean Pel. FL cm	% Pel FL	Mean Anal FL cm	% An FL
15.1-20.0	17.7 ±1.5	15.0 ±1.2	81.4	4.2 ±0.7	24.2	0.25 ±0.02	7.8	11.1 ±1.0	70.1	6.9 ±1.3	47.2	0.60 ±0.02	4.1	0.66 ±0.03	24	1.5 ±0.02	8.6
20.1-25.0	17.9 ±1.4	14.5 ±1.0	81.5	4.4 ±0.4	24.5	0.3 ±0.01	6.8	11.0 ±1.1	61.9	7.0 ±1.0	39.1	0.6 ±0.03	3.3	0.6 ±0.01	3.8	1.9 ±0.01	10.6
25.1-30.0	23.1 ±1.5	19.2 ±1.5	83.2	5.9 ±0.7	25.8	0.33 ±0.01	6.0	14.2 ±1.3	61.7	7.8 ±1.3	40.0	0.8 ±0.02	3.6	0.96 ±0.02	4.1	2.3 ±0.01	9.9
30.1-35.0	27.8 ±2.1	22.2 ±1.5	80.6	6.7 ±0.3	24.2	0.32 ±0.03	5.8	15.2 ±1.6	55.4	8.2 ±1.0	39.0	0.85 ±0.01	3.0	1.0 ±0.01	3.9	2.5 ±0.03	9.0
35.1-40.0	33.7 ±2.4	27.4 ±1.8	81.4	8.1 ±0.4	24.2	0.4 ±0.02	4.9	20.3 ±1.5	59.3	8.5 ±1.3	38.9	0.83 ±0.03	4.0	0.93 ±0.03	2.76	2.4 ±0.06	7.21

TL= Total Length; SL= Standard Length; HL= Head Length; ED= Eye Diameter; Gir= Girth; DFL= Dorsal Fin Length; Pec. FL = Pectoral Fin Length; Pel. FL = Pelvic Fin Length.

Table 3: *Range and mean values of meristic characters of male and female of catfish Clarias gariepinus, from cemented ponds.*

Serial no.	Parameters	Male		Female	
		Range	Mean	Range	Mean
01	Dorsal fin rays	6-8	7± 1.0	6-8	7±1.0
02	Pectoral fin rays	8-10	9± 1.	7-10	8±1.0
03	Pelvic fin rays	7-8	7.5± 0.5	7-8	7.5±0.5
04	Anal fin rays	8-12	10±2.0	8-12	10±2.0
05	Caudal fin rays	17-22	19.5± 4.5	16-20	18±2.0

Table 4: *Showed regression analysis of male and female of catfish Clarias gariepinus from cemented ponds.*

Parameters	a	b	R value for male	a	b	R value for female
TL-SL-Rs	-0.36	1.19	0.99	0.05	1.08	0.99
TL-HL-RS	-0.3	0.77	0.99	-0.15	1.02	0.99
HL-ED-RS	0.25	0.85	0.71	-1.0	0.60	0.92
TL-G-RS	0.26	0.63	0.99	-0.65	1.55	0.99
TL-DFL-RS	-2.56	3.30	0.97	-1.6	0.74	0.97
TL-Pec-RS	-0.83	2.41	0.87	-1.17	2.03	0.87
TL-Pel-Rs	-1.86	2.01	0.9	-1.2	1.81	0.98
TL-AFL-Rs	-1.13	1.20	0.96	-1.15	1.09	0.99

The link between different body measures in male and female *Clarias gariepinus* catfish from paved ponds was examined, and Females had a higher percentage of standard and anal length (85 and 15.3%) than males (83.2 and 10.6%), but males had longer head and fin lengths (90.8%), pectoral and pelvic dorsal fins, and girth values. Eye measurements in women were found to be 5.88% larger than those in men (2.08). Similar results were reported for *Gudusia variegata* and *Heteropneustes fossilis* from Pakistani waters by (Narejo and Jafri, 1997; Khan *et al*., 2015). These workers reported that the standard length of both sexes in proportion to body length was 79.34% and 79.88%, respectively. In addition, they noted that the head length, eye diameter, body depth, and post-orbital length of males were 24.70, 15.55, 3.28, and 8.55 percent of the body length, respectively. Regarding body length, the female values for the aforementioned parameters were 24.98, 15.92, 3.63, and 8.74%. All of these metrics were shown to have a positive relationship with overall length. A small number of studies, including those by Narejo (2010), Dars *et al*. (2012), Jalbani *et al*. (2014), Lal *et al*. (2015) and Khan as al. (2015) on different fish species. e, *Gudusiachapra, Channa punctatus, C. striata, Cirrhinusreba, and Heteropneustesfossilis* concur with the present results. Diverse studies, such as (Narejo and Jafri, 1997; Dars *et al*., 2012; Lal *et al*., 2015) have noticed a curvilinear relationship between the length of the body and its various properties. On different timescales, ratios of certain parameters may vary. Changes in the environmental state and water quality of the current environment may be responsible for these alterations (Hoque, 1984). In this study, the correlation coefficient values revealed the association between various body parameters and body length. In the case of males, parameters such as fork, standard, head, dorsal, pectoral, pelvic, and fin anal length were shown to be substantially associated (P>0.05), but in females, eye diameter was similarly positively connected (P>0.05) with total body head length. Similar observations were made by Khan *et al*. (2015), who observed that the values of the variables revealed a strong correlation with overall length. Some researchers, such as (Parkash and Verma, 1982; Hoque, 1984; Kohinoor *et al*., 1995) have made comparable observations regarding *Ompokpabda, Harpodonnehereus*, and *Notopterousnotopterous*. All of these findings are consistent with the current findings.

Conclusions and Recommendations

Finally, it was concluded from the inter-relationship of various body measurements and meristic analysis that there was a single homogenous population of *Clariasgariepinus*, available in ponds. Farmers should culture this fish on a commercial scale in the country.

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Novelty Statement

The examination of length and weight from the present study is excellent for future commercial species rearing and supports the fish potential to a significant extent. Assessment of the inter-relationship of various body measurements and meristic analysis shows that there was a single homogenous population of *Clarias gariepinus* in ponds.

Author's Contribution

Bushra Ainy Dars: Performed the experiment and prepared the initial draft of the manuscript.
Naeem Tariq Narejo: Designed and conceived the idea of this experiment.
Muhammad Hanif Chandio: Looked through the literature, read over the manuscript, and wrote the document by gathering data.
Faheem Saddar: Collected fish and eggs samples for the research.
Majida Parveen Narejo: Helped in relevant literature and reviewing the manuscript.
HamidaNarejo and Ghulam Dastagir: Helped in checking of data and relevant literature.
Ghulam Abbas and Shahnaz Rashid: Helped in literature, proofreading, format setting and updating the bibliography.

Conflict of interest
The authors have declared no conflict of interest.

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