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Length-weight relationship and wellness of *Clarias gariepinus* (Burchell, 1822) juveniles fed on three different feeds

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Abstract

The length-weight relationship and wellness of *Clarias gariepinus* juveniles fed once daily on three different feeds studied for 12 weeks between March and May 2019. 50 *C. gariepinus juveniles* were randomly separated into three different concrete tanks and fed with Coppens, Zeigler and Aller-aqua feed respectively at a rate of 10kg/body weight once daily. The study revealed that the fish in the three tanks showed negative allometric growth throughout the study ($b<3$). The b value ranged from 0.54±0.07 to 1.40±0.11 for all the feeds($p>0.05$). At the same time, condition factor decreased as the fish increased in length with Coppens varied from 7.40 to 1.18, Aller aqua from 9.69 to 1.46 and Zeigler from 9.09 to 1.31. Condition factor differences did not test statistically different ($p>0.05$). An indication that the different feeds are appropriate for efficient *C. gariepinus* production fed once with appropriate body weight feeding adjustment. The values of the condition factor reflect healthy fish status with the different feeds.

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Introduction

Fish the building block of a nation is not an overdrawn statement. Fish is a relatively cheap source of protein, and it also contains some essential nutrients required by the body (Waly *et al.*, 2015). For many motivators, including acceptability, *Clarias gariepinus* is one of the notable eco-friendly fish species farmed globally by both industrial and local fish farmers to market size (Agokei *et al.*, 2010). However, the fish farming current trend is not commensurate with fish demand. One of the challenges faced by this enterprise is the cost of feeding fish with high protein diets. Moreso, the readily available high protein commercial feed is unaffordable by the teeming local farmers. While the non-availability of funds hampers sourcing of local food materials for feed as well as curb rapidly water quality deterioration associated with its use (Robinson *et al.*, 2001). The benefits of commercial fish feed besides financial implications far outweigh locally sourced food. At present, the highly competitive cost of commercial feeds has forced local fish farmers to adopt once-daily-feeding contrary to the standard twice-feeding in the localities.

Feed finance is a fundamental issue in fish farming. Due to financial constraint, local fish farmers have devised means of escaping the current economic recession nationwide for economic viability. These include adopting a simple solution to feed fish once daily contrary to the standard prescribed twice-feeding daily of fish juveniles (Personal observation and questionnaire). These factors informed the present research designed to feed fish once daily in the present research conducted. Length-weight relationship (LWR) and condition factor is a crucial biological tool to obtain information on fish condition (Musa *et al.*, 2016) and to infer their growth pattern (Sibel and Cemal, 2017; Ashish *et al.* 2018). These measurements (Length-weight relationship (LWR) and condition factor) therefore act as indicators of a fish relative condition growth and survival potentials (Zubair and Imtiaz, 2018). Thus this study was directed at evaluating the length-weight relationship, and condition factor of *C. gariepinus* juveniles fed once with three different feeds used by the locals.

Materials and methods

Study area

This study performed at Delta State University site II, Abraka, in the Department of Animal and Environmental biology. The experimental rearing of C. gariepinus juveniles' was carried out using the Department concrete tank between March and May 2019. Three different ponds designated Coppen-pond, Aller Aqua-pond and Zeigler-pond; adopted after the feed used for specific ponds.

Fish Collection and Feeding

Fish for this study acquired from Songhai Delta Company, Sapele in Delta State, Nigeria. One hundred fifty of juveniles purchased for the study. The 2-day acclimatized fish were weighed and randomly sorted into the different concrete ponds. Fifty fish samples randomly distributed into each of the labelled concrete tanks were fed once a day at 10g/ body weight.

Measurement of Fish

The data on fish morphological parameters measured fortnightly. Fish weight of individual fish was determined with an electronic weighing scale while the standard length, fork length and head to tail determined with a measuring tape.

The length-weight relationship determined from the formula

$W=aLb$. The parameters "a" and "b" were estimated through logarithm transformation in the form

$\text{Log } W = \log a + b \log L$

Where w= Total weight of the fish (g)

L = Total length of the fish (cm)

a = intercept on the Y-axis

b = slope or regression coefficient

The condition factor (k) surrogates of the experimental Fish wellness estimated from the relationship

$$k = \frac{W \times 100}{L3}$$

Where k=condition factor

W= weight of fish (g)

L = Length of fish (cm)

Data measured were analyzed with the aid of Past statistical software. Data presented as mean ± S.D. the differences between the means of the variables tested using the One way ANOVA. All statistical test evaluated with Past statistical software.

Results and discussion

The fish sample weighed between 14.00 - 26.80g while the length ranged from 3.50 to 8.50cm. The manufacturer's proximate composition of the respective feed is in Table 1. The parameters of length-weight, slope, intercept, coefficient of determination and significance difference summarized in Table 2. In the Coppen fed-culture, the estimates of 'a' were within -0.31 ± 0.08 to 0.13 ± 0.09 while they were within -0.30 ± 0.29 to 0.25 ± 0.18 for Aller aqua fed-culture and – 0.34 ± 0.08 to 0.26 ± 0.30 for Zeigler feed. The b-values were within the range of 0.54 ± 0.07 to 1.40 ± 0.11 for Coppens, 0.54 ± 0.11 to 0.91 ± 0.20 for Aller aqua and 0.53 ± 0.18 – 0.96 ± 0.08 for Zeigler feed. The condition factor (k) decreased with an increase in the number of cultured days, and it ranged between 7.40 - 1.18. One way ANOVA revealed that there was a significant difference in the length-weight relationship ($p < 0.05$) throughout the study period.

Table 1. The proximate composition (% dry weight) of feeds fed C.gariepinus during the experiment.

	Proximate Composition						
Diets	Feed size	Protein	Carbohydrates	Lipid	Ash	Moisture	Fibre
Coppens	2	42	10	12	9.5	8.10	1.9
Aller Aqua	2	54	NP	12	NP	NP	NP
Zeigler	2	55	NP	12	13	10	NP

NP (Not Provided)

Table 2. Length-weight relationship parameters and condition factor of Clarias gariepinus fed with Coppens, Aller aqua and Zigler feeds.

Date	Feed type	Length(cm) (Min-Max)	Length(cm) (Mean±SD)	Weight(g) (Min-Max)	Weight(g) (Mean±SD)	a±SD	b±SD	r^2	k
9th March 2019	Coppens	3.50-8.00	6.63±0.89	14.00-25.90	19.85±3.93	0.13±0.09	0.54±0.07	0.55	7.40
	Aller aqua	4.50-8.00	6.03±0.87	15.00-26.80	20.07±3.51	-0.14±0.08	0.71-0.06	0.75	9.69
	Zeigler	4.00-8.50	6.21±1.04	15.10-25.60	20.01±3.04	-0.46±0.10	0.96±0.08	0.76	9.09
23rd March 2019	Coppens	5.00-10.50	7.00±1.22	14.30-29.30	21.86±3.69	-0.31±0.08	0.86±0.06	0.82	6.88
	Aller aqua	5.00-10.50	6.91±1.19	14.90-29.30	21.77±3.64	-0.25±0.10	0.82±0.07	0.72	7.16
	Zeigler	5.00-10.50	7.00±1.26	14.90-29.30	21.90±3.72	-0.34±0.08	0.88±0.06	0.83	6.92
6th April 2019	Coppens	7.00-14.50	11.23±2.58	21.60-35.90	30.29±4.47	-1.03±0.16	1.40±0.11	0.77	2.84
	Aller aqua	7.00-14.50	11.35±2.61	21.60-35.90	30.28±4.39	-0.30±0.29	0.91±0.20	0.31	2.89
	Zeigler	5.00-14.50	11.33±2.56	22.70-35.90	31.06±3.46	-0.13±0.44	0.78±3.00	0.13	3.20
20th April 2019	Coppens	9.50-17.00	13.45±6.48	28.30-52.00	40.88±6.48	-0.04±0.12	0.73±0.07	0.68	1.79
	Aller aqua	11.00-18.00	13.52±1.74	30.00-52.00	41.26±5.50	0.25±0.18	0.54±0.11	0.32	1.76
	Zeigler	5.20-17.00	13.00±2.31	22.70-52.00	40.50±6.81	0.26±0.30	0.53±0.18	0.15	2.85
4th May 2019	Coppens	13.00-20.00	16.61±2.21	33.70-60.70	51.06±7.78	0.05±0.12	0.68±0.07	0.66	1.18
	Aller aqua	8.50-19.00	15.76±1.96	37.60-57.80	50.42±5.24	0.21±0.27	0.58±0.16	0.22	1.46
	Zeigler	13.00-19.00	15.90±1.72	37.60-58.70	50.49±5.51	0.13±0.18	0.63±0.11	0.43	1.31

Information from length-weight relationship data revealed a negative allometric growth pattern of *C. gariepinus* in this study. The characteristic (b) values for all the feeds were below 3 throughout the study. The fishes were longer than fat as they increase in length (Ashish *et al.*, 2018; Antoine, 2019). As such, the increase in length and weight of the fishes are uneven as they become slimmer with an increase in length. The different feeds can be employed for efficient fish productions for *C. gariepinus* with 10g/ body weight feeding adjustment. The present study is in agreement with Getso *et al.*, (2017) on the length-weight relationship (0.11 to 0.55) and condition factor study of *C.gariepinus* and *Oreochromis niloticus* in Wudil River in the Kano State of Nigeria; Dan-Kishiya (2013) on the length-weight relationship and wellness of five different fish species from a tropical water supply reservoir in Abuja, Nigeria; Keri *et al.*, (2011) on *O. niloticus* (0.82 to 0.93) fed with different levels of maltose in Malaysia. Contrary reports of b>3 have also been established by researchers too; Ayo-Olalusi (2014) on the C. gariepinus length-weight in flow-through system tanks fed with pellets of 42% crude protein; Jafari *et al.*, (2016) on *Albrnus zagrosensis* from three

rivers in Iran. Nezek *et al.* (2018) opined that negative allometric growth might be attributable to the phenotype of the organism or environmental factors.

The condition factor in this study decreased as the fish increased in length (Fig 1). The condition factor ranged from 7.40 to – 1.18. The decrease in condition factor is characteristic of fish growing in length (Fig 1) (Waly *et al.* 2015). The Insignificant differences in condition factors generated by the different feeds satisfy them as adequate for fish production. The insignificant condition factor differences revealed the three feeds achieved approximately uniform condition pattern (P>0.05).

The significant condition factor the first two-week could be attributable to physiological adaptation (Saha *et al.*, 2019). The fish status or wellness in the present study was excellent. Vizvari *et al.* (2017) opined that the condition factor increases during the reproductive stage and reach the basal level afterwards. The condition factors achieved during this was higher than cultured Clarias, and none-Clarias Fish fed twice (Olarewaju *et al.*, 2017; Omodu *et al.*, 2017; Okomoda *et al.*, 2018; Olapade and Conteh, 2019). The better condition achieved with three feeds is attributable to efficient feed utilization, the growth phase, as well as excellent water quality maintained during the experiment (Eze *et al* ., 2017).

Feeding rate and growth phase are considered crucial in influencing b value in Fish (Abdul *et al.*, 2016). A higher coefficient of determination (r^2) was achieved mostly in the Coppen-based culture (Table 1). Higher coefficient of determination is notably due to Coppens acceptability as the other two feeds had higher protein composition (Table 2). Usually opined for significant fish growth (Ayinla and Bekibele, 1992).

However, no statistical difference established between the condition factors of the Coppens and the other diets (F= 0.395; p=0.6821). The crude protein of the feeds was within or better than the Ayinla and Bekibele (1992) recommended 31- 34 % for fish juveniles, 35% crude protein to raise table (table 3) size fish and 40% for broodstock. Recent studies on protein have opined that 16% protein level can grow out table size fish if fed to satisfaction (Robinson *et al.*, 2001).

The response of *C. gariepinus* juveniles to once feeding in the present study is an indication that the fish could do well on a high protein diet in association with good water quality. Thus fish attained significant negative allometric growth during the present investigation.

Table 3. One-Way Analysis of Variance (ANOVA) on the weights, lengths of the *C. gariepinus* in Coppen-pond, Aller Aqua-pond and Zeigler-ponds.

		Weight Range	F value	P-value	Length Range	F value	P-value
9th	Coppen	14.00-25.90	0.05	0.95	3.50-8.00	5.25	0.01*
	Aqua	15.00-26.80			4.50-8.00		
	Zeigler	15.10-25.60			4.00-8.50		
23rd	Coppen	14.30-29.30	0.02	0.98	5.00-10.50	0.09	0.91
	Aqua	14.90-29.30			5.00-10.50		
	Zeigler	14.90-29.30			5.00-10.50		
6th	Coppen	21.60-35.90	0.58	0.56	7.00-14.50	0.20	0.97
	Aqua	21.60-35.90			7.00-14.50		
	Zeigler	22.70-35.90			5.01-14.50		
20th	Coppen	28.30-52.00	0.36	0.70	9.50-17.00	1.23	0.29
	Aqua	30.00-52.00			11.00-18.00		
	Zeigler	22.70-52.00			5.20-17.00		
4th	Coppen	33.70-60.70	0.16	0.85	13.00-20.00	2.61	0.08
	Aqua	37.60-57.80			8.50-19.00		
	Zeigler	37.60-58.70			13.00-19.00		

*is significant at p<0.05.

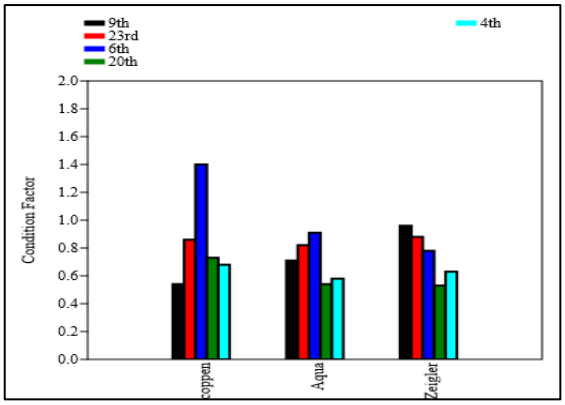

Fig. 1. Comparison of the different diets generated condition factors fortnightly during the study.

Conclusion

This study revealed the length-weight relationship and condition factor of *C. gariepinus* fed with three different meals. It revealed that the three meals used showed negative allometric growth in *C. gariepinus* fed 10% of body weight once daily. Therefore all feeds are suitable to achieve negative allometric growth. The average conditional factor values also revealed a healthy status of fish throughout the study.

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