

Effects of Different Commercial Feed on Water Quality and Survival of *Clarias gariepinus* (Burchell, 1822) Fingerlings

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Abstract: The survival rate and water quality of African Catfish fingerlings (*Clarias gariepinus*) fed with four commercial feed (Top, Vital, Lynx and Coppens) feeds was studied with the aim of establishing the effect of these feeds on water quality and survival rate, for a period of 8 weeks. One hundred and eighty (180) fingerlings of *Clarias gariepinus* and four commercial feeds with varying crude proteins were used for the experiment. Water quality parameters analyzed indicated temperature varied from 26.38 °C to 27.05°C while pH and dissolved oxygen ranged from 3.91 to 6.49 and 4.70mg/l to 6.49mg/l respectively. The treatment shows that there is a significant difference in pH, temperature and dissolved oxygen across the treatment ($p < 0.05$) while alkalinity showed significant difference across the treatment ($p < 0.05$). Survival rate showed Top feed (100%) followed by Coppens feed (93.3%) while the lowest was recorded in Vital feed (46.67%).

Keywords: Commercial feed, treatment, water quality, survival

1. INTRODUCTION

Fish makes a vital contribution to the survival and health of a significant portion of the world's population. Fish is especially important in the nutrition of the developing world. In some part of the world, people derive as much as 75% of their daily protein from fish. The growing need for fish supply and increase awareness of aquaculture in Nigeria has led to remarkable investment in aquaculture in recent years. However, the growing population in the country posed a challenge, which requires more investment to fill in the supply gap of 1.6 million metric tons [1]. Fish is still the cheapest and most available source of animal protein in Nigeria, though the high cost of fish today is attributed to low supply caused by low productivity from the water bodies that are already over-exploited due to reckless fishing methods [2]. For aquaculture to be highly successful in Nigeria there is need for good quality and affordable feed, which can also encourage small scale farmers in the field of aquaculture for sustainable production and also meet the demand for fish. The amount of feed consumed, age, body size and temperature are the most important factors that limit maximum growth of fish [3]. Water quality affects the general condition of cultured organism as it determines the health and growth conditions of cultured organism. The critical parameters are temperature, suspended solids and concentrations of dissolved oxygen, ammonia, nitrite, carbon dioxide and alkalinity [4]

2. MATERIALS AND METHODS

Study Area

The study was conducted at the Demonstration Farm. Fisheries unit, University of Port Harcourt, Choba, Rivers State, Nigeria.

Experimental Fish

One hundred and eighty fingerlings of *Clarias gariepinus* were obtained from demonstration farm of the University of Port Harcourt. The fish were acclimatized for one week and during the period of acclimatization the fish were fed ad libitum [5] at 5% body weight twice daily [6] with Coppens at 42% crude protein. Feed not consumed and fecal matters were siphoned out every day. At the end of the acclimatization period, the fish were randomly selected and stocked into 12 plastic tanks of 26 x 27 x 40 cm³ containing 30L of aerated water with each plastic tank holding 15 fish. Feeding was suspended 24 hours before the feeding trial to increase appetite and reception for new diet [7].

Experimental Diet

One imported (Coppens,) and three local (Vital, Top and Lynx feed) commercial feeds were obtained. The feeds contained different levels of crude protein- 42%, 45%, 42% and 42%. Each test diet was fed to duplicate groups for 8 weeks. The feed/experimental diets were analysed for proximate composition according to [8].

Experimental Procedure

The temperature, pH, dissolved oxygen and alkalinity of the plastic tanks were monitored on weekly basis. The initial weight and length of the fish at the commencement of the experiment and final weight and length was determined using meter weighing balance (model P168) and a calibrated meter rule. Weekly weight and length measurements were taken to monitor weight and length gain. Survival rate was calculated according to [9]

$$\% \text{ Survival rate (\%SR)} = \frac{\text{Final number of fish}}{\text{Initial number of fish}} \times 100$$

$$\text{Feed Conversion Ratio(FCR)} = \frac{\text{Weight of dry feed fed(g)}}{\text{Live weight gain of fish(g)}} \times 100 \quad [10]$$

Live weight gain of fish(g)

3. RESULTS AND DISCUSSION

Table 1 shows the physico- chemical parameters of the different treatment. Treatment 4(Coppens feed) recorded the highest pH value of 7.20 while treatment 2(Vital feed) had the lowest pH value of 6.51. Temperature ranged between 26.38^oC to 27.05^oC. Highest value of Dissolved Oxygen was recorded in treatment 4(6.49mg/l) and lowest in treatment 2(3.91mg/l) while alkalinity values range from 129.25mg/l to 189.75mg/l. This shows that there is significant difference in pH, temperature and dissolved oxygen across the treatment (p<0.05) while alkalinity show significant difference across the treatment (p<0.05). Table 2 shows the mean values of the growth parameters. Treatment 4; Coppens feed recorded the highest size in length (26.4cm) while treatment 3 Lynx feed recorded the lowest (17.73cm). The mean weight ranged from treatment 2(45.46g) with the highest to treatment 4(27.49g). Feed conversion ratio (FCR) in treatment 4(0.73) had the highest value while treatment 2(0.41) recorded the lowest value. The result shows that there is significant difference in length, weight and FCR across the treatments (p<0.05). Survival rate was at the highest in treatment 1; Top feed (100%) while treatment 2 Vital feed had the lowest survival rate of 46.67%. Table 3 shows the Pearson correlation matrix between physico-chemical parameters, length and weight. Temperature and pH showed positive correlation to length and is significant at p<0.01 while dissolved Oxygen(DO) is negatively correlated to temperature and length but weight showed a positive correlation to length and significant at p<0.05. There is positive correlation between length and weight and is significant at p<0.05 while alkalinity showed no correlation between length and weight.

African catfish can tolerate temperatures as low as 6^oC and as high as 50^oC [11]. During the period of investigation, water temperature varied from 17.5-30^oC. [12] found highest growth of *C. gariepinus* at the temperature of 28-30^oC whereas [13] found best result of *C. gariepinus* at temperature ranges from 24-29^oC. The range of water temperature recorded during the study period was quite stable and within the period of the experiment but the Dissolved Oxygen was low in treatment 2(3.91) and 3(4.70) which could be attributed to the feed quality.

The survival rate obtained in this study revealed that treatment 1 and 4 had the highest survival. The problem associated with the low survival rate in treatment 2 and 3 in this study arose due to the change in the physico-chemical parameters of the water as a result of the feed. Moreover, it was observed that the fingerlings showed loss of appetite in the 5th week of the study.

However, the result obtained from this study for survival rate is contrast to the findings of [14] on the growth performance of two African Catfish, of which the pure breeds recorded 37.8% and 38.75% for pure crossbred *C.gariepinus* and *H.longifilis* respectively. Lovell [15] stated that protein quality of feed can affect the growth performance of fish and protein quality is affected by amino acid composition and digestibility. Although, Coppens and Durante feeds had higher crude protein (CP) content (CP=56% and 57% respectively), least final mean weight and survival rates were obtained in them. This observation is in accordance with previous work on feeding trial [16]. It is important to

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note that percentage of protein in feed determined by chemical analysis is not synonymous with the amount of protein available from feed stuff to the fish [16].

The Pearson correlation matrix between physico-chemical parameters, length and weight of *C.gariepinus* (Table 3), indicated a level of significant ($p < 0.01$) between pH and length, while the relationship between the dissolved oxygen and length was at $p < 0.05$ level.

Table 1. Mean values of the Physico-chemical parameter of the treatment

S. No	Feed	pH	Temperature (°C)	DO (mg/l)	Alkalinity (mg/l)
1	Top	6.99 ^b	26.76 ^b	5.73 ^a	189.75 ^a
2	Vital	6.51 ^d	26.38 ^c	3.91 ^b	129.25 ^a
3	Lynx	6.80 ^c	27.05 ^a	4.70 ^c	131.25 ^a
4	Coppens	7.20 ^a	26.94 ^a	6.49 ^d	167.58 ^a
	SEM	0.044	0.617	0.304	3667.3

*Superscripts of the same alphabet are not significantly different ($P < 0.05$)

**Superscripts of different alphabets are significantly different ($P < 0.05$)

Table2: Mean values of growth parameters

S. No	Feed	Length (cm)	Weight (g)	FCR	Survival Rate (%)
1	Top	19.85 ^b	32.68 ^b	0.58 ^d	100
2	Vital	18.15 ^c	45.46 ^a	0.41 ^a	46.67
3	Lynx	17.73 ^c	29.91 ^b	0.61 ^c	53.33
4	Coppens	26.44 ^a	27.49 ^c	0.73 ^b	93.33
	SEM	7.368	31.254	0.448	123.98

*Superscripts of the same alphabet are not significantly different ($P < 0.05$)

**Superscripts of different alphabets are significantly different ($P < 0.05$)

Table3: Pearson's correlation matrix between physico-chemical parameters, length and weight

	Week	Treatment	pH	Temperature (°C)	Dissolved Oxygen (Mg/l)	Alkalinity (Mg/l)	Length (cm)	Weight (grams)
Week	1							
Treatment	.000	1						
pH	.305**	.253*	1					
Temperature	.109	.186	.381	1				
Dissolved Oxygen	-.181	-.557	-.178	-.204*	1			
Alkalinity	.126	-.035	.180	.069	-.161	1		
Length	.597**	.327**	.367**	.069	-.217*	.127	1	
Weight	.697**	-.259*	-.050	-.133	-.071	.041	.261*	1

**Significant at $p < 0.01$ *Significant at ($p < 0.05$)

4. CONCLUSION

The result of this experiment showed that fingerlings fed with different commercial feed has an effect on the physico-chemical parameters of the water. The best water quality and survival rate was observed with Coppens feed and Top feed while Vital feed has the least water quality and survival rate. Therefore, it is necessary to consider the prevailing physico-chemical characteristic that affects fish feeding behavior, survival and its utilization. The success of *Clarias gariepinus* fingerlings depends on quality feed and water for better growth.

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