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Effects Of Different Fish Feeds On Growth Performance Of African Catfish (C*larias Gariepinus (*Burchell, 1822) *Fingerlings*

[1]D. Torsabo, [1]B.T Iber, [2]D.P Elizabeth, [3]M.A Nasir

1. Federal University of Agriculture P.M.B 2373 Makurdi Benue State, Nigeria
2. Taraba State University P.M.B 1167 Jalingo Taraba State Nigeria
3. Usman Polytechnic Binyaminu P M B 013 Hadejia Jigawa State Nigeria

ABSTRACT

An investigation on the effects of different fish feeds on performance of African mud catfish *Clarias gariepinus* fingerlings was conducted in a semi flow through system at the outdoor facility of the Fisheries Department experimental farm of the Modibbo Adama University of Technology Yola for the period of 12 weeks. The fingerlings were stocked at the rate of 10 fish per tank, this was done in triplicate and the fingerlings were fed 5% of their body weight twice daily (9.00 and 16.00) in all the treatments. Water quality parameters observed were within tolerable limits and conducive for the growth and well being of the fingerlings. The highest mean weight gain of (125.99) was obtained in diet B (as well as the mean length gain of (19.65). The mean haematological parameters such as WBC was observed to be high in diet A (194.67) and low in diet B, but the differences were only observed in total protein and albumin in different treatments. Condition factor of diet A was the highest (2.02).The carcass proximate composition was significantly different in all the treatments with diet C having the highest crude protein (55.89); Diet A recorded the highest protein efficiency ratio (0.23). Therefore it can be concluded that indigenous or feeds locally formulated in the country in this research recorded the highest growth performance and nutrient utilization. Therefore it can be concluded that indigenous or feeds locally formulated in the country in this research recorded the highest growth performance and nutrient utilization.

Key words: Fish Feed, Clarias gariepinus, performance

INTRODUCTION

Fish represents a valuable source of micro nutrients, essential fatty acids and proteins. The importance of fish as nutrient is particularly high in developing countries, where the total protein intake level may be low. For 2.6 billion people in developing countries, fish provide more than 20% of the animal protein consumed compared to 8% in industrial countries (World Bank, 2005).

A decline in fishery resources caused by over fishing, or a significant increase in the price of food fish would seriously affect the nutritional status of major population groups (World Bank, 2005).

The nutritional status of developing countries can be salvaged by Aquaculture, but due to the expensive nature of fish feed, Aquaculture has not been able to help in the situation (World Bank, 2005).

Feed has been estimated to account for about 60 – 80% of the total cost of production of fish depending on species and environment (Balogun, *et al.,* 1992 and Adeparusi, 2005). The over dependence on fish as a major ingredient is also a constraint in the aquaculture industry, this has forced fish farmers to seek for comparatively cheaper

alternative source of animal and plant feed-stuff that can partially or completely replace fish meal in practical fish feed formation (Webster *et al.,* 1995).

The nutritional value of feed stuff in terms of feed formation for cultured fish in particular depends on their digestible crude protein and digestible energy (Dong, 2006). Feed is a compounded diet, a combination of feed ingredients otherwise known as nutrient sources (protein, lipid, carbohydrate, vitamin and minerals). Ingredients are combined through a process known as feed formulation. The primary objective of diet formulation is to provide a nutritionally balanced mixture of ingredients that will support the maintenance, growth, reproduction and health of the animal at relatively low cost (Otubusin, 1987).

Haruna (2003) defined feed formulation as the bringing together of feed ingredients and additives practically for the benefit of the stock.

Kumar (1992) also stated that supplementary feed can be compounded by using locally available feed ingredients and mixing with vitamins premix and essential minerals.

However to formulate a suitable balanced supplementary feed, the background knowledge of the nutritional requirement of the fish needs to be understood, this is because the qualities of nutrient required by the fish for attaining maximum growth vary with size and stages of the life cycle (Otubusin, 1987).

The essential nutrients such as vitamins, protein, fat, carbohydrates and minerals for the formulation of body tissues, production of energy and also for regulation of vital physiological processes are necessary for fish culture (Haruna, 2003).

Halver and Hardy (2002) reported that diet production must be economical to manufacture, store, ship and deliver. Pelleted feeds must remain intact in water until fish consume them and must be of high quality and good stability in aquatic environment (Miller *et al.,* 2003). Feeds have been traditionally fed as supplement or sole diet to fish aimed at ensuring maximum and economical production. The fish production rate may be increased significantly by merely supplementing the natural food with artificial feeds. Fish growth and yields are usually much higher with liming, fertilizers, adding concentrated feed minerals or by providing concentrated nutrients that the fish need as prepared supplementary feeds (Haruna, 2003)

Stickney and Lovel (1977) reported that where high densities of fish are reared in ponds under intensive culture system, a complete ration must be provided since natural foods from the system may not be present to balance a nutritionally incomplete diet.

According to De Silva (1988), availability of well balanced nutritionally complete and low cost effective compounded feed is very necessary in intensive fish culture system.

Nutritionally complete diet should be used whenever natural foods make small contribution to the nutrition (Dong, 2006). A quality fish feed can produce fast gains in fish weight; reduce the production period from 8 – 12 months to 5 or 6 months (Miller, 2002). The use of quality feed permits several harvests yearly with greater revenue. Fish feeds besides complementing natural pond food organism and supporting high stocking densities, enable the

fish farmer to observe the behavior, health status, feeding level and size changes during feeding (Delbert and Gatlin, 2010). In feeding, the nutritional requirement of the fish needs to be understood and evaluated.

The nutritional requirement of fish for proper growth are the same as those required by other animals i.e. protein, carbohydrate, lipid, vitamins and minerals

These elements form the basis for the preparation and selection of artificial feeds. Fish requirement for the various classes of food depends on species and age of the fish (Haruna, 2003).

Feedstuffs can be classified into two groups; energy feedstuffs and protein supplement feedstuffs.

Energy feedstuffs contain less than 20% crude protein while protein supplement feedstuffs contain 20% or more crude protein (Eyo, 2003). The maximum tolerable carbohydrate level depends on the overall balance of fat, protein and gross energy in the diet (Hilon *et al.*, 1982).

Hence, the nutritional value of the fish feed must be evaluated before feeding the fish The catfish genus can be defined as displaying an eel shape, having an elongated cylindrical body with dorsal anal fins being extremely long with both fins containing only soft fin rays.

The outer pectoral ray is in the form of a spine and pelvic fin which normally has six soft rays. The head is flattened, highly ossified, the skull bone forming a casque and the body is covered with smooth, scaleless skin. The skin is generally darkly pigmented on the dorsal and lateral parts of the body, the color is uniformly marbled and changes from grayish olive to blackish according to substrate. On exposure to light, the skin color generally becomes lighter (WWW.discoverlife, 2008).

A supra-branchial or accessory respiratory system composed of a paired pear-shaped air-chamber containing two aborecent structures is generally present. These aborecent or cauliflower-like structures located on the fourth branchial arcs are supported by cartilage and covered by highly vascularized tissue which can absorb oxygen directly from the atmosphere (Moussa, 1956). Since the air-chamber communicates directly with the pharynx and the gill-chamber, this accessory air breathing organ allows the fish to survive out of water for many hours or for many weeks in muddy marshes.

Clarias species inhabit calm waters from lakes, streams, rivers, swamps to floodplains, many of which are subject to seasonal drying. The most common habitat frequented are floodplains, swamps and pools in which the catfish can survive during the dry seasons due to the presence of their accessory air breathing organs (Bruton, 1979a;Clay,1979).

Although, numerous studies on the food composition of C. *gariepinus* have been carried out, a consistent pattern has not emerged and they are generally classified as omnivorous or predators.

Micha (1976) examined catfish from the river Ubangui (Central African Republic) and found that *C.gariepinus* fed mainly on aquatic insects, fish and higher plant debris. They have been found to feed on terrestrial insects, molluscs and fruits.

Haruna (2003) reported that *C. gariepinus* is an opportunistic feeder, feeding on what ever is available in its habitat. *C.gariepinus* shows a seasonal gonadal maturation which is usually associated with the rainy seasons.

The maturation processes of *C. gariepinus* are influenced by annual changes in water temperature and photoperiodicity and the final triggering of spawning is caused by a rise in water level due to rainfall (De Graaf *et al.*, 1996). It migrates to rivers and temporary streams to spawn

MATERIALS AND METHODS

Description of Study Area.

The study was conducted at the experimental farm of the department of fisheries at Modibbo Adama University of Technology, Yola located in Girei Local Government Area of Adamawa State, Nigeria

Duration of the Study.

The study lasted for the period of 12 weeks (84 days) from August to November 2014.

Experimental Set-up

The experimental set-up consisted of nine semi-flows through plastic tanks with 50liters water capacity. The plastic tanks were cleaned, disinfected with salt solution and allowed to dry for twenty-four (24) hours. After which, 30 liters of water was introduced in the tanks from a 2000 liters overhead tank

Experimental Fish.

Ninety *C. gariepinus* were obtained from Gesse Daddo farms along Yola-Numan road and was transported to the site of experiment using partially-cut 50 liters jerry can with cool water well aerated for about 40 minutes drive.

The fingerlings were starved for 24 hours prior to the time of transportation in order to reduce metabolic activities during the cause of transportation as recommended by Khanna and Sign (2003). The transportation was done at cool hours in order to avoid temperature increase as suggested by Haruna (2003). The fish were transferred to a holding tank and allowed to be acclimatized for two weeks (2 weeks). After the acclimatization period, the fish were stocked in plastic tanks at 10 fish per tank (30 liters of water).

Feeding of Fish.

Fish in all the treatments were fed two times a day (morning 9am and evening 4pm) on a protein balanced diet at the rate of 5% body weight per day. Feeding allowance was adjusted in accordance with increase in body weight and diet allotments were increased fortnightly after the length-weight determination.

Fish Length and Weight Measurement.

The initial body weight of each set of the fish was determined by using an electronic weighing balance before stocking. Subsequently, batch weighing of the fish in each tank was carried out bi-weekly during the course of the experiment

Fish Growth Performance.

The following parameters were analyzed considering mean weight gain (MWG), specific growth rate (SGR) %, percentage weight gain (PWG), feed conversion rate (FCR), protein efficiency ratio (PER) and condition factor (K)

Mean Weight Gain (MWG)

The fish weight gain was determined as the difference between the final mean weight of the fish at the end of the experiment and the initial mean weight gain in grams (Castel and Tiews, 1980).

$$MWG = \frac{W_1 - W_0}{n}$$

Where W_0 = Initial mean weight

W_1 = final mean weight

n = No. of fish in tank

Specific Growth Rate (SGR)

This is the mean percentage increase in body weight per day over a given time interval (Brown, 1957).

$$SGR = \frac{L_n W_1 - L_n W_0}{T} \times 100$$

Where W_0 = initial mean weight

W_1 = final mean weight

T = time interval

Feed Conversion Ratio (FCR)

The feed conversion ratio is the unit weight of feed given, divided by the live weight of fish (Wilson, 1989).

$$FCR = \frac{\text{Amount of feed fed (g)}}{\text{Weight gain by fish (g)}}$$

Protein Efficiency Ratio (PER)

This is the efficiency with which the fish utilizes dietary protein and is defined by the equation below (Osborne *et al.*, 1919).

$$PER = \frac{\text{Weight gain by fish (g)}}{\text{Weight of protein fed (g)}}$$

Where; weight of protein fed (g) = feed intake x % protein in the diet.

Condition Factor (K)

Condition factor (K) was calculated as :(Fulton 1902; Ricker 1975)

$$K = \frac{100W}{L^3}$$

Where; W= Weight of fish

L= Standard length of fish

Percentage Weight Gain (PWG). (Cheikyula and Ofojekwu 2003; Adewolu *et al.*, 2008).

$$PWG\% = \frac{\text{Mean Weight gain}}{\text{Initial Mean Weight}} \times 100$$

Analysis of Data.

Data was analyzed using one way ANOVA and the difference among means were tested for significance (p = 0.05) using Least Significant Difference (LSD) method

RESULTS

Composition of Formulated Diet

The results of the percentage composition of the ingredients used for the experiment is shown in Table 1

Proximate Composition of Experimental Diets

Table 2 shows the proximate composition of the various feeds used for the experiment; formulated diet designated as diet A, vital fish feed designated as diet B and Coppens fish feed designated as diet C with varying levels of crude protein, crude fiber, crude lipid, ash, dry matter and NFE respectively.

Weekly Mean Weight Gain of *Clarias gariepinus* Fingerlings Fed Different Fish Feed for 12 Weeks

Table 3 shows the weekly mean weight gain of *Clarias gariepinus* fingerlings fed diet A (formulated feed), Diet B (Vital fish feeds) and Diet C (Coppens fish feed). The highest mean weight gain of 125.99g was recorded in Diet B; while the lowest mean weight gain of 90.22g was recorded in Diet C.

Weekly Mean Length Gain of *Clarias gariepinus* Fingerlings Fed Different Fish Feed for 12 Weeks

Table 4 shows weekly mean length gain of *Clarias gariepinus* fingerlings fed diet A (formulated feed), diet B (vital fish feed) and diet C (Coppens fish feed). The highest mean length gain of 19.65cm was recorded in diet B; while the lowest mean length gain of 16.80cm was recorded in diet A.

Water Quality Parameters

Table 7 shows water quality parameters taken during the twelve weeks of the experiment. The temperature range was within 27.6 - 29.4; while pH was between the ranges of6.1 -7.0. Dissolved oxygen was within the ranges of 5.2 to 6.0 and ammonia was within the range of 0.02 – 0.04.

Table 1: Composition of Formulated Feed Used for the Experiment

Ingredient	% Composition
Fish meal	18.34
G.N.C	18.34
Soya bean	18.34
Yellow maize	19.74
Rice bran	19.74

Bone meal	1.5
Salt	1.5
Vitamin premix	2.5
Total %	100

Table 2: Proximate Composition of Experimental Diets

(%) Parameter	Formulated Feed (A)	Vital Fish Feed (B)	Coppens (C)
Crude protein	37.09	37.90	41.05
Crude fiber	4.05	3.45	1.75
Crude lipid	11.05	8.99	12.85
Ash	5.01	2.55	8.40
Dry matter	90.60	93.59	95.80
NFE	57.20	59.30	58.15

NFE: Nitrogen Free Extract.

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Table 3: Weekly Mean Weight Gain of *Clarias gariepinus* Fed Different Fish Feeds for 12 Weeks

Treatment Diet	Week 0 (Initial)	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	MWG
Diet A	2.60	3.75^{aa}	7.08^{a}	9.34^{aa}	13.99^{aa}	21.20^{ab}	26.49^{ab}	32.23^{bb}	38.49^{bb}	49.54^{bb}	60.72^{b}	77.50^{ab}	98.32^{aa}	95.72
Diet B	2.60	3.43^{a}	7.78^{aa}	10.85^{aa}	15.80^{aa}	23.20^{aa}	29.76^{aa}	44.44^{a}	60.29^{a}	80.07^{a}	98.52^{a}	113.52^{aa}	128.59^{aa}	125.99
Diet C	2.60	4.09^{aa}	8.13^{aa}	9.20^{a}	12.85^{a}	17.01^{bb}	20.79^{bb}	29.50^{b}	37.19^{b}	45.68^{b}	61.00^{bb}	76.91^{bb}	92.82^{a}	90.22
Mean	2.60	3.75	7.66	9.80	14.22	20.51	25.68	35.39	45.32	58.42	73.41	89.31	106.58	103.98
Pr > F	-	0.63	0.28	0.54	0.42	0.10	0.08	0.04	0.02	0.03	0.03	0.08	0.19	-
Coeff. Var	-	20.96	9.05	19.15	17.21	13.10	13.80	13.28	13.84	18.00	16.96	17.88	19.33	-

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Treatment Diets	Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	MLG

Means with the same Superscript on the same row are not significantly Different ($p > 0.05$)

Table 4: Weekly Mean Length Gain of *Clarias gariepinus* Fed Different Fish Feeds for 12 Weeks

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Diet A	4.21	6.03^{aa}	7.57^{a}	8.26^{a}	9.80^{a}	11.21^{aa}	12.98^{aa}	13.96^{aa}	14.67^{b}	16.11^{b}	17.49^{b}	19.28^{a}	21.02^{a}	16.80
Diet B	4.19	6.00^{a}	7.72^{aa}	8.75^{aa}	10.13^{aa}	11.70^{aa}	13.33^{aa}	14.62^{aa}	17.13^{aa}	18.95^{aa}	20.35^{a}	21.91^{aa}	23.84^{aa}	19.65
Diet C	4.20	6.10^{aa}	7.75^{aa}	8.54^{aa}	10.17^{aa}	11.05^{a}	12.41^{a}	13.86^{a}	15.44^{abb}	17.11^{abb}	18.03^{bb}	19.76^{aa}	21.03^{aa}	16.83
Mean	4.20	6.04	7.68	8.52	10.04	11.32	12.91	14.15	15.75	17.39	18.62	20.31	21.96	17.76
Pr > F	-	0.96	0.80	0.54	0.67	0.26	0.21	0.39	0.03	0.09	0.03	0.20	0.23	-
Coeff. Var	-	6.87	4.36	5.81	5.26	3.69	4.08	4.65	4.85	6.65	4.59	7.63	8.62	-

Means with the same Superscript are not Significantly Different ($p > 0.05$)

Table 5: Water Quality Parameters Taken From the Experimental Set-up for 12 Weeks.

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Parameters	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Temperature(℃)	28.6	28.8	29.3	27.6	28.7	29.4	29.5	28.2	28.3	29.1	29.1	28.3
pH	6.5	6.5	6.4	7.1	6.2	7.1	6.5	6.1	6.00	7.0	7.0	6.2
Dissolved Oxygen(mg/l)	5.2	5.3	6.0	6.0	5.4	5.2	6.0	6.0	5.9	5.3	5.3	5.4
Ammonia (mg/l)	0.04	0.03	0.03	0.02	0.03	0.03	0.03	0.04	0p.02	0.04	0.04	0.03

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DISCUSSION

The feeding trials revealed that Clarias gariepinus responded to all the diets, irrespective of their composition. Clarias gariepinus was able to effectively utilize the locally formulated diet for growth. It is interesting to note that better growth and nutrient utilization were achieved in diet B followed by diet A which had lower levels of crude protein compared to diet C.

It was observed that diet B showed a remarkable weight gain (125.99) compared to diet A (95.72) and diet C (90.22) in table 3, statistically using ANOVA; it was found that there is a significant difference in the body weight with different fish feeds.($P<0.05$). This is not in agreement with the study of Suphada and Kiriratnikom (2011) that body weights of catfish fed diet containing high levels of protein (40-44%) had the highest body weight gain.

This study clearly showed that diet B have the highest length (19.65) followed by diet C (16.83), statistically it was found that there was no significant difference in the length of the fingerlings with different fish feeds ($P<0.05$). The coefficient of variation (CV) in all the weeks indicates that the research work was reliable because none of its value was up to 50. Water quality parameters during the period of the study were all within the acceptable range for the culture of African catfish *Clarias gariepinus* as recommended by Boyd and Lichotkoter (1979) and did not have any negative effects on the performance of fish in all the treatments

CONCLUSION

Based on this investigation on the effects of different fish feeds on performance of African catfish *Clarias gariepinus* fingerlings, it was found that the locally formulated diets or feeds gave good performance. This could also reduce the cost of fish farmers going for foreign fish feeds which are expensive and may take longer time on the port to arrive in the country; it may as well give rise to nutrients leaching in the course of transportation.

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