GROWTH PERFORMANCE OF TILAPIA (*OREOCHROMIS NILOTICUS*) FED BAMBARA NUT

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ABSTRACT

The objective of this study was to assess the growth performance of Tilapia (Oreochromis niloticus) fed with Bambara nut. The experiment was conducted at the Hydrobiology and Fisheries Research Laboratory of the University of Jos. The experimental diet consisted of fish meal, Bambara nut, maize flour, cassava flour, bone meal, corn oil, and vitalyte. The diet was formulated to provide 25% crude protein. Bambara nut was used to replace fish meal. A total of 300 fingerlings were randomly assigned in a completely randomized design to five dietary treatments with 3 replicates: T1 (Control without Bambara nut meal), T2 (25% Bambara nut meal), T3 (50% Bambara nut meal), T4 (75% Bambara nut meal), and T5 (100% Bambara nut meal). The results revealed significant differences ($p < 0.05$) in percentage weight gained, feed intake, mortality, live number, and survival rate among the treatment. Fish in treatment 1 consistently exhibited significantly higher values for these parameters (80.40, 79.60, 79.03, 78.87, and 78.16%, respectively). Treatment 3, however, had a higher value for feed intake (22.62g) compared to treatment 5, which had a lower value (20.26). Survival rates were similar among treatment levels T1, T3, T2, and T4. Notably, weight gained, specific growth rate, length gained, condition factor, and feed conversion ratio were not significantly affected across the treatment levels. In conclusion, the study suggests that incorporating up to 50.0% Bambara nut meal in tilapia diets does not have detrimental effects on the growth of Tilapia.

Keywords: Growth Performance, Tilapia (*Oreochromis niloticus*), Bambara nut, Survival rate

INTRODUCTION

The ability of tilapia fish (*Oreochromis niloticus)* to tolerate environmental stress, reproduce easily, grow at a fast rate coupled with a high market demand for the species has made it an important fish for aquaculture production (El-Sayed, 2006). Tilapia are omnivorous and feed on a variety of foods ranging from zooplankton to fish food (Olaosebikan & Raji, 1998), and means they can use vegetable oil when it is supplied in the feed (Sala & Ballesteros, 1997).

Lack of feed ingredients is the most important challenge in Nigeria's aquaculture feed production industry. The indirect depreciation of the Naira is believed to have had a serious negative impact on the price of raw materials for aquaculture feeds. In addition, the supply of corn and soybeans is insufficient, and they are also contested by people and livestock hence, there is need for alternative raw materials.

Protein is the most expensive component of supplemental fish feed in aquaculture (Tacon *et al* 2009). Considering Bambara nut as an alternative protein supplement for commonly cultured fish species has become necessary for possible formulation of nutritionally balanced and low-cost diet for improved fish growth. High carbohydrate (65%) and relative high protein (18%) content as well as sufficient quantities of fat (6.5%) make the Bambara nut a complete food(Mahazib *et al* 2013). High cost of conventional feed ingredient contributes to high cost of animal protein (high cost of production) also there is inadequate literature on the use of Bambara nut for the production of Tilapia feed. Therefore, the aim of this study is to evaluate the growth performance of Tilapia (*Oreochromis niloticus*) fed Bambara nut.

MATERIALS AND METHODS

Experimental site

The experiment was carried out in the Hydrobiology and Fisheries Research Laboratory of the University of Jos, Nigeria.

Procurement of the Experimental Fish

Fingerlings of *Oreochromis niloticus* of the same brood stock with average weight of one gram were purchased from a private fish farm in Zarmaganda, Jos South, Plateau State, and transported to Hydrobiology and Fisheries Research Laboratory of University of Jos. Fish were placed in 15 plastic bowls (20 litres capacity). Twenty fingerlings in each of the bowls and acclimatized to laboratory conditions for 7 days during which the fish were fed with commercial fish feed (Vital feeds) twice daily (09.00 and 16.00 hours) at 3% of their body weight.

Collection of bambara nut dietary ingredient

Bambara nut was purchased from new market, Jos and transported to the Hydrobiology and Fisheries Laboratory of the University

Formulation of experimental diet

Experimental diet composed of fish meal, Bambara nut, maize flour, cassava flour, bone meal, corn oil, vitalyte and were weighed using Mettler MD-2000. Experimental diets were formulated to contain 25% crude protein. Pearson's square method was used to calculate the various proportions of ingredients inclusion levels and weighed before blending. Boiled water (100^0C) was added and mixed until complete homogenization was obtained and allowed to cool. The semi moist dough obtained was extruded using hand pelleting machine (2mm dice) and sun dried for 96 hours. Five experimental diets were prepared to contain varying proportions of Bambara nut and fishmeal as shown in the table below:

Table 1: Percentage composition of experimental diets fed *Oreochromis niloticus*

INGREDIENTS	Control	25% Bambara nut meal	50% Bambara nut meal	75% Bambara nut meal	100% Bambara nut meal
Fish meal	54.20	40.65	27.10	13.55	0.00
Bambara nut	0.00	13.55	27.10	40.65	54.20
Maize	18.40	18.40	18.40	18.40	18.40
Cassava flour	18.40	18.40	18.40	18.40	18.40
Oil	5.00	5.00	5.00	5.00	5.00
Bone meal	1.00	1.00	1.00	1.00	1.00
Vitalyte	2.50	2.50	2.50	2.50	2.50
Chromic oxide	0.50	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Experimental Design

After the acclimatization period, 20 fingerlings were randomly selected, sacrificed and used in determining the initial carcass percentage proximate composition as follows:

Determination of Growth and Feed Utilization Indices of *O. niloticus*

At the end of the experimental period, the following growth and feed utilization indices were determined:

Growth indices

(a) Specific Growth Rate (SGR)

This was calculated as:

$$\frac{\text{Log}_e W_2 - \text{Log}_e W_1}{T} \times 100$$

Where:

W_1 = Initial weight

W_2 = Final weight

Log_e = Natural log of base e

T = Experimental time in days

(b) Mean Growth Rate (MGR)

This is the average relative growth calculated thus;

$$MGR\ (g)/day = \frac{W_2 - W_1 \quad X\ 100}{0.5\ (W_1 + W_2)t}$$

Where:

W_1 = Initial fish weight

W_2 = Final fish weight

t = Duration of experiment in days

(c) Length Gain (LG)

$LG = L_2 - L_2$

Where:

L_1 = Initial length

L_2 = Final Length

(d) Condition factor (K-factor) = $\frac{w \times 100}{L^3}$

These were determined according to the method described by Hamid *et al*., (2017)

(e) Feed Conversion Ratio (FCR)

This is expressed as the proportion of dry feed per unit live weight gain of fish and calculated as:

$$FCR = \frac{\text{Weight of the feed (g)}}{\text{Live weight gain}}$$

(f) feed conversion efficiency (FCE) = $\frac{\text{Live weight Gain x 100}}{\text{Dry Weight of feed fed}}$

(g) Survival rate (SR) = $\frac{\text{live number of fish x 100}}{\text{Initial number of Fish}}$

Were determined using the method of (Hamid, *et al.,* 2017)

RESULTS

The result obtained in this study showed significant ($p<0.05$) difference in the percentage weight gained (%), feed intake (g), mortality, live number and survival rate across the treatment levels. The fish placed on treatment 1 consistently had a significantly higher value of (80.40, 79.60, 79.03, 78.87 and 78.16%) respectively. However, treatment 3 had (22.62) higher value obtained for feed intake compared to treatment 5 with a lesser value of (20.26g). Similarly, T1, T3, T2 and T4 had showed similar values of (58.00 and 57.00g) compared to (55.00g) in T5 for Live number. The values obtained at the treatment levels were also similar among each other in T1, T3, T2 and T4 for survival rate. However, it was observed that weight gained(g), specific growth rate, length gained (cm), condition factor and feed conversion ratio were not significantly affected.

Table 2: Growth performance of Tilapia (*Oreochromis niloticus*) fed Bambara nut meal

Parameters	**Control**	**25%** Bambara nut meal	**50%** Bambara nut meal	**75%** Bambara nut meal	**100%** Bambara nut meal	SEM	P-value
weight gain (g)	5.66	5.61	6.06	5.74	5.28	0.23	0.911
Percentage weight gain (%)	79.60^{ab}	78.87^{ab}	80.40^{a}	79.03^{ab}	78.16^{b}	0.30	0.155
Specific growth rate %	6.74	6.68	7.22	6.84	6.28	0.23	0.480
Length gain (cm)	3.78	3.59	4.04	3.92	3.37	0.23	0.927
Condition factor	1.37	1.47	1.34	1.32	1.55	0.22	0.998
Feed intake (g)	21.32^{ab}	21.34^{ab}	22.62^{a}	21.80^{ab}	20.26^{b}	0.3	0.142
Feed conversion ratio	2.27	2.30	2.23	2.30	2.34	0.22	1.000
Mortality %	2.00^{c}	3.33^{b}	1.67^{c}	3.33^{b}	5.33^{a}	0.36	0.000
Live number	58.00^{a}	57.00^{a}	58.00^{a}	57.00^{a}	55.00^{b}	0.37	0.240
Survival rate %	96.67^{a}	95.00^{a}	96.67^{a}	95.00^{a}	91.67^{b}	0.53	0.001

abc….values with different superscript letters across the rows are not significantly different ($p>0.05$), SEM: Standard error mean

DISCUSSION

In this study, it was possible to replace fishmeal with Bambara nut meal in Nile tilapia diets which was reflected in the growth and body compositions of tilapia. This is in agreement with Brough *et al*. (1993) who reported that, Bambara nut seed has enough quantity of carbohydrate, protein and fats with relatively high proportion of lysine and methionine as percentage of the protein. This is also corroborated by Amarteifio *et al.* (2006), who reported that, Bambara groundnut is a good source of minerals and can be helpful in formulating a balanced diet. Jackson *et al.* (1982) reported that Tilapia performed well on a diet containing 50% pigeon pea (*Cajanus cajan*) and Bambara nut *(Vigna subterranean L.)* as replacement for fishmeal. However, Agbo *et al.*(2011), reported decline in growth and feed digestibility when cotton seed meal was stepped up from 25% to 75% in the diet of *Oreochromis niloticus*, the author suggested a maximum of 50% replacement for fishmeal. Mbahinzireki *et al.* (2000) reported depressed growth and even mortality of tilapia after been fed up to 100% cotton seed meal as replacement for fish meal of the feed and recommended an inclusion level of about 50%. The least growth performance as obtained from this research was from fish fed 100% Bambara ground nut meal. The weight gained in this study was significant higher in 50% inclusion level of Bambara nut meals which is in line with the result obtained by Obirikorang *et al.* (2016), who used Copra Meal to feed *Oreochromis niloticus.*

However, the **feed conversion** ratio of the treatment diets showed no significant difference ($p>0.05$). Nevertheless, the quality of protein of Bambara waste meals has been reported to influence its utilization (Oyenuga, 1968).

The survival rate and live number was higher in fish fed 50% bambara nut meal with least mortality rate. The survival rate was slightly higher than the one reported by Ishiwu *et al.* (2020), who fed Bambara nut meal to catfish and obtained Survival Rate (SR) of the entire fishes during the experimental period of six weeks which was 86.67%. The difference (13.33 %) was mortality rate.

CONCLUSION

In conclusion, the results of this study demonstrate that it is possible to include Bambara nut meal up to 50.0% in tilapia diets without any deleterious effects on fish growth of Tilapia.

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