GROWTH RESPONSE AND NUTRITIONAL EVALUATION OF MANGO PEEL-BASED DIETS ON TILAPIA (*Oreochromis Niloticus)* FINGERLINGS.

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Abstract: One hundred (100) fingerlings of tilapia (*Oreochromis niloticus*) with average weight of 10.83±0.37g were obtained from the college ponds. The fish were acclimatized for three days in the plastic bowls during which the fish were not fed with any form of feed. Five iso-nitrogeneous diets were formulated to contain 35% crude protein. Maize (10% crude protein) was replaced by mango peel meal (6.6% crude protein) at 0% (MPD1), 25% (MPD2), 50% (MPD3), 75% (MPD4) and 100% (MPD5). The results of the nutrient utilization of *Oreochromis niloticus* fingerlings are expressed as food conversion ratio (FCR) and protein efficiency ratio (PER). The FCR ranged between 1.26 in fish fed diet DT2 and 2.09 in fish fed diet DT5. This increases with increase in level of replacement of mango peel meal in the diets. In FCR, Diet 2 is better than Diet 3, 4 and 5. Though, it is not significantly different from diet 3 but significantly different from diets 4 and 5 at $P< 0.05$. Protein efficiency ratio ranges between 0.28 in DT5 and 0.59 in DT2. Fish survival rate ranged between 61.2% in fish fed DT5 and 76.7% in fish fed DT1. Survival rate increased with decrease in replacement level of mango peel meal in the diets. Total fish production (TFP) ranged between 0.95kg/m^3 in fish fed diet DT5 and 1.91kg/m^3 in fish fed diet DT2. This decreases with increase in level of replacement of mango peel meal in the diets. Diet 2 is recommended also because of its better performance in weight gain and specific growth rate which is significantly different from diets 3, 4 and 5 at $P< 0.05$. [Researcher. 2010;2(6):44-49]. (ISSN: 1553-9865).

KEY WORDS: Tilapia, fingerlings, mango peel meal, replacement and growth rate.

Introduction

Fish is a major source of animal protein source and an essential food item in the diet of many people in Nigeria. Fish is also a good source of thiamine, riboflavin, vitamins A and D, phosphorus, calcium and iron. It is also very high in polyunsaturated fatty acids which are important in lowering blood cholesterol level. It is therefore suitable for complementing high carbohydrate diets typical of the low income group in Nigeria (Areola, 2008). The development of fish production is adversely affected by high cost of fish feed. Olomola (1990) reiterated that cost of fish feed has been recognized as major factor affecting the development and expansion of Aquaculture enterprise in African countries. Thus, reducing feed cost is a major challenge in Aquaculture nutrition. According to Falaye (1992), feed cost claims about 60% of recurrent cost of fish farming venture. This minimizes profit margin of fish farmers and negate the economic viability and sustainability of the fish industry. Pathmasethy (1983) and Olvera-Nova (1996) also reported that feed alone has been estimated to account for between 40-70% of the cost of intensive aquaculture operations.

Apart from high cost, it should also be noted that most of fish feed ingredients are also being competed for as food by man. For instance, maize is an important component in man's diet and prominent competitor for essential raw materials for animal feed industry (Alatise, 2007). In fact, major source of metabolisable energy in most compounded diets for fish and livestock is maize (Fagbenro *et al*, 1992 and Balogun *et al*, 1995). All these emphasize the importance and need for development of economic nutrient-complete diets for continuing expansion of aquaculture industry. Okoye and Sule (2001) supported this by stating that rapid expansion and success of commercial fish culture depends largely on availability of good quality and cheap feed. To fish farmers, in order to minimize running cost, it is important to use cheaper alternative feed ingredients that are locally available to produce good quality, suitable and palatable fish feeds. Harnessing non-conventional feedstuffs and by-products for aqua feeds would reduce unit cost of fish production.

By changing to alternative ingredients, the aim is not only economical but also sanitation of environment of wastes (or un-utilized agro-wastes). However, the increasing prohibitive cost of this commodity as a result of its many competing uses has

made it necessary to evaluate other ingredients to replace maize with other cheaper carbohydrates (Olurin *et al*, 2006). Mango peel meal fits into this. Mango fruit is one of the most important tropical fruits. Mango peel is its by-product and forms a sizeable part of the whole fruit. At present, mango peel is a waste product and its disposal is a problem. Mango peel is a valuable source of cheap calories and its use in animal feed is increasing (IITA, 1990), because of its high energy content and cheap nature. Mango peel can be utilized in rural areas among low-income group in fish farming. Though seasonal in availability, it can be made available relatively in large quantity if processed (dry) when plenty. Thus, incorporating mango peel meal in fish feed would not only help get rid of waste from the environment, it will also serve as tool for rural development.

The objective of this study is to assess the effect of varying replacement levels of maize with mango peel in diets on the growth performance of *Oreochromis niloticus* fingerlings. And to assess the optimal replacement levels of maize with mango peel in diets of *Oreochromis niloticus* fingerlings.

MATERIALS AND METHODS

Experimental System

The feeding experiment was conducted in 10 plastic bowls (44L) in Feed mill laboratory of Fisheries Technology, Federal College of Freshwater Fisheries Technology, and New Bussa. The bowls were filled to 2/3 of its volume with borehole water supplied from the college's borehole. To sustain optimal environment and to preclude primary productivity, the water was introduced in a splash for better aeration. The system was continuously flushed with freshwater through outflow pipes from the bowls.

Experimental Fish

One hundred (100) fingerlings of tilapia (*Oreochromis niloticus*) with average weight of 10.83±0.37g were obtained from the college ponds. The fish were acclimatized for three (3) days in the plastic bowls. During the acclimatization the fish were not fed with any form of feed, this was done to empty their gastrointestinal tract and prepare them for the new diet. The fish were transferred to the wet laboratory and acclimatized for one week.

Water Quality Parameters

Water quality parameters in the bowls during the experimental period are presented in Table 4.0. The values observed were within the tolerant range of *Oreochromis niloticus*. The pH was between 6.97–7.64, dissolved oxygen 6.3–8.2 mg/ litre and temperature 26.15 – 28.00 ˚C.

The entire feed ingredients except the mango peel meal were obtained from Monday market New Bussa. Mango (*Magnifera indica*) peels were obtained from local market and sun-dried for 72hours. All the ingredients were milled with hammer mill and sieved through a 595µm to remove chaff and ensure homogenous size profile. The ingredients for each diet were mixed thoroughly in a bowl and pelletized in a mechanically operated pelletizer. The moist pellets were sun-dried for 48hours, packaged in tagged air-tight polythene bags and stored in dry place at room temperature.

RESULTS AND DISCUSSION

Experimental Diets

Five iso-nitrogeneous diets were formulated to contain 35% crude protein. Maize (10% crude protein) was replaced by mango peel meal (6.6% crude protein) at 0% (MPD1), 25% (MPD2), 50% (MPD3), 75% (MPD4) and 100% (MPD5). The formulation was based on proximate composition of the ingredient is shown in Table 1. Likewise, the percentage composition of the experimental diets is also shown in Table 2.

Proximate Composition of Experimental Diets

The proximate composition of diets fed to *Oreochromis niloticus* fingerlings are presented in Table 3.0. The protein content varied from approximately 34.69% in DT5 to 35.74% in DT4. Crude fiber ranged between 2.20% in DT1 and 11.10% in DT5. Moisture content ranged between 9.30% in DT1 and 14.05% in DT5. Lipid content ranged between 23.30% in DT1 and 27.95% in DT2 while ash content ranged between 5.05% in DT1 and 5.95% in DT4. NFE ranged between 9.31% in DT4 and 24.35% in DT1. NFE decreases with increase in the inclusion levels of mango peel meal in the diet.

Table 1.0: Proximate composition of feed ingredients

INGREDIENTS	Moisture Content	Crude Protein %	Ether extract %	Crude Fibre %	Ash%	NFE
Fishmeal	6.90	72.00	4.10	1.31	14.80	0.89
Soybean meal	4.36	48.50	18.00	5.00	4.60	19.54
Groundnut cake	23.10	34.46	8.80	4.31	13.80	15.53
Mango peel meal	4.69	6.28	7.25	5.36	3.45	72.97
Maize	14.30	10.80	4.55	3.50	1.40	65.45

Growth performance

The growth performance of *Oreochromis niloticus* fingerlings fed the experimental diets in terms of weight gain, percentage weight gain (PWG), specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), and survival rate is presented in Table 4.3. The best growth was recorded for groups of fish fed DT1 and DT2. Final mean body weight ranged between 18. 24g in DT4 and 24.02g in DT2. Mean weight gain (MWG) and percentage weight gain (PWG) decreased with increase in replacement level of mango peel meal in the diets. Fish fed DT2 had the highest MWG and PWG values of 20.42g and 443.91% respectively. 10.09g and 242.6%, the lowest values of MWG and PWG were recorded for DT5. The decrease with increase in replacement level of mango peel meal in the diets was also observed in specific growth rate (SGR). SGR ranged between 2.20%/day in fish fed DT5 and 3.02%/day in fish fed DT2.

In the experiments, Figure 1 shows the weekly growth trend of the experimental fish fed the treatment diets for eight (8) weeks. The specific growth rate of *O. niloticus* fingerlings fed Diet 1 of mango peel meal based diet is not significantly different ($p > 0.05$) from Diet 2 and Diet 3 but significantly different from the remaining diets. However, Diet 2 which is recommended is significantly different from diets 3, 4 and 5 at $P < 0.05$. In the substituted diet, the optimum growth was recorded in *Oreochromis niloticus* fingerlings fed with 35.76% crude protein in the Diet 2 as against a lower crude protein of Diet 5 fed *Oreochromis niloticus* fingerlings. This agrees with observation made by Omoregie and Ogbemudia (1993) that *Oreochromis niloticus* requires percentage crude protein range of 30-35%. Faturoti and Akinbote (1986) also stated that *Oreochromis niloticus* requires 28% for fry and fingerlings. The poor performance of feed fed with Diet 5 which contains 100% mango peel-meal without maize meal could be attributed to its low crude protein percentage levels as shown in Table 3.0. Growth response and nutrient utilization of *Oreochromis niloticus* fingerlings diets with different levels of mango peel meal based diets are presented in Table 5.0. Diet 2 had the best result in weight gain of 443.91% and specific growth rate of 3.02%. The poorest was found in Diet 5 as shown in Table 5.0. This demonstrate the fish fed with diets containing moderate levels of mango peel meal along with maize meal grows better than those fed with high levels of mango peel meal without maize. Also, the result obtained in this study is in agreement with the result obtained by Omoregie *et al.* (1991) when they included cassava peelings and mango seeds in the diet of *Oreochromis niloticus.* Also Ofojekwu *et al*. (2003) reported a decrease in weight gain of *Oreochromis niloticus* with an increase in levels of palm kernel meal. The poor performance of fish feed with Diet 5 with 100% mango peel meal without maize meal could be attributed to its low crude protein percentage level as shown in Table 3.0. From the results obtained, the incorporation of mango peel meal (for the levels studied) in the diet of *Oreochromis niloticus* has no significant depression in growth nor deleterious effect on health of the fish, which to a lesser extent (25%) mango peel meal was not only well utilized by Oreochromis niloticus but also show some high level of performance.

Table 2.0: Percentage composition of the experimental diets

Ingredients	**MPD1 0%**	**MPD2 25%**	**MPD3 50%**	**MPD4 75%**	**MPD5 100%**
Mango peel meal	00.00	12.00	24.00	36.00	48.00
Maize	48.00	36.00	24.00	12.00	00.00
Fishmeal	15.00	15.00	15.00	15.00	15.00
Soybean meal	15.00	15.00	15.00	15.00	15.00
Groundnut cake	15.00	15.00	15.00	15.00	15.00
Vegetable oil	2.00	2.00	2.00	2.00	2.00
Methionine	1.00	1.00	1.00	1.00	1.00
Lysine	1.00	1.00	1.00	1.00	1.00
Chromic oxide	1.00	1.00	1.00	1.00	1.00
Vitamins Premix	2.00	2.00	2.00	2.00	2.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 3.0: Proximate composition of experimental diets

Parameters %	**DT1**	**DT2**	**DT3**	**DT4**	**DT5**
Moisture	9.30a	11.95b	12.70b	13.25bc	14.05c
Lipid	23.30a	27.95b	26.75bc	25.25c	25.00c
Ash	5.05a	5.90b	5.45b	5.95b	5.45b
Crude Fibre	2.20a	5.50b	8.50c	10.50d	11.10d
Crude Protein	35.80a	35.76a	35.72a	34.74b	34.69b
NFE	24.35a	13.00b	10.88c	9.31c	9.71c

NFE - Nitrogen Free Extract

Mean in the same row with different letters are significantly different from each other at $P< 0.05$.

Table 4.0: Mean weekly values of physico-chemical parameters during the experimental period.

Weeks	pH	Dissolved Oxygen (mg/l)	Temperature (˚C)
O	7.16	6.4	26.71
1	7.02	6.7	27.50
2	7.33	6.3	27.00
3	7.47	6.5	27.00
4	7.64	8.2	27.50
5	7.54	7.9	26.15
6	7.44	7.2	27.00
7	7.58	7.4	28.00
8	6.97	7.6	26.78
MEAN	7.40	7.1	27.07

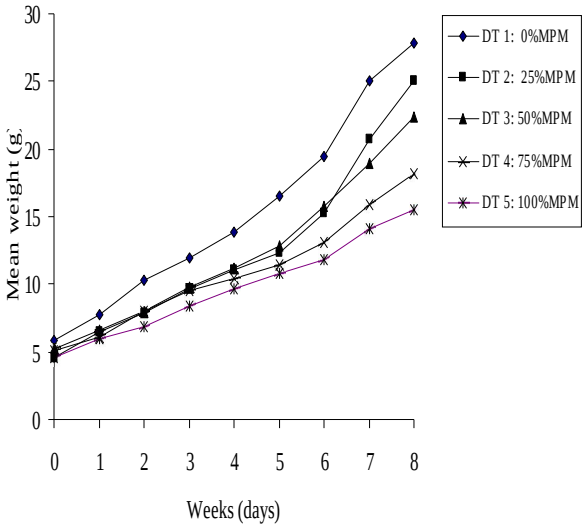

Figure 1: Meam weekly growth trend of *Orechromis niloticus* figerlings fed various levels of mango peel meal based diets

Table 5.0: Growth response and nutrient utilization of *Oreochromis niloticus* fingerlings fed various level of mango peel meal based diets

Parameters	**DT1**	**DT2**	**DT3**	**DT4**	**DT5**
Initial mean body weight(g)	5.83	4.60	5.23	5.03	4.53
Final mean body weight (g)	27.89	25.02	22.32	18.24	15.52
Weight gain (g)	22.06	20.42	17.09	13.21	10.09
Feed Intake (g)	27.46	25.76	22.17	27.10	21.13
Percentage weight gain	378.39	443.91	326.77	262.62	242.60
Specific growth rate (%/ day)	2.80	3.02	2.61	2.20	2.29
Food conversion ratio (FCR)	1.24	1.26	1.30	2.05	2.09
Protein efficiency ratio (PER)	0.63	0.59	0.48	0.38	0.28
Survival rate (%)	79.70	76.70	75.70	71.20	61.20
Total fish production (Kg/m^3)	2.22	1.91	1.69	1.30	0.95

CONCLUSION AND RECOMMENDATION

It could be concluded that the growth performance of *Oreochromis niloticus* decreases with increase in inclusion level of mango peel meal in the diet and 25% maize replacement with mango peel is optimal for *Oreochromis niloticus* growth performance. It is therefore recommended that mango peel, though seasonal, be included at not more than 25% inclusion level to reduce cost of feed without necessarily compromising fish growth rate. This will not only boost fish production but also serve as means of waste disposal as well as utilization of mango peel. It will also serve as a tool for rural development.

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