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Response of *Tilapia niloticus* Fed on Different Feeds Composition

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ABSTRACT

Ninety juveniles of *Tilapia niloticus* were collected and fed on three different composed diets which are the locally compounded feeds with fish meal inclusion as treatment one (T1). The second treatment was fed on imported feed (T2) and treatment three (T3) with locally compounded feed with feather meal inclusion. At the end of eight weeks it was found out that fish under treatment (1) had the highest feed intake than the treatment 2 and 3. The weight gained in treatment 2 was higher than 1 and 3. The survival rate was high in this experiment but the means were not significantly different ($p>0.05$). The higher survival rates were attributable to the range of the physiochemical measurement. The weight gained was attributed to the palatability of the floating nature of the feed. The treatment 3 had the lowest weight gained which might be due to the low palatability as a result of feather meal inclusion in the feed. The feed conversion ratio in treatment 2 was the highest subsequently followed treatments 3 and 1 respectively. Since, T1 and T2 recorded a reasonable profit it can then be worked upon, also it is recommend that *Tilapia* could be raised in glass tank because the survival rate is bearable depending on the management.

Key words: *Tilapia niloticus*, fish meal, feather meal and imported feed

INTRODUCTION

Aquaculture is the rearing of water organisms that are beneficial to mankind in a confined or controlled environment.

One of the great advantages of *Tilapia* for aquacultures is that they feed on a low trophic level. *Tilapia* are currently divided into three major taxonomic groups based primarily on their reproductive behavior which are the substrate incubator (*Tilapia* spp.) maternal mouth brooder (*Oreochromis* spp.) and parental or bi-parental mouth brooder (*Sarotherdon* spp.). The members of the genius *Oreochromis* feed on algae, aquatic plant, small invertebrate, detrital material and associated bacterial films. This provides an advantage to farmer because the fish can be reared in extensive system that depends upon the natural productivity of a water body or in intensive system that can be operated with lower feeds cost (Jauncey, 1998).

Tilapia species whose taxonomy has undergone some changes are known to feed on a wide variety of food material (Trewavas, 1982). Bowen (1981) reported that *Tilapia* species may ingest animal material but usually doesn't constitute a significant proportion of the fish total food intake. The diets of *Tilapia* species have been reported to vary with fish size and time or season of the year (Adesulu, 2004).

Fish is one of the cheapest sources of animal protein when compared to beef and chicken. Thus, it is widely consumed by both rich and poor and also the demand for fish outstripped its supply.

Fish farming has shown remarkable 20% increase in growth per year for the past six years with highest growth in small-to-medium enterprises and a number of large scales intensively managed fish farm. Together with Egypt and South Africa, Nigeria is now one of the most significant and strongly growing aquaculture producers in the region. Nigeria's fast growing aquaculture is a replication of that observed in other regions where the market has been a long in driving growth (Fish Stat Plus, 2004). Hence, the study is designed to determine the response of *Tilapia niloticus* to different types of feed, fed on imported pelletized feed, locally compounded feed and feather meal as inclusion with the feed in glass tank since it is known that *Tilapia* are mostly reared in earthen pond and they feed on natural diets which is a free supply from the pond.

The objectives of study are to evaluate the growth performance of juvenile *Tilapia niloticus* in glass tank and to determine the survival rate of *Tilapia niloticus* fed on imported feed, local feed and feather meal inclusion feed, respectively.

MATERIALS AND METHODS

The study was carried out at the Department of Fisheries Technology, School of Agriculture, Lagos State Polytechnic Ikorodu Campus. The experiment was carried out in three glass tank, each divided into three replicate having a volume of 0.178 m^8. Before the commencement of the experiment, the tanks were washed, cleaned and filled with water to about three quarter of its volume.

Stocking of experimental fish: Ninety juveniles of *Tilapia niloticus* were used for the experiments which were purchased from a reputable farm at Badagry. Each of the tanks replicate contained ten juveniles of *Tilapia niloticus* and was randomly assigned to experimental diets treatment.

Physical and chemical parameters: Physio-chemical parameters were monitored and analyzed with Bauch and Lamb field analysis kit. Parameters such as Water pH, Dissolved Oxygen, Temperature and Ammonia were analyzed. Dissolved Oxygen was improved by using aerator for proper and effective circulation of oxygen in all the glass tanks for the fishes. Also, changing of water was done every 2 days by siphoning and adding new water to prevent pollution.

Feeding of the fish: The fish was fed with the experimental diets daily for the duration of two months. And they were properly fed. Treatment 1 (control) contained locally compounded feed (fish meal inclusion), treatment 2 with imported feed and treatment three was locally compounded feed with feather meal inclusion (at 14.5% inclusion). The feed was served at a fixed point in the glass tank at each feeding time and was served twice daily (in the morning and in the evening).

The total weight of feed consumed per each feeding trial and total body weight of fish were recorded every week.

Experimental design: Complete Randomized Design (CRD) method was used. The experiment consists of three treatments and three replicate.

Composition of experimental diets: The choice of the ingredients was based on the content of the essential dietary nutrient and their availability and price. The local feed was prepared using

the following ingredient; fish meal, maize, wheat, offal, groundnut cake, soya bean, blood meal, spaghetti, salt, fish premix and vitamin C while the feather meal inclusion feed contained the entire ingredient in the local feed with the inclusion of hydrolyzed feather meal and the imported feed was brought from the market at Sabo, Ikorodu.

Data collection and analysis: The weight gain, feed intake, survival rate and feed conversion ratio were measured on a weekly basis to determine the effect of the experimental diet on the fishes. Also data was collected and analyzed using analysis of variance:

$$\text{Weight gain} = \text{Final weight-initial weight}$$

$$\text{Mortality (\%)} = \frac{\text{No. of stock-No. of remnant}}{\text{No. of stock}} \times 100$$

$$\text{Feed conversion ratio} = \text{Weight gain/Feed intake}$$

RESULTS AND DISCUSSION

Physio-chemical parameters

Water temperature: The water temperature ranged from 24-30°C for the treatment.

pH of water: The pH ranged from 6.4-8.0 for the treatment.

Dissolved oxygen: The dissolved oxygen ranged from 5.0-9.0 mg L^{-1} for the treatment.

Average feed intake: Table 1 contains the composition of experimental diets in g/100 g in which we have the composition of T1 and T3, respectively and that of imported feed was not available as at that time, so, it was left out. Proximate analysis of experimental diets is in the Table 2 where we have the crude protein of T1 (44.36), T2 (45) and T3 (44.56), respectively. The average feed intake g/fish/week was shown in Table 3. Fish on treatment 1 (local feed) had the highest feed intake of 3.94 g followed by T2 and T3 with the intake value of 3.06 and 2.38, respectively. Statistical analysis revealed that there was no significant difference ($p>0.05$) in the

Table 1: Composition of experimental diets g/100 g

	Diets		
Ingredients	1 (Local feed)	2 (Imported feed)	3 (Feather meal inclusion feeds*)
Maize	10	N	12
Wheat offal	5	O	5
Groundnut cake	18	T	18
Soya bean	36	V	36
Fish meal	20	A	0
Blood meal	5	I	5
Spaghetti	5	L	5
Salt	0.25	A	0.25
Fish premix	0.25	B	0.25
Vitamin C	0.50	L	0.50
Feather meal	0	E	18
Total (kg)	100		100

Table 2: Proximate analysis of experimental diets

	Diets		
Ingredients	1 (Local feed)	2 (Imported feed)	3 (Feather meal inclusion feeds)
Crude protein	44.36	45	44.56
Energy (kcal)	2806	-	2809.7
Fiber (%)	3.89	1.5	4
Fat (%)	3.74	12	4.09
Calcium	1.35	-	0.1
Phosphorus	0.88	1.2	0.33

Table 3: Average feed intakes (g) /fish/week

Weeks	T1	T2	T3
1	2.29	5.96	3.26
2	4.10	3.05	1.93
3	3.92	2.24	2.27
4	3.92	2.20	3.39
5	3.33	3.43	3.90
6	4.70	1.40	2.23
7	5.00	2.67	1.57
8	4.27	3.50	1.47
∑X	31.53	24.45	19.02
X	3.94	3.06	2.38

Table 4: Average weight gain (g)/fish/week

Weeks	T1	T2	T3
1	3.17	5.83	1.33
2	3.98	6.39	1.00
3	3.79	2.13	1.83
4	2.37	3.38	3.78
5	3.50	2.70	2.20
6	2.50	1.07	1.80
7	2.00	2.70	2.43
8	2.00	2.90	2.10
∑X	23.31	27.10	16.47
X	2.91	3.39	2.06

overall average feed intake of the fishes (Appendix 1). It was noted that there was differences in the value with T3 having the lowest feed intake. This may be attributed to the low palatability of the feather meal which was earlier reported by Ayanwale (2006) who fed rabbit with feather meal based diet.

Average weight gain: Table 4 shows the average weight gain in g/fish/week of the treatment. Statistical analysis revealed that there was no significant difference ($p>0.05$) in the overall average weight gain of fishes. (Appendix II), Fish on treatment 2 (imported feed) had the highest average weight gain of 3.39 g per fish/week. Fish on treatment 1 had average weight gain of 2.91 g while fish on T3 had the lowest weight gain of 2.06 g.

Table 5: Survival rate per treatment/week

Weeks	T1	T2	T3
1	30	30	30
2	28	28	30
3	22	28	30
4	20	28	30
5	20	28	29
6	20	28	28
7	19	27	26
8	18	27	25
∑X	177	224	228
X	22.12	28	28.5

Table 6: Percentage survival rate

Parameters	T1	T2	T3
Initial stocking rate of juvenile per tank	30	30	30
Final stocking rate/No. of juvenile per tank	18	27	25
Mortality (%)	40%	10%	16.7%
Survival rate (%)	60%	90%	83.3%

Table 7: Average feed conversion ratio/week

Weeks	T1	T2	T3
1	1.38	0.98	0.41
2	0.97	2.09	0.41
3	0.97	0.95	0.81
4	0.60	1.54	1.58
5	1.05	0.79	0.56
6	0.53	0.76	0.81
7	0.40	1.01	1.54
8	0.47	0.83	1.42
∑X	6.37	8.95	7.65
X	0.80	1.11	0.96

Survival rate: Table 5 above shows the survival rate of the fishes fed in the experimental diet. Fish on treatment 3 had the highest survival rate of 28.5 followed by treatment 2 and treatment 3 with survival rate of 28 and 22.12, respectively. While treatment 2 had the highest percentage survival rate as shown in the Table 6. Statistical analysis revealed that there is no significant difference ($p>0.05$) among the treatment mean (Appendix III).

Average feed conversion ratio: The Table 7 shown above contained the feed conversion ratio of the fishes feed with the experimental diets. Fish on treatment 2 (imported feed) had high feed conversion ratio of 1.11 which was followed by T3 and T1 with average feed conversion ratio of 0.96 and 0.80, respectively. Statistical analysis revealed that there was no significant difference ($p<0.05$) in the feed conversion ratio of the fishes fed with the experimental diets (Appendix IV).

The Table 8 above shows the production cost of experimental diet. Treatment 2 had the highest profit of N 11.55 followed treatment 1 with N 9.66 while treatment 3 had a profit of N 6.24. This is as a result of the feather meal that was used to replace fish meal.

Table 8: Production costs of experimental diets: variable

Variables	T1	T2	T3
No. of days	56	56	56
No. of fish/treatment	30	30	30
No. of fish/replicate	10	10	10
Cost of 1 juvenile fish (₦)	10	10	10
Cost/kg of feed ₦/kg	150	350	130
Cost/g of feed	0.15	0.35	0.13
Average feed intake/fish (g)	3.94	3.06	2.38
Average weight gain/fish (g)	2.91	3.39	2.06
Average feed conversion ratio	0.8	1.11	0.96
Total feed intake/fish (g)	31.52	24.48	19.04
Total cost of feeding ₦	4.73	8.57	2.48
Other variables ₦	2	2	2
Market price per kg (₦)	500	500	500
Market price per g (₦)	0.5	0.5	0.5
Average final weight per fish (g)	23.31	27.1	16.47
Revenue ₦	11.66	13.55	8.24
Total cost of production	12.15	12.35	12.13
Profit (₦)	9.66	11.55	6.24

Fish growth is influenced by various physiochemical parameters and nutrient availability in the water body. The level of nutrient may vary considerably. All fish species has different level of tolerance and lethal values to various environmental conditions prevailing in the ambient water body. Temperature plays a crucial role in fish production as high temperature help in high dissolution of oxygen. Huet (1972) recommended pH range of 7.0-8.0 with less fluctuation is best for *Tilapia*. According to Boyd (1979) natural water that contains high alkalinity support more productivity than water of lower alkalinity. *Tilapias* are generally hardened and have a high tolerance level for alkalinity. The feed intake of the fish were not uniform from week one to eight, fish under treatment 1 had the highest feed intake than those of treatment 2 and treatment 3. The high feed intake observed among the treatment might be attributed to the protein requirement by juvenile *Tilapia* which is within the range of 30-45% crude protein (Gunasekera *et al*., 1996). The weight gain of the fish in treatment 2 was higher than treatment 1 and 3. The high weight gain of the fish in treatment 2 might be attributed to the palatability and the floating nature of the feed. NRC (1987) and Pompa (1982) reported that high level of anti-nutrient can result in low consumption and high utilization. While treatment 3 had the lowest weight gain. This might be attributed to the low palatability as a result of feather meal inclusion in the feed.

The feed conversion ratio in treatment 2 was higher subsequently followed by T3 and T1. The considerable FCR recorded in this study agrees with result of Maldonado and Pagan-Front (1979), Villareal (1980) and Pantastico *et al*. (1982) that fish reared in lower volume consumed less food and convert far less efficiently spending greater energy on surfacing resulting in low growth performance and vice versa. The survival rate were high in this experiment but the means were not significantly different ($p>0.05$). The high survival rates were partly attributable to the tolerable range of the physiochemical measurement during the experiment. The result of production cost showed that treatment 2 is economical than other treatment in terms of profit gain followed by

treatment 1, while treatment 3 is least profit gain because of the feather meal inclusion. However, feather meal is not as profit rewarding in production of *Tilapia* in glass tank as fish meal but the survival rate is considerable.

CONCLUSION

There was no significance difference ($p>0.05$) in the weight gain, feed intake and feed conversion ratio of fish fed with the experimental diet. The highest feed cost was recorded in the imported pelletized feed while the lowest cost was observed in hydrolyzed feather meal inclusion feed. However, hydrolyzed feather meal cannot be used as an inclusion in *Tilapia* feeding ration as a source of protein because it is not economical in terms of production cost and also has low palatability. The result obtained with use of hydrolyzed feather meal as a fish meal replacer with aqua feeds for *Tilapia* has been more controversial. However, Tacon *et al*. (1983), Viola and Zohar (1984) and Davies *et al*. (1989) all reported poor growth in *Tilapia* when fed hydrolyzed feather meal base diet. While Bishop *et al*. (1995) reported that Hydrolyzed Feather Meal could replace up to 50 and 66% of the fish meal within diet for *O. niloticus* fingerlings and fry with no lost of growth performance. So, *Tilapia* can be raised in glass tank because survival rate is bearable depending on the management.

RECOMMENDATION

More study should be carried out on how to improve on the method of processing local feed for better utilization.

Appendix I: ANOVA Table for feed intake source

Variation	DF	SS	MS	F_{CAL}	F_{TAB}
Treatment	2	0.451	0.225	4.687	5.14
Error	6	0.292	0.048	-	
Total	8	0.743	-	-	

Appendix II: ANOVA Table for weight gain

SS	DF	SS	MS	F_{CAL}	F_{TAB}
Treatment	2	2.21	1.103	2.49	5.14
Error	6	2.65	0.44	-	
Total	8	4.86	-	-	

Appendix III: ANOVA Table for survival rate

SS	DF	SS	MS	F_{CAL}	F_{TAB}
Treatment	2	8.31	4.15	0.96	5.14
Error	6	25.70	4.26	-	-
Total	8	34.07	-	-	-

Appendix IV: ANOVA Table for feed conversion ratio

SS	DF	SS	MS	F_{CAL}	F_{TAB}
Treatment	2	0.263	0.263	0.521	5.14
Error	6	1.523	1.523	-	
Total	8	1.786	-	-	

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