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The response of *Tilapia niloticus fed* on different feeds composition

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Abstract

Ninety juveniles of Tilapia niloticus were fed on three different composed diets, the locally compounded feeds with fish meal inclusion, the control, the second treatment were fed on imported feed (2) and treatment (3) 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 those of treatment 2 and 3. The weight gained in treatment 2 was higher than 1 and 3. The survival rate were 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 highest subsequently followed treatments 2 and 3 respectively.

Keywords: Tilapia niloticus, feather meal, survival rate, growth parameters.

Introduction

Aquaculture is the rearing of water organisms that are beneficial to man-kind 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 paternal or bi-parental mouth brooder (*Sarotherdon spp*). The members of the genius *Oreochromis* feed on algae, aquatic plant, small invertebrate, detrital material and the 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 1999). Bowen (2001) 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 (Adesalu 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 farms, 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 in aquaculture is a replication of that observed in other regions where the market has been a long in driving growth (FAO, 2004). Hence the study is designed to determine the response of *T. 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 objective of the project:

1. To evaluate the growth performance of juvenile *T. niloticus* in glass tank.
2. To determine the survival rate of T. niloticus fed on imported feed, locally feed and feather meal inclusion feed respectively.

Materials and Methods

The project was carried out at the Fisheries Technology Department, School of Agriculture, Lagos State Polytechnic Ikorodu Campus. The experiment was carried out in three (3) glass tank, each divided into three (3) replicate having a volume of 0.178m^3. 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 (10) 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 two (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 One (control) contained locally compounded feed (fish meal inclusion), treatment Two with imported feed and Treatment Three was locally compounded feed with feather meal inclusion (at14.5% 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.

Table 1: Composition of experimental diets g/100g.

Ingredient	Diet 1 Local feed	Diet 2 Imported feed	Diet 3 Feather meal inclusion feeds*
Maize	10	NA**	12
Wheat offal	5	NA	5
Groundnut cake	18	NA	18
Soybean	36	NA	36
Fish meal	20	NA	0
Blood meal	5	NA	5
Spaghetti	5	NA	5
Salt	0.25	NA	0.25
Fish premix	0.25	NA	0.25
Vitamin c	0.50	NA	0.50
Feather meal	0	NA	18
	100Kg	NA	100Kg

*NA** – Not available.*

Table 2: Proximate analysis of experimental diets.

Ingredient	Diet 1 Local feed	Diet 2 Imported feed	Diet 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

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 were collected and analyzed using analysis of variance.

i. Weight Gain = Final Weight – Initial Weight

ii. $$Percentage\ mortality = \frac{Number\ of\ stock - number\ of\ remnant}{Number\ of\ stock} \times 100$$

iii. Feed Conversion Ratio =Weight Gain / Feed Intake.

Results and Discussion

Physio-chemical parameters

- Water temperature: The water temperature ranged from 24 to 30°C for the treatment.
- pH of water: The pH ranged from 6.4 to 8.0 for the treatment.
- Dissolved oxygen: The dissolved oxygen ranged from 5.0 to 9.0 mg/l for the treatment.
- Average feed intake:

Table 4.1.2: Average feed intake (G) /Fish/Week

Week	T_1	T_2	T_3
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

- The average feed intake g/fish/week was shown in table 4.1.2 above. Fish on Treatment 1 (Local Feed) had the highest feed intake of 3.94g followed by T_2 and T_3 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 overall average feed intake of the fishes. 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 (g):

Table 3: Average weight gain (g)/fish/week.

Week	T_1	T_2	T_3
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	1.60
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

- Table 4.1.3 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 3.39g per fish/week. Fish on Treatment 1 had average weight gain of 2.91g while fish on T3 had the lowest weight gain of 2.06g.
- Survival rate: C

Table 4: Survival rate per treatment/week.

Week	T_1	T_2	T_3
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 5: Percentage survival rate.

	T_1	T_2	T_3
Initial stocking rate of juveniles per tank	30	30	30
Final Stocking Rate/No. of juveniles per tank	18	27	25
Percentage mortality	40%	10%	16.7%
Percentage survival rate	60%	90%	83.3%

- Table 4.1.4 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 4.5. Statistical analysis revealed that there is no significant difference (P>0.05) among the treatment mean. (Appendix IV).
- Average feed conversion ratio:

Table 6: Average feed conversion ratio/week.

Week	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

- The table 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 III)

Table 4.1.6: Production costs of experimental diets:

Variable	T1	T2	T3
Duration of the study (days)	56	56	56
Number of fish/treatment	30	30	30
Number 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

The above table shows the production cost of experimental diet. Treatment 2 had the highest profit of N11.55 followed Treatment 1 with N9.66 while Treatment 3 had a profit of N6.24, this is as a result of the feather meal that was used to replace fish meal.

Discussion

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 dissolve 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 [1] to eight [8], 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, 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 et al (1979), Villarreal (1980) and Pastastico 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 lease 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. More so, Tilapia can be raised in glass tank because survival rate is bearable depending on the management.

Recommendation

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

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