103 Nutrition Evaluation and Growth Performance of catfish Fingerling fed Varying Inclusions of Toasted Tamarind Tree Seed Meal

Orire, A.M. & Ogbu, N.I.

Abstract

Ninety (90) fingerling of Clarias gariepinus with mean weight of 2.23 ± 0.21g were fed three diets for 56 days in 20 litres round plastic bowls in a randomized design. The experiment was conducted to utilize toasted Tamarindus indica seed(TTSM) as a replacement for groundnut cake. The three diets were formulated to contain 40% crude protein and 5% lipid. The TTSM was included at three graded levels of 0%, 50% and 100% designated as diet 1,diet 2 and diet 3 respectively. The results showed significant differences (P>0.05) in the growth parameters among the diets fed. Diets with the inclusion of 50% TTSMhad thehighest growth performance and exhibited the best specific growth rate (SGR), feed conversion ratio(FCR), protein efficiency ratio (PER), apparent net protein utilization (ANPU)and body compositions. This indicated that T. indicaseed can be utilized by C. gariepinus withoutany adverse effect.

Keywords: *alternative,plants, protein sources, catfish*

Introduction

As aquaculture gains ground, and its demand in the word today is increasing geometrically, there is need for its sustainability specifically in fish feed production. Aquaculture propagation of *Heterobranchus* spp. and *C. gariepinus* known as African catfishes have been carried out for centuries in Africa. The need for biomass enhancement of the species' larvae, fries and fingerling with respect to fast growth rate is indispensable to ensuring fish food security in Africa (U.S.D.A., 1988). In our quest for a suitable alternative protein sources for fishmeal due to its high cost.*T. indica* was identified as a good but underutilized plant protein source(El-Saddiq et al., 2006; Emmy et al., 2010). According to world health organization report, *T. indica* seed is an essential source of all necessary amino acid but tryptophan (Bhadoriya et al., 2011). It is in this view that, this research was carried out to evaluate the growth performance of *C. gariepinus* fingerling fed toasted *T. indica* as replacement for groundnut cake.

Materials and Methods

Preparation of *T. indica*: The tamarind fruit was soaked and washed thoroughly to obtain the seed which is coated with a hard seed coat, the seed was then soaked in warm water for 30min to soften and then roasted with low heat of about 60°C until it turns dark brown in color. The shell was separated from the endosperm immediately and then ground to fine.

Diets formulation three diets containing 40% crude protein and 5% lipid was formulated at three inclusion levels of toasted *T. indica* (0%, 50% and 100%) using Pearson square method (table 2).

Experimental set up twenty fish (20) of mean weight 2.23 ± 0.22g was randomly distributed in triplicate of nine plastic tanks (30cmx20cm) containing bore hole water in a complete random design. The fish was fed thrice daily (9.00; 14.00 and 17.00) at their body weight (3%, 5% and 7% respectively).

Routine Management: Water exchange was done daily with the siphoning of waste product first at dawn and 45minutes after each feeding. Also, unconsumed feed was siphoned 30 minutes after feeding. Bulk weighting of experimental fish was done fortnightly in other to adjust feeding rate based on their percentage body weight.

Water quality parameters: The quality of the water in culture medium was examined on a weekly basis for pH, dissolved oxygen, temperature and conductivity.

Biochemical analysis: This involves analysis for, lipid, crude fibre, total ash, crude protein and moisture content of diets and carcass according to the method of AOAC(2000).

Assessment of growth parameters: Growth performance and nutrient of diets were analyzed in relative to weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), feed intake (FI), protein efficiency ratio (PER) and Apparent net protein utilization (ANPU).

Statistical Analysis: Data obtained were analysed using one–way analysis of variance (ANOVA) using Minitab release 14. Variances among treatments were related by Tukey's test. Level of significance was tested at P<0.05.

Table 1: Proximate composition of feedstuff.

Proximate compositions (%)	Feedstuffs			
	Fish meal	Maize meal	Groundnut cake meal	Toasted *T. indica* seed meal (TTSM)
Moisture	5.79	4.66	3.19	

Crude protein	69.34	7.32	42.56	29.75
Crude lipid	10.09	4.2	13.45	12.5
Ash	13.34	3.22	12.35	7.34
Crude fibre	0.06	3.4	9.82	7.00

Table 2: Formulated experimental diets

Ingredients (%)	Diet 1	Diet 2	Diet 3
Groundnut cake	829.23	398.81	0.00
Toasted *T. indica* seed meal	0.00	398.81	670.80
Maize	70.76	102.36	229.19
Shea butter	50.00	50.00	50.00
Vitamin-mineral premix	50.00	50.00	50.00
Total	999.99	999.98	999.99

Table 3: Proximate composition of the formulated diets

Composition (%)	Diet 1	Diet 2	Diet 3
Crude protein	40.60	40.25	40.25
Lipid	13.40	9.40	8.90
Moisture	10.18	10.29	9.71
Crude fibre	1.50	1.00	2.00

Results

The proximate composition of feedstuff used (table 1) shows that groundnut cake had the highest crude protein content (42.56%) with highest crude lipid (13.45%) amongst all the ingredients used. However, the % crude protein and lipid content of Toasted *T. indica* seed meal (TTSM) were 29.75% and 12.5% respectively. The proximate composition of the experimental diets (table 2) exhibited that the crude protein of the diets was similar and ranged between 40.25 and 40.60 %. However, the crude lipid, crude fibre, ash and moisture contents of the diets were similar and ranged between 8.9 and 13.40 %, 1.0 and 2.0, 3.37 and 5.31, 9.71 and 10.29, respectively.

From the result in Table 3, there were significant differences ($P>0.05$) in the growth parameters among the three diets fed to the fish fingerling. Diet 1 with 0% inclusion of TTSM recorded lowest mean weight gain (MWG) of 0.61g, and was significantly different ($p<0.05$) from other diets. However, there was no significant difference ($P<0.05$) between Diet 2 (1.20g) and Diet 3 (1.02g) however diet 2 recorded high mean weight gain. Similarly, other parameters like feed conversion ration and apparent net protein utilization followed same trend as mean weight fain and feed intake. The specific growth rate and protein efficiency ratio were significantly high ($p<0.05$) for diet 2 than other diets however, diet 2 had a significantly high ($p<0.05$) survival rate. The result on water quality parameter shows that the dissolved oxygen (DO) ranged between 4.0mg/l and 11.0mg/l, temperature's ranged from 26.2 and 31.0°C, conductivity (260 to 299) and hydrogen ion concentration (pH) had values from 6.74 and 7.93.

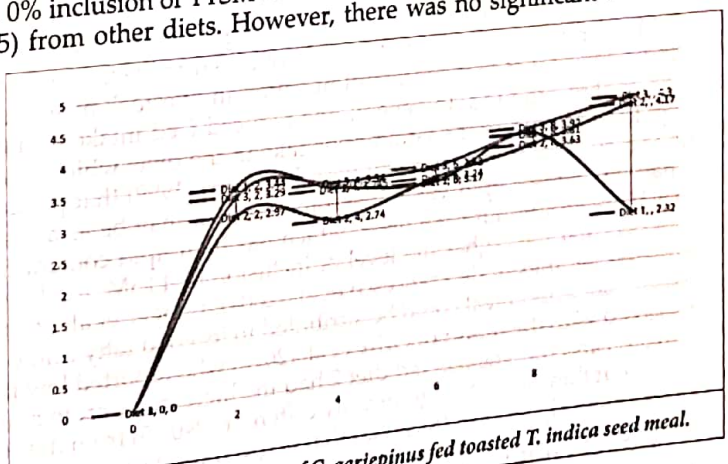

Fig. 1: Growth Performance of C. gariepinus fed toasted T. indica seed meal.

The chemical compositions of the fish carcass indicated significant differences ($p<0.05$) for the parameters measured. Diet 2 had a significant high ($p<0.05$) body protein and significantly low ($p<0.05$) moisture content. There were no significantly differences ($p<0.05$) in the lipid and ash values of diets 2 and 3 but were significantly lower ($p<0.05$) than diet 1. Furthermore, Figure 1 expressed a slightly higher growth curve for diet 3 than other diets.

Table 3: Growth performances of C. gariepinus fed experimental diets for 56 days.

Growth parameters	Diet 1	Diet 2	Diet 3	SD ±
Initial body weight (g)	$3.44^a \pm 0.17$	$3.01^a \pm 0.45$	$3.29^a \pm 0.08$	0.28
Final body weight (g)		$4.17^a \pm 0.01$	$4.31^a \pm 0.88$	0.71

Growth parameters	Diet 1	Diet 2	Diet 3	SD ±
Mean weight gain (g)	$0.61^{b} \pm 0.67$	$1.20^{a} \pm 0.41$	$1.02^{a} \pm 0.96$	0.72
Feed intake	$1.29^{b} \pm 0.53$	$1.49^{a} \pm 0.42$	$1.52^{a} \pm 0.16$	1.01
Feed conversion ratio	$5.02^{a} \pm 5.20$	$1.33^{b} \pm 0.51$	$2.48^{b} \pm 2.11$	3.26
Specific growth rate (%/day)	$0.29^{b} \pm 0.28$	$0.62^{a} \pm 0.25$	$0.47^{b} \pm 0.42$	0.33
Protein efficiency ratio (PER)	$1.06^{b} \pm 1.10$	$2.02^{a} \pm 0.78$	$1.55^{b} \pm 1.29$	1.08
ANPU (%)	$101.50^{b} \pm 62.93$	$233.00^{a} \pm 8.49$	$198.00^{a} \pm 117.38$	77.05
Survival Rate (%)	$20.00^{c} \pm 28.30$	$36.60^{b} \pm 14.10$	$66.65^{a} \pm 9.40$	19.05

Values in the same row carrying different superscripts are significantly different ($p<0.05$) from each other

Table 4: Chemical composition of fingerling' carcass fed experimental diets for 56 days

		Final			
Body compositions (%)	Initial	Diet 1	Diet 2	Diet 3	SD ±
Moisture	15.50	$5.68^{a} \pm 0.10$	$2.35^{b} \pm 0.47$	$2.61^{b} \pm 0.60$	0.45
Protein	57.75	$62.57^{b} \pm 0.62$	$70.69^{a} \pm 0.62$	$70.06^{a} \pm 0.96$	0.75
Lipid	12.25	$10.31^{a} \pm 0.16$	$9.34^{b} \pm 0.79$	$9.43^{b} \pm 0.53$	0.56
Ash	14.52	$3.24^{b} \pm 0.01$	$16.72^{a} \pm 0.91$	$16.52^{a} \pm 0.66$	0.65

Values in the same row carrying different superscripts are significantly different ($p<0.05$) from each other.

Discussion

The current research investigated the effect of toasted *T. indica* seed meal (TTSM) on the growth performance of *C. gariepinus*. The result obtained indicated the utilization of TTSM by *C. gariepinus*. The value obtained from the parameters were within the ranges suggested for warm water fishes (Boyd, 1981). The mean initial weight of the experimental fish differed insignificantly ($P>0.05$). The three formulated diets for this experiment performed well but diet 2 performed best with the highest mean body weight gain (MWG- 1.20g), specific growth rate (SGR-0.62), low feed conversion ratio(FCR-1.33), protein efficiency ratio (PER-2.02) and apparent net protein utilization (ANPU-233). Although diet 3 had the highest final weight gain (4.31), feed intake (1.52), which were not significantly different ($P>0.05$) from diet 2 and survival rate (66.65%). This implies that *C. gariepinus* can tolerate inclusion level of toasted *T. indica* meal up to 100% inclusion in it diet without any adverse effect on the growth and body compositions, however, 50% inclusion level gave best growth performance and nutrient utilization (table 4).

The performance was an indication of constructive influence to growth of the fish as opined by Houlihan et al. (2001), who stated that successful nutrition in livestock husbandry is important to frugally produce healthy and high-quality products. In general, the reduced feed intake in diet 1 could be attributed to the unpalatability and high level of lipid in the Groundnut cake in the diets which lead to decline in the growth performance and feed utilization. This is in agreement with Fagbenro (1999) that palatability could be a factor of diet acceptability. Diet 1 had the highest lipid value than others and it may be as a result of the zero inclusion level of tamarind in the diet(100% groundnut cake meal) which has high lipid content than the TTSM based diets, in this case the result revealed that the higher the level of inclusion of TTSM, the lower the lipid in the muscle which is in agreement with the findings of de Francesco et al. (2004); Lunger et al. (2006). The low lipid content of the carcass of fish fed toasted tamarind meal could be attributed to its good fatty acid of the oil as it was metabolized for growth which is in accord with the report of Orire et al. (2018) who reported low fat deposit in *C. gariepinus* fingerling fed detoxified *Jatropha curca* oil. The fish fed diet 2 had the high crude protein although, with no significant difference ($P>0.05$) to diets 3but they are both significantly different ($P<0.05$) from diet 1 an evidence of protein availability in tamarindus diets (Bhadoriya et al., 2011) than that of groundnut cake.

Conclusions

From the result obtained 50% inclusion of toasted *T. indica* seed meal in the diet of *Clarias gariepinus* fingerling was efficiently utilized and gave the highest body composition and growth performance. The performance recorded indicated that toasted tamarind can substitute for groundnut cake and oil in the diet of *C. gariepinus* fingerling.

Recommendation

Based on the findings from this research work*C. gariepinus* may be able to uptake more than 50% inclusion level of tamarind in its diet. Therefore, further research can be carried on the nutrient's improvement of the seed for better utilization by the fish.

REFERENCES

AOAC (2000). Official method of analysis of AOAC International Vol. 1 Agricultural Chemicals, Contaminants, drugs. 16thedn, AOAC Int'l., Arlington, V.A

Bhadoriya S. S, Ganeshpurkar A., Narwaria J., Rai G., Jain A. P. (2011) T. indica : Extentof explored potential. Phcog Rev [serial online],5:73-81.

Boyd, C. E. (1981), Water Quality in warm water fish ponds. Anburn University, Alabama.

De Francesco, M. G. Parisi, F. M'edale, P. Lupi, S. J. Kaushik,and B. M. P. (2004). Effect of longterm feeding with a plant protein mixture based diet on growth & body fillet quality traits of large rainbow trout (Onchorhynchus mykiss). Aquaculture 236:413-429.

El-Siddig, K. et al. (2006). Tamarind–T. indica L. Fruits for the future 1.Southampton Centre for Underutilized Crops, Southampton, UK, 188p.

Emmy D. C., Halamová K., Patrick V. D (2010). Tamarinusindica L. A reveiw on traditional uses, phytochemistry & pharmacology. Dept. of Plant Production, Ghent University, Belgium. Department of Crop Sciences & Agroforestry in Tropics and Subtropics, Czech Univ. of Life Sciences Prague, Czech Republic. *Afrika focus*, 23/1:53-83.

Fagbenro, O.A. (1999) comparative evaluation of heat-processed winged bean (psohocarpustetregonolobus) meal as a partial replacement for fish meal in diets of African catfish (Clarias gariepinus). Aquaculture 103, 55-63.

Houlihan, D., Bouiard T. & Jobling, M. (2001): Food Intake in fish. Iowa state university press. Blackwell science Ltd. 418pp.

Lunger,A.N., S.R. Craig & E.Mclean (2006).Replacement of fish meal in cobia diets using an organically certified protein. Aquaculture 257:393-399

Orire A. M., Ebonyi, G. E. & Daniyan, S.Y. (2018). Effects of Replacement of

Vegetable oil with Detoxified Jatropha curcasoil in the Diet of C. gariepinus (Burchell, 1822) fingerling. Nigerian Journal of Fisheries & Aquaculture 6(1):7 –14.

Siddhuraju, P., Vijayakumari, K., Janardhanan, K. (1995). Nutritional & Antinutritional Properties of the Underexploited Legumes Cassia laevigata Willd. & Tamarindus Indica L. Journal of Food Composition & Analysis, 8, 351-162.

USDA (United States Department of Agriculture) (1988)Aquacultural genetics & breeding. Nationalresearch priorities. USDA, cooperative state research service, Washington D.C.