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Growth Performance of *Clarias Gariepinus* Fingerlings Fed Varying Levels of the Seed of *Luffa Cylindrica* Meal in Outdoor Hapas

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ABSTRACT

Fingerlings of *Clarias gariepinus* were fed diets containing 0%, 10%, 15%, 20% and 25% inclusion levels of *Luffa cylindrical* seed. After eight weeks of feeding trials in outdoor hapas, it was observed that growth performance indices such as Mean Weight Gain, Feed Conversion Ratio, Specific Growth Rate, and Protein Efficiency Ratio were not significantly affected (P>0.05) across the treatment, however Net Protein Utilization therefore *Luffa cylindrica* seed can be included up to 25% in the diet of *Clarias gariepinus* without any negative effect on growth and also reduce production cost of fish since the plant grows in the wild.

INTRODUCTION

The nutritional requirements of fish are similar to those of land animals (Lovell, 1984). Fish, like other animals, have a requirement for essential nutrients in other to grow properly, the essential nutrient requirement of fish are Proteins, Carbohydrates, Vitamins, Minerals and Lipids (Eyo, 2003). Out of all these protein appear to be most expensive of all. In recent time, it has been observed that the major sources of protein in the diet of fish are the fish meal and soy bean meal which are of high quality but most expense. These sources of protein are usually in short supply in many countries (Pillay, 1994) due to competition between human and livestock industries for the use of conventional protein sources to meet protein requirement, hence the is an urgent need to explore other protein source such as un-conventional feed stuff to meet this protein needs for animals, this will not only meet the protein requirement of animals but reduce cost of production which has been estimated to be between 40-80% in Aquaculture.

Any un-conventional protein sources to be used to replace conventional feed stuff for any animal must contain not only adequate protein content but also an adequate amino acid profile as well as mineral content for optimum growth of the organism in question. *Luffa cylindrical* like other un-coventional feedstuff is common as a spontaneous plant on abandoned land, fallow crop and on garbage heaps. The Luffa, Loffah or Lufah (in Arabic) are tropical and sub-tropical vines comprising of the Genus Luffa, which is the only genus of the plant family Cucurbitaceae. Un-like many other Cucurbit, it grows well in tropical low lands. (Adebisi *et al.,* 2000). *Luffa cylindrica* has been discovered to have a high protein value and also rich in minerals with very low anti nutritional factors (ANFs).Study by Olaofe, *et al*.,(2008) showed that *L. cylindrical* contain higher level of mineral content with a balanced content of essential amino acid in phenyl- alamine and tyrosine alone with respect to the FAO and WHO provisional pattern.The fruit of at least two species, *Luffa acutangula* and *Luffa cylindrica*, are grown in some parts of the world, harvested before maturity and eaten as a vegetable.

Luffas are also used to make the soles of beach sandals while the ripe dried fruit is a source of the loofah or plant sponge. Parts of the plant are used to create bath or kitchen sponges, and could also serve as a natural remedy for treating jaundice (James, 2009). However the luffa seed in most part are usually thrown away which then germinate under favourable conditions as wild luffa plants. Hence this study was designed to evaluate the growth response of African catfish fingerlings to diet with luffa seed meal at different levels of inclusions.

MATERIALS AND METHODS

The fingerlings of *Clarias gariepinus* were obtained from aFish farm in Makurdi, Benue State, Nigeria and acclimatized at the Research Farm of the Department of Fisheries and Aquaculture, University of Agriculture.

Makurdi for two weeks prior to the experiment. The feeding trials was carried out using ten hapas made from nets of dimension 1m1m1m with Twenty fingerlings distributed per hapa. The hapas were mounted on a kuralon rope and set across the pond surface and properly staked to the dyke of the pond using bamboo sticks. Stones were attached to the four bottom corners of the hapas to serve as sinkers. This enabled the bottom surface of the hapas to spread uniformly and to extend properly.

The ingredients used in the feed formulation included Fish meal, Soy bean meal, *Luffa cylindrica* seed meal, Maize meal, Rice bran, Vitamin, mineral premixes and Salt. The *Luffa cylindrica* seeds were obtained within and around the University premises, while other ingredients mention where purchased at theMakurdi Modern Market, Benue State. The soybean was toasted and milling to eliminate anti-nutritional factor in the feed stuff. Dirt and stones were removed from the maize before milling. The rice bran was also milled and sieved. The *Luffa cylindrica* seeds were removed from the dried fruits and winnowed to remove dust. The seeds were milled using a hammer mill into a meal

Thirty-Five percent (35%) crude protein diet was formulated for the fish using Pearson square method with *L. Cylindrical* included at 0% for Diet I, 10% for Diet II, 15% for Diet III, 20% for Diet IV and 25% for Diet V. The diets were pelletized using a pelletizing machine after weighing and thorough mixing of the ingredients. Fish during the period of the experiment were fed at 5% of their body weight twice daily with faecal materials and uneaten feedremoved weekly from the hapas during sampling (weighing). The fish were weighed at the beginning of the experiment and after every week for a period of 8 weeks. The quantity of feed was adjusted based on the new body weight of fish in each hapa. Mortalities were recorded accordingly. Water quality parameters such as temperature, Dissolved Oxygen and pH where determined using thermometer, dissolved Oxygen meter and pH meter respectively. Dissolved Oxygen ranged from 5.74 to 6.25, Temperature 25.00-29.50 C and pH 6.3- 6.91.

Feed Ingredients, diets formulated as well as initial and final carcass of *Clariasgariepinus* fingerlings were analyzed for proximate composition according to standard methods (AOAC, 1990). Performance in growth and feed utilization were determined as Weight gain calculated as; Final weight – initial weight Growth rate was determined by calculating the value of

$$\frac{\text{Weight gained}}{\text{Duration of the Experiment}}$$

Specific growth rate (SGR) was calculated as:

$$\frac{\text{Ln Final Weight-Ln Initial Weight}}{\text{Duration of the Experiment (Days)}}$$

Feed conversion ratio (FCR) was measured by:

$$\frac{\text{Feed Intake}}{\text{Body Weight Gain}}$$

Feed conversion efficiency was measured by:

$$\frac{\text{Weight Gained X 100}}{\text{Feed Intake}}$$

Percentage Survival:

$$\frac{}{\text{=Nt X 100}}$$
$$\text{No}$$

Where N_t and N_0 are the Number of fish at the end of the experiment and the initial number of fish stocked at the start of the experiment respectively.

Each experimental diet was fed to two groups of fish in a completely randomized design. Statistical analyses in the present study included descriptive statistics as well as analysis of variance using a computer software GENSTAT Discovery edition 3 from Lawes Agricultural Trust Rothamsted. Due to significant differences in mean Initial weights of test fish (ANOVA $P<0.05$), Parameters that are dependent on body weight were analysed using Analysis of Co-variance (ANCOVA) with the Mean Initial weight (MIW) as variate.

RESULTS

The proximate composition of *Luffa cylindrical* as determined in the laboratory (Table 2) shows that the percentage moisture content was 8.00%, 20.00% for crude protein, 2.60% for Ash, 3.00% for Fat while Fibre content was 3.00%, and Carbohydrate which was obtained to be 41.90%. The proximate composition of the diets formulated showedthat crude protein content varied from 34.54 – 35.25% and were statistically same in all the diet formulated.

The growth performance and utilization of *Clarias gariepinus* fed varying levels of L. cylindrical as shown in Table 3, revealed that Net Protein Utilization (NPU) was highest in Diet IV (66.593.79) and the lowest in Diet I (28.271.00). However though other parameters were statistically same among the treatment, numerical differences were observed. Fish fed Diet IV had the highest weight gainand lowestFeed conversion ratio (1.470.05) while Diet II had the highest (2.120.09) value for Feed conversion ratio. The specific growth rate (SGR) ranged from 0.270.03 (Diet III) to 0.530.04 (Diet I).

Table 1: Gross Composition Of The Experimental Diets

Ingredients	Diet I (0% inclusion)	Diet II (10% inclusion)	Diet III (15% inclusion)	Diet IV (20% inclusion)	Diet V (25% inclusion)
Fish meal	26.91	39.63	38.76	37.91	37.05
Soybean meal	26.91	0.00	0.00	0.00	0.00
Luffa seed meal	0.00	10.00	15.00	20.00	25.00
Maize meal	22.34	24.44	22.37	20.30	18.25
Rice bran	22.34	24.44	22.37	20.30	18.25
Mineral premix**	0.50	0.50	0.50	0.50	0.50
Vitamin premix*	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00

*contain (as mg kg-1 of diet): Thiamine (B_1), 85.00; Riboflavin (B_2), 60.00; Pyridoxine (B_6), 25.00; Pantothemic acid, 105.00; Inositol, 500.00; Biotin, 1.80; Folic acid, 20.00; Ethoxyquin, 4.00; Choline, 1481.00; Nicotinic acid (Niacin), 250.00; Cyanocobalamin (B_{12}), 0.03; Retinol palmitate (A), 20.00; Tocopherol acetate (E), 140.00; Ascorbic acid (C), 750.00; Menadione (K), 30.00; Cholecalciferol (D_3), 0.08 (according to Jauncey and Ross 1982)

**Contained (as g kg-1 of diet): $MgSO_4,7H_2O$, 20.40; NaCl, 8.00; KCl, 6.04; $FeSO_4,7H_2O$, 4.00; ZnSO4, $4H_2O$, 0.88; $MnSO_4.4H_2O$, 0.41; $CuSO_4,5H_2O$, 0.13;$CoSO_4,7H_2O$, 0.08; $CalO_3$, $6H_2O$, 0.05; $CrCl_3,6H_2O$, 0.02 (according to Jauncey and Ross 1982).

Table 2: Proximate Composition of the experimental diet

Parameter (%)	DIET 1	DIET 2	DIET 3	DIET 4	DIET 5	*L. cylindrica*
Moisture	9.00	9.00	7.50	6.50	5.00	8.00
Protein	34.54	34.85	35.15	35.00	35.25	20.00
Ash	7.80	8.40	8.40	9.20	9.80	2.60
Fat	4.12	4.52	5.11	6.78	8.00	3.00
Fibre	5.54	5.50	5.47	5.46	5.57	3.00
Carbohydrate	40.10	36.95	35.71	32.06	29.44	41.90

Values were determined in the laboratory using AOAC (2000).

The highest (1.860.11) value of Protein Efficiency Ratio (PER) was observed in Diet 1 whereas, the lowest value was found in Diet III (0.970.12). Percentage Survival was highest in Diets II and III (92.506.80) and lowest in Diet IV (70.005.29). Carcass analysis shows (Table 4) crude protein increasing from Diet I (15.79%) to Diet V (21.54% 0.19)($p<0.05$) and though same trend of increase were observed in Fat, Fibre and Ash, values obtained however were statistically same among the treatment; carbohydrate as well as Moisture content of the fish decreased as the inclusion levels of *L. cylindrica* increased.

DISCUSSION

The percentage Crude protein (20%) determined for *Luffa cylindrical* in the present study shows the Luffa meal is sparing in protein, Amoo, *et al*., (2008) reported 33.55% crude protein, for un-defatted luffa meal and 54.49% for defatted meal, however Nutritive composition of plants with potential for waste water treatment have been reported to differ with the environment in which they are grown due to nutrient accumulated by the plants in the tissues. Nutrient contents in duckweed for instance have been reported to vary according to the conditions in which it is grown, Leng,.*et al.,* (1995) reported that) reported that Duckweed species grown under nutrient-poor water or under sub-optimum nutrient conditions have crude protein contents varying between 9-20 percent, while it may varied from 24-41 percent for duckweed species grown in nutrient-rich water. Innocent *et al*., (2009) reported the potential of *Luffa cylindrical* in waste water treatment;

Table 3: Growth Performance and nutrient Utilization of *Clarias gariepinus* fingerlings fed varying levels of *L. cylindrical* seed meal.

Growth parameters	DIET 1	DIET 2	DIET 3	DIET 4	DIET 5	P
Mean Initial Weight	76.6±3.45	75.4±0.4	76.9±1.41	74.9±1.8	76.6±2.1	NS
Mean Final Weight	123.3±1.67	133.1±1.62	136.4±1.84	102.6±1.50	123.3±1.06	NS
Mean Weight Gain	27.00±0.02	25.00±0.04	26.00±0.01	27.00±0.04	26.00±0.07	NS
Feed Conversion Ratio	1.82±0.00	2.12±0.09	2.14±0.02	1.47±0.05	1.87±0.00	NS
Specific Growth Rate (%/day)	0.53±0.04	0.29±0.03	0.27±0.03	0.28±0.11	0.42±0.08	NS
Protein Efficiency Ratio (PER)	1.86±0.11	1.07±0.08	0.97±0.12	1.05±0.39	1.51±0.26	NS
Net Protein Utilization (NPU)	28.27±1.00 ^{c}	33.07±0.54 ^{c}	37.46±0.14 ^{b}	66.59±3.79 ^{a}	62.55±2.03 ^{a}	0.011
% Survival	82.50±6.42	92.50±6.80	92.50±6.80	70.00±5.92	82.50±6.42	NS

Means in a row followed by the same superscript are not significantly different (P<0.05), NS = Not Significant.

Table 4: Initial and Final Carcass Analysis of *Clarias Gariepinus* Fed Different Levels of *L. Cylindrica* Seed Meal.

Parameters	INITIAL	FINAL					
		DIET 1	DIET 2	DIET 3	DIET 4	DIET 5	P
Protein (%)	10.94^{a}±0.02	15.79^{b}±0.04	17.08^{c}±0.07	18.23^{d}±0.02	20.14^{e}±0.03	21.54^{f}±0.19	0.02
Carbohydrate (%)	5.36±0.00	4.34±0.00	4.29±0.02	4.25±0.00	4.22±0.00	4.19±0.01	NS
Fat (%)	5.20±0.00	3.21±0.00	3.45±0.00	3.83±0.03	4.28±0.02	4.28±0.07	NS
Moisture (%)	72.40±0.09	73.21±0.05	71.38±0.33	69.54±0.05	67.09±0.01	65.61±0.17	NS
Fibre (%)	3.00±0.91	2.71±0.50	2.93±0.53	3.21±0.61	3.43±0.84	3.54±0.82	NS
Ash (%)	3.10±0.03	1.18±0.18	1.31±0.15	1.58±0.02	1.66±0.04	1.77±0.09	NS

Figures in the same row having the same superscript are not significantly different from one another (p>0.05)

difference in environmental media and condition from which the plants were grown. However with a fat content of 22.17% reported in the present study, this qualifies the luffa seeds as an oil seed.

Growth performance and nutrient utilization shows no significant difference (p>0.05) in experimental fish fed the five experimental diets but numerically value increased from Diet I to Diet V. However, Net Protein utilization were significantly higher in higher inclusion levels which indication that the protein quality of the dietwas effectively utilized by the fingerlings of *Clarias gariepinus*as the level of inclusion increase, hence, protein retention in carcass was higher significantly as the level of inclusion increased, this is in consonance with the works of Kalita*et al*., (2007).

CONCLUSION

Carcass composition of the fingerlings fed all the various diets had more protein retained in the body at the end of the experiment compared to the start. This is an indication that the protein to energy ratio in all diet formulated wereenough to meet the energy need of the fish and so there was no sparing of protein for energy (Omoniyi and Fagade, 2003) hence the reduction in lipid deposits in the carcass of fish fed experimental diet of *L. cylindrical* since dietary lipids function as a ready source of energy for fish metabolic activity. Proximate composition of carcass of the present study agrees with the findings of Ugwumba and Abumoye (1998) on*C. gariepinus* fingerlings fed maggot as supplemental food to artificial feed. Therefore with this level of acceptance and utilization, it may be concluded that the inclusion of *L.cylindrica* at 25% level is tolerated in the diet of *Clarias gariepinus,* it is however recommended that the use of *L. cylindrica*as an alternative to costly conventional energy source should be well investigated to take advantage of this wild crop in reducing production cost of feeding cultured fish.

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