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Utilization of *Gliricdia* Leaf Protein Concentrate in the Diet of *Clarias gariepinus* Fingerlings

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Abstract: A 56-day feeding trial was conducted to evaluate the suitability of dehulled lima beans supplemented with *Gliricidia sepium* Leaf Protein Concentrate (LPC) as a replacement for either cooked or toasted dehulled soybean in the diet of *Clarias gariepinus* fingerlings. Dehulled soybeans were replaced with raw, cooked or toasted lima bean supplemented with LPC. There were no significant differences ($p>0.05$) in the weight gain, specific growth rate, protein efficiency ratio and feed conversion efficiency.

Key words: Gliricidia, Leaf Protein Concentrate (LPC), clarias gariepinus fingerings

INTRODUCTION

The demand for animal protein increases as human population increases. This calls for the need to also increase all possible protein sources. Fish is one of the main animal protein sources and has been cultured using different sources of feed ingredients. Soybean has been used to completely or partially replace fishmeal, due to the various uses and high demand for soybean, the price is increasing it equally needs locqally available alternatives. Lima bean and various leave meals are part of the readily available underutilized legumes in Nigeria. Lima beans are cheap and have good amino-acid composition, Ologhobo *et al.,*[1] reported that lima bean contain cyanogenic non-specific inhibitor of several enzyme[2]. However, they could be removed by heat treatment. *Glyricidia sepium* is potentially suitable for fish feed. The leaves are as nutritious as leucaena leaves with crude protein content as high as 23%[3]. It is fast growing, easily propagated and under-utilized. The plant is frequently used as shelter plants, fences and supporting plants while the leaves are used as feed for livestock, fish and shrimp. *Clarias gariepinus* is omnivorous, predatory and cannibalistic in nature with accessory respiratory[4]. The crude protein requirement of juvenile *Clarias gariepinus* reported by Faturoti *et al.*, is 40%. This study is aimed at evaluating the effect of substituting dehulled soybean with dehuilled lima bean supplemented with leaf protein concentrates from G*lyricidia sepium* in the diet of *Clarias gariepianus* fingerlings.

MATERIALS AND METHODS

Processing Of Lima Beans: 1.0 kg of lima beans was soaked in water for 1 h peeled off manually and divided into 4 batches. Two A batch was subjected to one-stage cooking and another to two-stage cooking. Cooking was done in aluminum pot on a thermostat hot plate containing 1L of clean water. For one-stage cooking was done for 20 min, drained and the seed sun dried. Two-stage cooking was for 40 min. After 20 min, the water was poured off and fresh clean water was added and then cooked for another 20 min after which the water was drained and the seed were sun dried. The third batch was toasted in an electrical oven at temperature of 100°C for 5 h, thereafter, the seeds cooled while the fourth batch was used as dehulled raw seed. 1.0 kg of soya beans were soaked for 18 h, drained before cooking for 30 min and divided into two batches: A batch sun dried while the other was further toasted in an electrical oven at 100°C for 5 h. All samples were finely grinded and stored in an air-tight container prior to analysis.

Processing of *Glyricidia* Leaf Protein Concentrate (GLPC): Fresh leaves of *Glyricidia sepium* were washed and grinded. The juice was squeezed out and the fibre discarded. The juice was then heated in a vat for 10 min between the temperature of 80°C and 90°C to coagulate the protein. The coagulated protein was separated out from the whey by filtering through a fine cotton cloth. The filterate was collected while the fibrous residue was discarded. The leaf concentrate was sun dried, milled and stored in an air-tight plastic bottle, kept in a freezing cabinet till when used.

Diets: Six iso-nitrogenous diets were formulated at 40% Crude Protein (CP) as recommended for fingerlings of *Clarias gariepinus*. The combination of any of the processed lima beans and leaf protein concentrate was used to replace soybean meal at equi-protein levels (Table 1).

Experimental fish: *Clarias gariepinus* fingerlings of average weight of 2.61± 0.02 g were acclimatized, starvied for 24 h before they were placed fed in twelve (12) aquaria tanks each measuring (75 x 35 x 45cm).

Table 1: Gross composition of experimental diet (g/ 100)

Ingredients	DRL	D1SCL	D2SCL	DTS	DTS	DSCS
Fish meal (65%Cp)	27.0	27.0	27.0	27.0	27.0	27.0
Blood meal	5.0	5.0	5.0	5.0	5.0	5.0
Lima bean	30.28	30.28	30.28	30.28	-	-
Soyabean	-	-	-	-	39.55	39.55
Yellow maize	10.00	10.00	10.00	10.00	20.69	20.69
Glyricidia sepium LPC	20.00	20.00	20.00	20.00	-	-
Bone meal	1.0	1.0	1.0	1.0	1.0	1.0
Oyster shell	1.0	1.0	1.0	1.0	1.0	1.0
Ground nut oil	3.50	3.50	3.50	3.50	3.50	3.50
Starch	0.66	0.66	0.66	0.66	0.66	0.66
Vit premix	1.0	1.0	1.0	1.0	1.0	1.0
Vitamin C	0.2	0.2	0.2	0.2	0.2	0.2
Salt	0.4	0.4	0.4	0.4	0.4	0.4
Total	100.00	100.00	100.00	100.00	100.00	100.00

DRL dehulled raw Lima
D1SCL dehulled one-stage cooked lima beans
D2SCL dehulled two-stage cooked lima beans
DTS dehulled toasted lima beans
DTS dehulled toasted soya bean
DSCS dehulled soaked and cooked soya bean

Before stocking, the tanks were washed, cleaned and filled with water obtained from borehole and the water level of 15cm was maintained. The twelve (12) tanks were randomly stocked with 15 fingerlings per tanks. Fish were fed at 3% of their body in two installments daily between 8.00 – 9.00 a.m and 3.00– 4.00 p.m. Feeding was done manually by broadcasting the feed over the water surface. Weighing of fish was done on a weekly basis to assess growth and adjust feed ration. Feed remnants were siphoned every day and the water was topped with fresh water to maintain good water quality. The water was changed every week and water parameters such as temperature, pH and dissolved oxygen taken for analyses. Water temperature was determined using a standard laboratory thermometer of model. Dissolved oxygen was determined using oxygen meter calibrated in milligram per litre of model. pH was determined using a digital pH meter (Toledo 320). Samples of the six experimental diets were analyzed for proximate composition using AOAC[5] method. Carcass analyses of the fingerlings were also carried out before and after the feeding trial.

Determination of Acid Insoluble Ash (AIA): AIA was calculated as:

$$\%AIA = \frac{\text{weight of Ash} - \text{weight of AIA}}{\text{weight of Ash}} x100$$

Digestibility coefficients: The value obtained from AIA as indicator was used in calculation of digestibility coefficient.

$$\text{Digestibility} = \frac{100 - 100\%\text{AIA of feeds X\% nutrient in faeces}}{\%\text{AIA in faeces X\% nutrient in feed.}}$$

Evaluation of growth performance and nutrient utilization The parameters used to determine the growth performance and nutrient utilization of fish were calculated as in Adeparusi and Jimoh[6].

RESULTS

Table 2 shows the growth performance and nutrient utilization of *Clarias gariepinus* fed the experiment diets. The result shows that Weight Gain (WG), percentage Weight Gain (% WG), Specific Growth Rate (SGR), Protein Efficiency Ratio (PER), Feed Efficiency Ratio (FER), Feed Conversion Ratio (FCR) of *Clarias* fed experimental diets were not significantly different ($p > 0.05$). Fish fed on diet DSCS had the highest WG, SGR, % WG, PER while fish fed diet DRL had the least. Table 3 shows the proximate composition of the experimental diets. Table 4 shows the result of the Apparent Digestibility Coefficient (ADC) of the formulated diet fed to *Clarias gariepinus*. Protein digestibility of the diets ranged from 59.17 to 79.14. There was no significant different ($p>0.05$) in the digestibility of crude protein by fish fed experimental diets. The highest apparent crude protein digestibility was recorded in diet DSCS and least in diet DRL. The apparent digestibility coefficient for protein was not significant different ($P > 0.05$). The highest was obtained in fish fed diet DSCS and least in diet DRL. The apparent digestibility coefficient for lipid was not significant different ($P>0.05$). The highest

Table 2: Growth Performance And Nutrient Utilization Of (*Clarias Gariepinus*) Fingerlings Fed The Experimental Diets

Parameters	DRL	D1SCL	D2SCL	DTL	DTS	DSCS
Initial weight gain (g)	2.63 ± 0.00	2.60 ±0.00	2.62 ± 0.00	2.61 ± 0.01	2.58 ± 0.02	2.57 ± 0.01
Final weight gain (g)	3.44 ± 0.41	5.10 ± 0.03	5.80 ± 1.00	4.785 ± 0.02	5.41 ± 1.39	7.105 ± 0.845
Weight gain (g)	0.81 ± 0.41	3.50 ± 0.96	3.18 ± 1.00	2.165 ± 0.005	2.83 ± 1.37	4.62 ± 0.84
Specified growth rate	0.465 ± 0.215	1.205 ± 0.015	1.39 ± 0.31	1.075 ± 0.005	1.265 ± 0.455	1.825 ± 0.205
Feed conversion ratio	5.49 ± 1.95	1.395 ± 0.125	1.465 ± 0.325	2.105 ± 0.04	2.145 ± 0.915	1.43 ± 0.25
Protein efficiency ratio	19.345 ± 5.905	53.00 ± 3.5	71.795 ± 15.925	47.52 ± 0.79	56.975 ± 24.325	71.785 ± 11.545
Feed efficiency ratio	0.475 ± 0.235	1.345 ± 0.105	1.795 ± 0.395	1.19 ± 0.02	1.42 ± 0.6	2.245 ± 0.355
Percentage weight gain	0.81 ± 0.41	2.5 ± 0.04	3.18 ±1.00	2.165 ± 0.005	2.83 ± 1.37	4.62 ± 0.84
Cost / kg of fish	108.96	171.25	131.15	488.99	200.15	134.56

Table 3: Proximate composition of GLPC and experimental diets (%)

Contents	GLPC	DRL	D1SCL	D2SCL	DTL	DTS	DSCS
Crude protein	46.89	40.55	41.29	40.17	38.69	40.95	41.56
Crude fibre	3.20	6.41	5.22	5.87	6.48	6.36	6.08
Ether Extract	14.50	13.49	18.03	15.41	13.87	16.19	18.04
Ash	3.51	11.90	13.47	10.07	11.91	11.24	12.29
NFE	26.90	27.65	21.99	28.48	29.05	25.26	22.23
Gross energy (K/cal/100g)	510.62	468.60	492.67	488.12	467.534	486.70	495.26

Table 4: Digestibility coefficients of experimental diets (%) Fed To *Clarias Gariepinus* fingerlings

Content	DRL	D1SCL	D2SCL	DTL	DTS	DSCS
Crude protein	63.53 ± 1.07	65.49 ± 0.93	68.45 ± 3.63	59.17 ± 3.24	71.62 ± 2.85	76.14 ± 6.01
Lipid	52.67 ± 0.49	55.6 ± 4.92d	54.14 ± 2.86	51.07 ± 0.88	58.71 ± 3.24	62.57 ± 1.43
Energy	55.58 ± 4.10	53.76 ± 4.81	54.62 ± 2.74	58.62 ± 2.11	53.98 ± 0.22	56.39 ± 2.24

was obtained in fish fed diet DSCS and least in diet DRL. Fish fed diet DRL gave the highest apparent digestibility coefficient for energy and least in diet D1SCL. It is not significant different ($p>0.05$). The average dissolved oxygen ranged between 5.55 – 6.13 ppm. The pH value ranged between 6.86 – 7.18 and temperature ranged between 25.3 – 25.73. The cost of producing 1kg of feed was highest in diet DRL with N89.77k and least in diet DTL with N89.07k The cost of producing 1 kg weight of fish was highest in diet DRL with N223. 53k and least in diet DTL with N107. 49k

CONCLUSIONS

The result showed that there was no significant difference ($p>0.05$) in growth and nutrient utilization of *Clarias gariepinus* fed the diets. The best growth responses were obtained in *Clarias gariepinus* fed diet DSCS supplemented with (GLPC). This is because dehulling and cooking reduced heat-labile antinutritional factors. This agreed with the report of Preet and Punia,[6] that removal of seed coat in soaked cowpeas reduced the polyphenol by 70–71%. Similarly, Sharma and Seghgals,[8] reported that dehulled seeds showed a decline in tannin (76–78%) on cooking. The low growth obtained in *Clarias gariepinus* fed diet Dehulled Raw Lima (DRL) supplemented with (GLPC) could therefore due to the presence of Anti-Nutritional Factors (ANF) present in lima bean. Digestibility coefficients of crude protein were not significantly different ($p>0.05$).

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