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Growth and Nutrient Utilization of *Clarias gariepinus* Fed Dietary Levels of Jackbean (*Canavalia ensiformis*) Meal

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Abstract: *Clarias gariepinus* fingerlings of average weight 0.71 g were sourced from ARAC, Port Harcourt and used to evaluate the effect of feeding dietary levels of Jackbean meal on growth and nutrient utilization of the fish. 35% isonitrogenous diets of 0%, 10%, 20% and 30% dietary levels of JBM were formulated. These were fed to the fingerlings randomly assigned to 4 treatments - TCN (Control), TJ_1 (10% JBM), TJ_2 (20% JBM) and TJ_3 (30% JBM) respectively in 3 replicates of 13 fingerlings each, using 12 plastic aquaria of 250 x 150 cm dimension. The fish were fed at 5% body weight twice daily within the experimental period of 8 weeks. Mortality was highest in TJ_3 and least in the control (TCN). Daily feed intake and protein intake were not significantly ($p>0.05$) different. The control (TCN) had the highest body weight gain, followed by TJ_3, TJ_1 and TJ_2. Specific growth rate and feed conversion ratio of the treatments were not significantly ($p>0.05$) different. The protein efficiency ratio of treatment TJ_3 was significantly ($p<0.05$) higher than the rest of the treatments. Dietary levels of JBM up to 30% inclusion level therefore had nutritional attributes as feedstuff in the diet of *Clarias gariepinus* fingerlings.

Key words: Growth, nutrient utilization of *Clarias gariepinus* fed JBM

INTRODUCTION

The growing interest in the use of cheap non conventional feedstuffs in the dietary feeds of fish has been necessitated by the over 60% total input cost in fish production (Eyo, 2001). Diet formulation with cheap and locally available feedstuffs that are not in direct competition with human foods are therefore very much accepted (Anyanwu, 2008) in order to reduce production cost.

Jackbean (*Canavalia ensiformis*) is a grain legume that offers good possibilities for its use and also an indigenous legume that serves as energy and protein source for livestock production in view of its high yield and protein content of relatively good amino acid profile (Udedibe and Carlini, 1998a). Besides, there is no competition existing between man and livestock for it as feed, though the young green pods are eaten as vegetable in the far East tropical Asia and Japan. These qualities seem to position Jack bean as useful for trial in the diet of *Clarias gariepinus* which is a fresh water fish. The fish is suited in low technology farming system mainly because of its growth rate, propensity to consume a variety of supplementary feeds, omnivorous food habits and tolerance to a wide range of environmental condition (Anyanwu, 2005). The objective of this study therefore was to determine the effects of feeding dietary levels of Jackbean meal on fingerlings of *Clarias gariepinus*.

MATERIALS AND METHODS

The experiment was mounted in the Department of Agric. Science, Alvan Ikoku Federal College of Education Owerri farm house. 12 plastic aquaria (250 x 150 cm), covered with mosquito mesh screen to prevent fish from jumping out and possible predation were used.

Jackbean (*Canavalia ensiformis)* harvested from a pilot farm at Orogwe in Owerri West L.G.A. of Imo State was cracked, soaked in water for 24 hrs, boiled for an hour, dried under the sun and milled into powered form using a hammer mill to produce the Jackbean meal.

The meal was used to make 35% isonitrogenous dietary levels of JBM - 0%, 10%, 20% and 30% for treatments TCN (control), TJ_1, TJ_2 and TJ_3 respectively. Maize was used as the major source of energy in the diets, while Soyabean meal and fish meal were major sources of protein. These and other ingredients (Table 1) in their various proportions were finely ground and mixed in plastic bowl into dough form using hot water, with cassava starch as binding material. The mixture was then pelleted by passing it through a mincer of 2 mm die to produce 2 mm diameter size of pellets. These were then sundried to about 10% moisture content, packed in polythene bags and kept safely dry for use.

One hundred and fifty - six fingerlings of *Clarias gariepinus* of average weight 0.71 g, obtained from the African Regional Aquacultural Centre (ARAC), Port Harcourt were used for the study. The fish were

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Table 1: Gross composition of dietary experimental feeds

Ingredients	TCN (0% JBM)	TJ_1 (10% JBM)	TJ_2 (20% JBM)	TJ_3 (30% JBM)
Jackbean meal	-	10.00	20.00	30.00
Maize	34.10	28.80	23.90	18.17
Fish meal	20.00	20.00	20.00	20.00
Soybean	41.10	36.30	31.20	26.40
Cassava starch	2.00	2.00	2.00	2.00
Palm oil	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Vit/Min. premix	0.50	0.50	0.50	0.50
Common salt	0.50	0.50	0.50	0.50
Bone meal	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00

Table 2: Chemical composition of the diets

Parameters	TCN (0% JBM)	TJ_1 (10% JBM)	TJ_2 (20% JBM)	TJ_3 (30% JBM)
Crude protein (%)	35.00	35.02	34.98	34.99
Ash (%)	7.44	7.57	7.70	7.80
Ether extract (%)	14.48	14.04	13.58	13.14
Crude fiber (%)	2.86	3.36	3.79	4.38
NFE (%)	33.40	26.74	20.53	14.14
M. Energy (kcal/g)	2710.00	2840.00	2970.00	3100.00

Table 3: Water quality parameters (Mean values)

Parameters	TCN	TJ_1	TJ_2	TJ_3	Mean±SE
Temp (°C)	26.20±0.34	25.90±0.22	26.10±0.32	26.00±0.35	26.05±0.05
pH	6.40±0.12	6.50±0.13	6.40±0.09	6.30±0.07	6.40±0.04
Do (mgk)	4.60±0.07	4.20±0.07	4.60±0.06	4.40±0.06	4.45±0.08

acclimatized for 7 days using the 0% (control) JBM diet of 35% CP and fed twice daily at 08.30-09.30 hr and 17.30-18.30 hr. The fingerlings were completely randomized in 3 replicates of 13 fingerlings per replicate for the 4 treatments - TCN (control), TJ_1, TJ_2 and TJ_3. The initial weight of fish in the aquaria were taken and recorded. Feeding commenced an hour after weighing exercise and the fish fed at 5% of their body weight twice daily, morning (08.30-09.30 hr) and evening (17.30-18.30 hr). Body weight measurements were taken biweekly and rations adjusted according to fish weight gain. The water in the aquaria was regularly monitored for the physico-chemical properties and renewed completely every other day within the experimental period that lasted 56 days of culture. Temperature was determined using mercury in glass thermometer calibrated from 0-100°C; immersed 5 cm deep on the water surface. The pH and dissolved oxygen readings were taken using pH and oxygen meters respectively.

The proximate analysis of the diets were carried out to determine the moisture content, ash, lipid, crude protein, crude fibre and nitrogen free extract, using the AOAC (1990) and Kekeocha (2001) methods. Growth and nutrient utilization index were calculated according to Brown (1957) and AOAC (1990). Data were subjected to Analysis of Variance (ANOVA) as described by Steel and Torrie (1980). Test of significance was by Duncan Multiple Range Test (DMRT) at 95% confidence level, using Statistical Package for Social Sciences (SPSS) for windows (version 7.5).

RESULTS

The gross composition of the experimental diets, as well as their proximate compositions are presented in Table 1 and 2 respectively. The limnological mean values of the experimental aquaria were 26.05±0.05°C, 6.40±0.04 and 4.45±0.08 mg/l for temperature, pH and dissolved oxygen respectively (Table 3).

The growth and nutrient utilization of *Clarias gariepinus* fed dietary levels of Jack bean meal are shown in Table 4. The initial body weight, final body weight and increase in body weight of the experimental fish ranged from 0.06-0.86 g, 4.34-5.46 g and 3.72-4.60 g respectively, with the control (4.60 g) achieving the highest increase in body weight. Mortality ranged from 20-23 within the experimental period of 56 days. Daily feed intake and daily protein intake for the treatments were not significantly ($p>0.05$) different. The specific growth rate and feed conversion ratio similarly were not significantly ($p<0.05$) different. The protein efficiency ratio for treatment TJ_3 was significantly ($p<0.05$) higher than the rest of the treatments.

DISCUSSION

The Limnological mean values of the experimental fish fall within the optimal production requirements for fish (Anyanwu, 2005; Ochang *et al*., 2007). The chemical composition of the experimental diets majorly revealed that energy level of the diets increased with increase in JBM dietary inclusion levels. There were also variations in ash, ether extract and crude fiber contents of the diets

Table 4: Growth and nutrient utilization of *Clarias gariepinus* fed dietary levels of Jackbean meal

Parameters	TCN (Control)	TJ_1 (10% JBM)	TJ_2 (20% JBM)	TJ_3 (30% JBM)	SEM
Initial weight (g)	0.86	0.72	0.66	0.60	0.05
Final weight (g)	5.46	4.57	4.38	4.34	0.22
Increase in body weight (g)	4.60	3.85	3.72	3.94	0.16
Mortality (%)	20.00	22.00	22.00	23.00	0.54
Daily feed intake (g)	0.20^{NS}	0.20^{NS}	0.20^{NS}	0.20^{NS}	0.00
Daily protein intake (g)	0.04^{NS}	0.04^{NS}	0.04^{NS}	0.20^{NS}	0.00
Specific growth rate (E/Day)	2.96^{NS}	2.77^{NS}	2.71^{NS}	2.85^{NS}	0.05
Protein Efficiency Ratio (PER)	1.24^{b}	1.43^{b}	1.320^{b}	1.59^{a}	0.06
Feed Conversion Ratio (FCR)	2.81^{NS}	3.25^{NS}	2.49^{NS}	3.07^{NS}	0.14

Within each row, figures with different superscripts are significantly ($p<0.05$) different

and these observations were in agreement with those of Alegbeleye *et al.* (2001) on Jackbean meal as an ingredient in the diets of *Clarias gariepinus* fingerlings. The increase in energy level of the diets with increase in dietary levels of JBM is an indication of the high energy level of JBM. Proximate composition values of 28.50%, 3.74%, 3.10%, 7.80% for crude protein, ash, ether extract, crude fiber respectively and also energy level of 4600 kcal/g for JBM have been reported by Udedibe (1990). These are comparatively higher than those of other dietary seed meals. Besides, JBM had been reported to contain toxic substances, for example the L-Canavanine which limits its use as feed ingredient for livestock, especially monogastric animals, including fish (Udedibe, 1997; Esonu, 2009).

The result of this experiment revealed slight variations in body weight gain of the fish. The specific growth rate and feed conversion ratio of the treatments, 2.71-2.96%/day and 2.49-3.25 respectively were not significantly ($p>0.05$) different.

The protein efficiency ratio of the 30% JBM dietary treatment was significantly ($p<0.05$) higher than other treatments, with range 1.24-1.59. These values were in consonance with the reports of Erfanullah and Jafri (1998); Abd *et al.* (2009) and Schuchardt *et al.* (2008) in their various studies on growth and nutrient utilization of fingerlings of some species of fish. The importance of energy in fish nutrition as discussed by NRC (1993) and Bakke-Makellep *et al.* (2007), is that low energy in the ration means that protein may not be fully utilized to the fullest potentials. This may however account for the little variations in the performance of the experimental fish fed the dietary treatments. There were no observed deleterious effects of the dietary levels of JBM on the fingerlings of *Clarias gariepienus*. The trend of the observation of the study is in line with some feeding trial reports on indigenous and fresh water species of fish (Alegbeleye *et al.*, 2001; Babalola and Apata, 2006; Oyelese, 2006). Besides, it reveals that despite the limitation of JBM as with other seed meals for their content of toxic substances, its dietary levels up to 30%, nutritionally measured well in improving the performance of the fish. This may have been possible partly due to the employed cracked, soaked and cooked (CAC) processing technique of the JBM in line with Udedibe and Carlini (1998b), which would have removed to a very good extent some of the antinutritional limitations of the meal.

Recommendation: It is therefore recommended that Jackbean meal up to 30% inclusion level under good processing, using the cracked, soaked and cooked (CAC) technique, can be used in the diet of *Clarias gariepinus*.

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