Growth Responses of Hybrid Catfish (*Clarias gariepinus* ♀ X *Heterobranchus bidosarlis* ♂) Fingerlings Fed Diets Lablab Bean Meal (*Lablab purpureus*)

Original Research Article

ABSTRACT

This study examined the replacement of soyabean meal (SBM) with Lablab bean meal (LBM) in the practical diets of Clariid catfish (*Heteroclarias*). Five Iso-nitrogenous diets of 40%CP containing varying levels of LBM were incorporated as a non-conventional feedstuff at D_1(10% LBM); D_2(20%LBM); D_3(30%LBM); D_4(40%LBM) and D_5(50% LBM) as a replacement for soyabean meal. Seventy-five Heteroclarias fingerlings with an initial mean weight of 1.46±0.01g were stocked randomly to five treatments in triplicate groups and were fed to satiation twice daily for a period of 70 days. At the end of the 70days experimental period, all growth parameters decreased across all diets from D_1 to D_5. D_1(10% LBM) had the best growth rate as it recorded the highest value in terms of weight gain (1.25); feed intake (2.34); feed conversion ratio (1.86); relative weight gain (4.86) and specific Growth rate of (1.33) while D_5 recorded the least values across all parameters. D_1 was not significantly different (P>0.05) from D_2 in all growth parameters listed above but D_1 and D_2 were significantly different (P<0.05) from D_3, D_4 and D_5. Therefore, Lablab bean meal can replace soyabean meal totally but will be best at 10% replacement in diets for *Hetero clarias* without compromising the growth and carcass composition. Further research should be carried out to test lablab meal on pure *Heterobranchus bidorsalis* fingerlings.

Keywords: Lablab meal; soyabean replacer; Heteroclarias and non-conventional feedstuff.

1. INTRODUCTION

Nutrition is one of the characteristics of all living things, fish inclusive whereby organisms are provided with feed in order to metabolize the energy stored in food into chemical energy used in maintaining their body. Nutrition is the synopsis of all the process whereby an organism is provided with materials necessary for energy release, growth and repair, of its various secretions, for storage and for maintenance of internal osmotic and pH of the environment [1]. In fish farming, nutrition is critical because feed represents 60-70% of the production cost [2]. Low-quality fish feed and its attendant high cost is the primary factor limiting the development of aquaculture in Africa [3].

In recent years, the use of grain legumes in the diet formulation has received considerable attention due largely to its ready availability, low cost and high amino acid composition [4] compared to a conventional fish meal which is scarce and expensive. Lablab bean (*Lablab purpureus*), a legume high in crude lignin and protein, has nutrient density compared to common beans [5], but is grossly under-utilised in Nigeria. Lablab bean originated in India and had been widely distributed to many tropical countries where it is grown as an annual or a

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short-lived perennial. The seeds and immediate pods are used as human food, while the herbage is used as green manure, for erosion control and as a feed supplement for cattle grazing. The use of indigenous legumes in diet formulation is generally limited by the presence of anti-nutritional factors such as tannin, phytates, saponin, and trypsin inhibitor [6]. Consumption of feeds containing these factors reduces nutrient utilisation, feed efficiency and animal productivity. At high levels of intake, toxicity ensues, and animal sometimes dies [7]. The activity of these compounds can be reduced by dehulling, soaking, cooking, toasting and fermenting [8]. *Heteroclarias,* which is used in this investigation is increasingly cultured in Nigeria because of its remarkable fast growth [9], resistance to diseases and poor environment. The rapid increase in its market demand because of its fleshy and tasty body has added stimulus to the aquaculture sector to supplement the deficit in the needed sustainable production and supply.

2. MATERIALS AND METHODS

The study was conducted in the wet laboratory of the Department of Aquaculture and Fisheries Management, Faculty of Agriculture, University of Benin, Benin-city, Edo state for Seventy days.

2.1 Experimental Diets

The lablab beans (LB) contains anti-nutritional factors such as tannins, phytate and trypsin inhibitors. The beans were toasted for about 25 minutes to destroy the presence of the anti-nutritional factors, which are readily destroyed by heat. The roasted beans were then ground finely to yield the lablab bean meal. Fishmeal, soybeans cake, cornmeal, palm oil, Vitamin E-gel and bone meal were purchased from a retail outlet at Murtala Mohammed Way in Benin City. The composition of the experimental diets is shown in Table 1.

The various ingredients were measured accurately to their required quantity, after which they were homogeneously mixed, finely pelleted with 2 mm die size and dried at the departmental fish farm. *Heteroclarias* fingerlings with a mean weight of 1.46±0.01g were obtained from the nursery pond of the department.

2.2 Feeding Trial

The study was conducted in the wet laboratory of Department of Aquaculture and Fisheries Management, University of Benin, Benin City. Fifteen rectangular plastic tanks, five treatments in three replicates measuring (30 cm×36 cm×52 cm) were used. Each tank was filled up to 2/3 of its volume with bore-hole water attached to the laboratory. Experimental fishes were allowed for two weeks to acclimate to laboratory conditions and was fed twice daily at 5% of their body weight during this period to avoid mortality due to stress. The fishes were weighed in batches of five into each of the experimental units replicated thrice for each treatment. They were fed twice daily to satiation to ensure maximum growth between 08:00 hrs and 16:00 hrs. Feeding was monitored for each unit to ensure that fishes were not underfed or overfed. The experimental units were cleaned by total changing of the water daily. All fishes tanks were weighed and counted weekly to determine growth and survival, also the weekly weighing of feed was also carried out. The data obtained from the feeding trials were tested for significant differences using one-way Analysis of Variance (ANOVA) test, and the means were separated using Duncan's Multiple Range Test, all at 5% level of significance.

Table 1. Composition of the experimental diets

Ingredients	D_1	D_2	D_3	D_4	D_5
% replacement of Lablab	10%	20%	30%	40%	50%
LBM	10.00	20.00	30.00	40.00	50.00
Fish crumbs (50% CP)	25.40	25.40	25.40	25.40	25.40
SBC (48.0% CP)	42.00	32.00	22.00	12.00	2.00
Yellow maize (9.5% CP)	10.00	10.00	10.00	10.00	10.00
Palm oil	8.00	8.00	8.00	8.00	8.00
Bone meal	4.00	4.00	4.00	4.00	4.00
Vitamin premix	0.60	0.60	0.60	0.60	0.60

LBM= Lablab bean meal. SBC= Soyabean Cake

2.3 Parameters Monitored

Data on feed consumed and weight gain were collected weekly for each unit from which the following performance parameters were evaluated using [10] formula.

1. Weight gain (WG) = $W_2 - W_{1\,(g)}$

Where; W_1 = initial weight
W_2 = final weight

2. Feed intake = Initial weight of feed – Final weight of feed

3. Specific growth rate per day (SGR) % =

$$\frac{\text{Loge W2} - \text{loge W1}}{\text{T2} - \text{T1}} \text{ X } 100$$

Where: T_1 and T_2 are time of experiment in days.
W_2 = final weight at T_2
W_1 = initial weight at T_1
Loge = natural logarithm.

4. Relative weight gain (PWG) % =

$$\frac{\text{Weight Gain}}{\text{Initial Weight}} \text{ X } 100$$

5. Food conversion ratio (FCR) =

$$\frac{\text{Feed Intake(g)}}{\text{Wet Weight Gain(g)}} \text{ X } 100$$

6. Protein efficiency ratio (PER) =

$$\frac{\text{Weight Gain (g)}}{\text{Protein Intake}} \text{ X } 100$$

7. Survival rate % =

$$\frac{\text{Initial stocked} - \text{mortality}}{\text{Initial stocked}} \text{ X } 100.$$

3. RESULTS

The water temperature of the experimental tanks containing the fish within the experimental period was within the range of 26 °C to 28 °C and water PH at 6.9 to 7.8.

From the result in Table 2 above, the crude protein level of lablab meal is 24.49% with a fat content of 9.54% and a crude fibre content of 3.27. Among the various diets incorporated with lablab meal, D_1 with 10% incorporation level had the highest crude protein value (46.08) while D_5 had the least value (28.35) as the crude protein level reduced with an increase in corporation percentage of lablab meal.

3.1 Growth and Feed Utilization Parameters

Result showed that Weight gained by *Heteroclarias* fingerlings after ten weeks was not significantly different (P> 0.05) in D_1(1.25), D_2(1.17) and D_3(0.77) while D_5(0.37) was significantly decreased(P< 0.05) with the least weight gain value (0.37) (Table 3).

Table 2. Proximate composition (%) of lablab bean meal (Lbm) and experimental diets

Diets	Moisture	Ash	Fat	Fibre	Crude protein	NFE
LBM	6.90	8.25	9.54	3.27	24.49	47.83
D_1	5.91	10.24	15.37	3.72	46.08	18.78
D_2	7.06	10.32	16.30	4.18	40.25	21.90
D_3	6.14	9.60	15.60	4.31	34.42	30.12
D_4	5.62	9.93	16.30	3.89	31.50	33.40
D_5	6.19	10.07	15.32	3.90	28.35	36.20

NFE= nitrogen-free extract. It was determined by subtracting the summation of the values of crude protein, fat, fibre, ash and moisture from 100%

Table 3. Growth performance and feed utilisation of Clariid catfish, (*Heteroclarias*) to lablab bean meal (LBM) based diet

Parameters	Treatments					SEM
	D_1 10%	D_2 20%	D_3 30%	D_4 40%	D_5 50%	
Weight gain(g)	1.25^a	1.17^a	1.08^a	0.77^b	0.37^c	0.30
Specific Growth Rate(%/day)	1.33^a	1.16^a	1.08^b	0.46^c	0.33^c	0.70
Relative Weight Gain (%)	4.86^a	3.64^a	1.67^b	0.87^c	0.63^c	4.58
Protein Efficiency ratio	59.12^a	29.00^b	26.76^b	14.18^c	14.03^c	50.0
Feed Intake(g)	2.34^a	2.17^a	2.08^a	1.51^b	1.63^b	1.76
Feed Conversion Ratio	1.87^a	1.86^a	1.93^a	1.96^a	4.41^b	8.75

N/B: Mean Values with the same superscript on the same row are not significantly different, (P> 0.05)

The Specific growth rate shown in Table 3 was significantly higher ($P<0.05$) in D_1(1.33) and D_2(1.16) than D_5 (0.33) with the least Specific growth rate. The feed conversion ratio (FCR) recorded was an indication that food was converted to flesh at a different rate. The best FCR value was reported in D_1 (1.87) while the D_5 had the worst value (4.41) (Table 3).

From Table 3 above, Fish fed with 10% LBM was superior regarding relative weight gain to other diets. However, the Relative Weight gain was not significantly different ($P>0.05$) between D_1(4.86) and D_2(3.64) while D_5(0.63) had the least relative weight gain. The Protein Efficiency Ratio for D_1(59.12) was significantly different ($P<0.05$) from all other treatments, while D_5(14.03) had the least protein efficiency ratio. Feed Intake by fish amongst D_1(2.34), D_2(2.17) and D_3(2.08) were not significantly different ($P>0.05$), while D_5(1.63) was significantly depressed. However, Fish fed with 10% LBM recorded the highest amount of feed intake (Table 3).

Table 4 shows the carcass composition of experimental fish after being fed with experimental diets for ten weeks. From the result, the crude protein level of the initial carcass was 50.17% and this increased with treatment level but however decreased at TF_3. Fishes fed with 20%LBM incorporations had the highest level of crude protein (66.50%) in their carcass while TF_3 with 30% inclusion level had the least crude protein value of 44.92%.

4. DISCUSSION

The analysed crude protein of the lablab bean meal in this study was 24.49%. This falls within the range of 20.46-25.47% reported by [11] and also between 20-28% reported by [12]. The fat content value of 9.54% reported in this study was higher than the 2.69-4.17% reported by [11], it was also higher than the report of [13] which reported a low-fat content of 5.45%. The high-fat content reported on the Lablab meal may have led to the higher concentration of fat in the fish carcass as the fat content exceeds the maximum inclusion level of 8% in a normal catfish diet. The ash content was also higher than the ash content of 3.97-4.48% reported by [11].

Table 4. Carcass composition of the experimental fish (%)

Diets	Crude protein	Fat	Ash	MC	NFE
Fish (initial) carcass	50.17	13.49	10.21	5.15	21.00
TF_1	53.08	12.32	10.22	5.26	19.12
TF_2	66.50	11.22	10.22	5.15	6.91
TF_3	44.92	12.12	9.80	5.10	28.22
TF_4	62.42	11.59	9.74	5.21	11.04
TF_5	63.00	12.87	10.07	5.11	8.95

MC= moisture content, NFE= nitrogen-free extract, TF= Test Fish

The growth rate varied with different inclusion level of lablab bean meal. This variation in growth rate that was highest in *lablab* may be related to anti-nutritional factor(s) present in seeds such as trypsin inhibitors, proteins inhibitors and phytic acid [14]. It is a common knowledge that heat treatment is known to detoxify anti-nutrients but affects growth response, the retarded growth and nutrients utilization recorded in this study was in line with the findings of [15], who reported that heat treated *leucaena* seeds gave lower performance than *leucaena* soaked in water and sundried. Toasting of the seeds could have also resulted in the destruction of the amino acid bonds thereby reducing the protein quality of the feed ingredients. This was supported by [16] who reported that heating destroys and reduces nitrogenous compounds in legume seeds.

Protein efficiency ratio (PER) was highest in fish fed with 10% LLBM meal. This is in conformity with what was stated by [17], who reported that similarity in the PER of *Clarias gariepinus* has a direct link with feed intake. All diets produced different values of fish carcass protein and lipid than initial values with marginal difference among them indicating different retention and utilization levels of the diets. This is in line with [18] who reported that effective utilization of bambara groundnut at different inclusion levels was responsible for variations in *Heteroclarias* carcass protein and lipid.

The lower the FCR of a feed, the higher the efficiency of the feed. D_1 had the best feed conversion ratio while D_5 had the poorest FCR. There was an increase in the FCR as the LBM inclusion level increased and this could be attributed to low feed utilisation, low digestibility and the presence of anti-nutrients which is in line with [19] who stated that fish decreased digestibility is caused mainly by the increased cumulative residual effect of anti-nutritional factors.

There is a reduction in the feed intake as the percentage of LBM increased. This is in line with [20] who reported a similar reduction in feed intake with an increased level of legume concentrate. This reduction was attributed to the unpalatable residual effect of the anti-nutrients which increased with the dietary level of test feedstuff (hyacinth bean).

5. CONCLUSION

The result obtained from this study showed that D_1 with 10% inclusion of LBM was the best though this was not significantly different from D_2 with 20% inclusion level which performed best among the other Diet that had LBM present in it. From the study carried out, the recommended levels of LSM are 10% and 20% for catfish Hybrid (*heteroclarias*) since they performed better than the other inclusion levels but since weight gain of fish is what would translate into income for the fish farmer at the end of the production cycle, 10% inclusion rate of LBM in catfish diet would produce better and profitable result at present. Further research should be carried out to test lablab meal on pure *H. bidorsalis* fingerlings.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The authors ensured that all ethical and other basic principles underlying behaviour and advancing welfare for the use of animals in research, including handling, relevant laws and regulations were considered before proceeding with the research. Permission was also received from the relevant bodies for the use of fish for this experiment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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