

Growth responses of Hybrid Catfish (*Clarias gariepinus* ♀ X *Heterobranchus bidorsalis* ♂) fingerlings fed diets containing Lablab Bean Meal (*Lablab Purpureus*)

Abstract

This study examined the replacement of soyabean meal (SBM) with Lablab bean meal (LBM) in the practical diets of Clariid catfish (*Heteroclaris*). Five Iso-nitrogenous diets of 40%CP containing varying levels of LBM were incorporated as a non-conventional feedstuff at D₁(10% LBM); D₂(20%LBM); D₃(30%LBM); D₄(40%LBM) and D₅(50% LBM) as a replacement for soyabean meal. Seventy five (75) *Heteroclaris* 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 D₁ to D₅. D₁(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 D₅ recorded the least values across all parameters. D₁ was not significantly different (P>0.05) from D₂ in all growth parameters listed above but D₁ and D₂ were significantly different (P<0.05) from D₃, D₄ and D₅. Therefore, Lablab bean meal can replace soyabean meal totally but will be best at 10% replacement in diets for *Hetero claris* 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, *Heteroclaris* and non-conventional feedstuff

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 major 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 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-utilized in Nigeria. Lablab bean originated in India and has been widely distributed to many tropical countries where it is grown as an annual or a 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 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 utilization, feed efficiency and animal productivity. At high levels of intake, toxicity ensues and animal

48 sometimes die [7]. The activity of these compounds can be reduced by dehulling, soaking,
 49 cooking, toasting and fermenting [8]. *Heteroclarias*, which is used in this investigation is
 50 increasingly cultured in Nigeria because of its remarkable fast growth [9], resistance to
 51 diseases and poor environment. The rapid increase in its market demand because of its fleshy
 52 and tasty body has added stimulus to the aquaculture sector to supplement the deficit in the
 53 needed sustainable production and supply.

54 **Materials and Methods**

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

58 **Experimental Diets:** The lablab beans (LB) contains anti-nutritional factors such as tannins,
 59 phytate and trypsin inhibitors. The beans were toasted for about 25 minutes to destroy the
 60 presence of the anti-nutritional factors, which are readily destroyed by heat. The toasted
 61 beans were then ground finely to yield the lablab bean meal. Fishmeal, soybeans cake, corn
 62 meal, palm oil, Vitamin E-gel and bone meal were purchased from a retail outlet at Muratala
 63 Mohammed Way in Benin City. The composition of the experimental diets is shown in Table
 64 1.

65 **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

66 **LBM= Lablab bean meal. SBC= Soyabean Cake**

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

71 **Feeding Trial:** The study was conducted in the wet laboratory of Department of Aquaculture
 72 and Fisheries Management, University of Benin, Benin City. Fifteen (15) rectangular plastic
 73 tanks, five (5) treatments in three (3) replicates measuring (30cm×36cm×52cm) were used.
 74 Each tank was filled up to 2/3 of its volume with bore-hole water attached to the laboratory.
 75 Experimental fishes was allowed for two weeks to acclimate to laboratory conditions, and
 76 was fed twice daily at 5% of their body weight during this period to avoid mortality due to
 77 stress. The fishes were weighed in batches of five into each of the experimental units
 78 replicated thrice for each treatment. They were fed twice daily to satiation to ensure
 79 maximum growth between 08:00hrs and 16:00hrs. Feeding was monitored for each unit to
 80 ensure that fishes were not underfed or overfed. The experimental units were cleaned by total
 81 changing of the water daily. All fishes tanks were weighed and counted weekly to determine
 82 growth and survival, also the weekly weighing of feed was also carried out. The data
 83 obtained from the feeding trials were tested for significant differences using one way

84 Analysis of Variance (ANOVA) test and the means were separated using Duncan's Multiple
85 Range Test, all at 5% level of significance.

86 **Parameters Monitored:** Data on feed consumed and weight gain were collected weekly for
87 each unit from which the following performance parameters were evaluated using [10]
88 formula.

89 1. Weight gain (WG) = $W_2 - W_1$ (g) Where; W_1 = initial weight
90 W_2 = final weight

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

92 3. Specific growth rate per day (SGR) % = $\frac{\text{Loge } W_2 - \text{loge } W_1}{T_2 - T_1} \times 100$

93 Where: T_1 and T_2 are time of experiment in days.

94 W_2 = final weight at T_2

95 W_1 = initial weight at T_1

96 Loge = natural logarithm.

97 4. Relative weight gain (PWG) % = $\frac{\text{Weight Gain}}{\text{Initial Weight}} \times 100$

98 5. Food conversion ratio (FCR) = $\frac{\text{Feed Intake (g)}}{\text{Wet Weight Gain (g)}} \times 100$

99 6. Protein efficiency ratio (PER) = $\frac{\text{Weight Gain (g)}}{\text{Protein Intake}} \times 100$

100 7. Survival rate % = $\frac{\text{Initial stocked} - \text{mortality}}{\text{Initial stocked}} \times 100$.

101

102 RESULTS

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

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106 **Table 2: Proximate Composition (%) Of Lablab Bean Meal (Lbm) and Experimental**
107 **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

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

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112 From the result in Table 2 above, the crude protein level of lablab meal is 24.49% with fat
113 content of 9.54% and a crude fibre content of 3.27. Among the various diets incorporated
114 with lablab meal, D₁ with 10% incorporation level had the highest crude protein value (46.08)
115 while D₅ had the least value (28.35) as the crude protein level reduced with increase in
116 incorporation percentage of lablab meal.

117 4.1 Growth and Feed Utilization Parameters

118 Result showed that Weight gained by *Heteroclaris* fingerlings after ten weeks was not
 119 significantly different ($P > 0.05$) in D₁(1.25), D₂(1.17) and D₃(0.77) while D₅(0.37) was
 120 significantly decreased ($P < 0.05$) with least weight gain value (0.37) (Table 3).

121 **Table 3. Growth performance and feed utilization of Clariid catfish, (*Heteroclaris*) to**
 122 **lablab bean meal (LBM) based diet.**

PARAMETERS	Treatments					SEM
	D ₁	D ₂	D ₃	D ₄	D ₅	
	10%	20%	30%	40%	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

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

125 The Specific growth rate shown in Table 3 was significantly higher ($P < 0.05$) in D₁(1.33) and
 126 D₂(1.16) than D₅ (0.33) with the least Specific growth rate. The feed conversion ratio (FCR)
 127 recorded was an indication that food was converted to flesh at different rate. The best FCR
 128 value was reported in D₁ (1.87) while the D₅ had the worst value (4.41) (Table 3).

129 From Table 3 above, Fish fed with 10% LBM was superior in terms of relative weight gain to
 130 other diets. However, the Relative Weight gain was not significantly different ($P > 0.05$)
 131 between D₁(4.86) and D₂(3.64) while D₅(0.63) had the least relative weight gain. The Protein
 132 Efficiency Ratio for D₁(59.12) was significantly different ($P < 0.05$) from all other treatments,
 133 while D₅(14.03) had the least protein efficiency ratio. Feed Intake by fish amongst D₁(2.34),
 134 D₂(2.17) and D₃(2.08) were not significantly different ($P > 0.05$), while D₅(1.63) was
 135 significantly depressed. However, Fish fed with 10% LBM recorded the highest amount of
 136 feed intake (Table 3)

137 **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

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

139 Table 4 show the carcass composition of experimental fish after being fed with experimental
 140 diets for ten weeks. From the result, the crude protein level of the initial carcass was 50.17%
 141 and this increased with treatment level but however decreased at TF₃. Fishes fed with

142 20%LBM incorporation had the highest level of crude protein (66.50%) in their carcass while
143 TF₃ with 30% inclusion level had the least crude protein value of 44.92%.

144

145 **DISCUSSION**

146 The analyzed crude protein of the lablab bean meal in this study was 24.49%. This falls
147 within the range of 20.46-25.47% reported by [11] and also between 20-28% reported by
148 [12]. The fat content value of 9.54% reported in this study was higher than the 2.69-4.17%
149 reported by [11], it was also higher than the report of [13] which reported a low fat content of
150 5.45%. The high fat content reported on the Lablab meal may have led to the higher
151 concentration of fat in the fish carcass as the fat content exceeds the maximum inclusion level
152 of 8% in a normal catfish diet. The ash content was also higher than the ash content of 3.97-
153 4.48% reported by [11].

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

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

171 The lower the FCR of a feed, the higher the efficiency of the feed. D₁ had the best feed
172 conversion ratio while D₅ had the poorest FCR. There was an increase in the FCR as the
173 LBM inclusion level increased and this could be attributed to low feed utilization, low
174 digestibility and the presence of anti-nutrients which is in line with [19] who stated that fish
175 decreased digestibility is caused mainly by increased cumulative residual effect of anti-
176 nutritional factors.

177 There is reduction in the feed intake as the percentage of LBM increased. This is in line with
178 [20] who reported similar reduction in feed intake with increased level of legume concentrate.
179 This reduction was attributed to unpalatable residual effect of the anti-nutrients which
180 increased with the dietary level of test feedstuff (hyacinth bean).

181 **Conclusion**

182 The result obtained from this study showed that D₁ with 10% inclusion of LBM was the best
183 though this was not significantly different from D₂ with 20% inclusion level which performed
184 best among the other Diet that had LBM present in it. From the study carried out, the
185 recommended levels of LSM are 10% and 20% for catfish Hybrid (*heteroclarias*) since they
186 performed better than the other inclusion levels but since weight gain of fish is what would
187 translate into income for the fish farmer at the end of the production cycle, 10% inclusion rate
188 of LBM in catfish diet would produce better and profitable result at present. Further research
189 should be carried out to test lablab meal on pure *Heterobranchus bidorsalis* fingerlings

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

Ethical Approval:

The authors ensured that all ethical and other basic principles underlying behavior 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.

Consent: NA

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