GROWTH PERFORMANCE AND NUTRIENT UTILIZATION OF *Heterobranchus bidorsalis* FED FERMENTED MILLET BRAN MEAL DIETS

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ABSTRACT

For aquaculture industry sustainability, apart from developing and improving of manpower; it is of immense importance to research and develop on various inputs of production, such as feed. Agro by-products such as Millet bran is a source of dietary energy in fish feed. Hence it was study in this work. This agro by-product was fermented at varying fermentation periods one day, four days and seven days. The fermented by-product was subjected to proximate analysis after which four days' fermentation was selected for feed formulation. Four formulated isoproteic (40% crude protein) diets at 25%, 50%, 75% and 100% inclusion levels to replace maize meal. The diets were fed to Heterobranchus bidorsalis for twelve (12) weeks. The result obtained in this study showed that fish fed 100% inclusion levels showed significance difference ($p<0.05$) compared to fish fed other diets and control. Fish fed 100% inclusion level diet had the highest mean weight gain, average daily growth rate, specific growth rate and relative growth rate compared to fish fed control diet. The nutrients utilization showed significant difference ($p<0.05$) in fish fed 100% inclusion levels compared to those fed control diet. The highest feed conversion ratio, protein intake, protein efficiency ratio, and protein rating were recorded in the fish fed 100% inclusion levels while the lowest were recorded in the fish fed control diet.

Keywords: ***Heterobranchus bidorsalis*, Fermented Millet Bran, Growth Performance**

INTRODUCTION

The prominence of aquaculture in improving the diet of man, generating employment, conserving foreign exchange and reducing fish importation has increased greatly (Adewumi, 2015). For aquaculture industry sustainability, apart from developing and improving of manpower; it is of immense importance to research and develop on various inputs of production, such as feed. The need for feed improvement is becoming increasingly urgent because feeds accounts for about 60 – 75% of the total cost of production (Sogbesan, 2014). In Nigeria, emphasis has been placed on spurring indigenous feed enterprises that make use of local ingredients in formulating feeds for the fish industry. The task of meeting the increasing demand for fish feed can be best actualized through increased availability of indigenous feed production (Eyo, 2003). Indigenous feed enterprise is seen as an honest approach because of ease of availability of raw materials for feed production and access by fish farmers. Millet is one of the cereals asides the major wheat, rice, and maize, millets are important foods in many underdeveloped countries as major source of energy and protein for millions of people (Ali *et al.,* 2024). This study evaluates the growth performance and nutrient utilization of *Hetrobranchus bidorsalis* fed fermented millet bran meal diets.

MATERIALS AND METHODS

Experimental Location

The experiment was carried out at Biological Garden of the Department of Biological Science, Yobe State University Damaturu, Yobe State, Nigeria. The University is located at 5km Gujba road Damaturu, situated at 11.678oN 11.946oE. The indoor experiment lasted for Twelve (12) weeks.

Collection and Processing of Experimental Diets

The Maize and Millet bran were purchased from feedstuffs market in Damaturu, and sterilized for the study. The experimental fish was procured from MBG Mega Fish Farm 6km Gujba road, Damaturu. Millet bran was collected in three different bowls, ground into powder, then sieved and fermented using solid-state fermentation procedure as described by Sogbesan (2014). Each sample was solidly fermented at 10% moisture and keep in a fermenter at ambient temperature for 24 hours (1 day), 96 hours (4 days), and 168 hours (7 days). Afterward, the fermented samples were oven dried at 100^{o}C for one hours (1 hour) as described by Sogbesan (2014). The fermented samples were taken to the laboratory for proximate analysis and the best was used to replace maize at 25%, 50%, 75% and 100%. The diets were formulated using Pearson square method at 40% crude protein. Therefore, five (5) diets including control were formulated for the feeding trial (Table 1).

Experimental Design

A Completely Randomized Design (CRD) was used in this experiment in which four experimental diets each comprising of three different ingredients to replace maize. Five different treatments in triplicate making fifteen experimental units were used for the experiment. One hundred and fifty (150) *H. bidorsalis* fingerlings were procured from MBG Mega Fish Farm Damaturu and acclimatized for seven (7) days and fed with a control diet. Subsequently, they were randomly assigned to four (4) treatments in triplicate each and control. Ten (10) fish fingerlings were assigned in each plastic bowl of 30 litres volume of water and fed at 5% of their body weight.

Growth and Nutrient Utilization

The following growth and nutrient utilization parameters were calculated as follows:

Weight gain $=Wf - Wi$, Average Daily Growth (ADG) $=Wf - Wi/t$, Relative growth rate (RGR) $=Wf - Wi/Wi\ x\ 100$, Specific growth rate (SGR) $= LogWf - LogWi/t\ x\ 100$ and Survival (SR) = $Nf/Ni\ x\ 100$. Feed conversion ratio (FCR) $=Weight\ gain\ g/Feed\ intake\ (g)$, Protein intake (PI) (g of protein in 100 g diet/fish) = Total feed intake x % crude protein in the diet, Protein efficiency ratio PER= $Mean\ weight\ gain\ g/Mean\ protein\ intake\ (g\ of\ protein\ in\ 100g\ of\ diet/fish)$ and Protein rating (PR) Daily protein intake x PER.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) at 95% probability level and where significant differences were detected, mean values were separated using Least Significant Difference (LSD).

Table 1: Gross Ingredient Composition (g/100g) of the Experiment Diets

S/N	Ingredients (g/kg)	Inclusion Levels				
		0% Diet 1	25% Diet 2	50% Diet 3	75% Diet 4	100% Diet 5
1	Fish Meal	33.33	33.33	33.33	33.33	33.33
2	Soybean Meal	30.34	30.34	30.34	30.34	30.34
3	Maize Meal	31.33	23.50	15.67	7.83	0.00
4	FMBM	0.00	7.83	15.67	23.50	31.33
5	Vitamin premix	1.50	1.50	1.50	1.50	1.50
6	Starch	2.00	2.00	2.00	2.00	2.00
7	Salt	0.50	0.50	0.50	0.50	0.50
8	Oil	1.00	1.00	1.00	1.00	1.00
Total		100.00	100.00	100.00	100.00	100.00
Calculated % Crude Protein		40.00	40.00	40.00	40.00	40.00

Key: FMBM = Fermented Millet Bran Meal

RESULTS

The results of the growth performance and nutrient utilization of *H. bidorsalis* fed fermented millet bran meal diets are presented in Table 2. The mean final weight was highest in diet D_5 with 61.69±1.43g and the lowest was recorded in diet D_1 with 35.05±1.86g. The mean weight gain recorded was highest in diet D_5 with 55.45±0.82g and lowest was recorded in diet D_1 with 28.97±0.54g. The values for average daily growth (ADG), specific growth rate (SGR) and relative growth rate (RGR) was highest in fish fed diet D_5 with 0.66±0.53g, 1.19±0.62g and 888.62±0.63g and the lowest value recorded was recorded in diet D_1 with 0.35±0.54g, 0.91±0.62g and 476.48±1.05g respectively. The percentage survival rate recorded in the fish exposed to the experimental diets was highest in diet D_2 with 90±0.74% and the lowest was recorded in the fish fed diet D_5 with 76.67±0.81%. There was a significant difference ($P<0.05$) between the experimental diets fed. The mean feed intake recorded was highest in fish fed D_5 with 103.42±0.51g and the lowest was recorded in the fish fed diet D_1 experimental diet with 71.41±0.54g. Fish fed diet D_5 experimental diet had the highest feed conversion ratio (FCR), protein intake and protein efficiency ratio (PER) of 0.54±0.83, 50.19±0.64 and 1.11±0.62 and the lowest were found in the fish fed diet D_1 experimental diet with 0.41±0.24, 29.99±0.71 and 0.97±1.28 respectively. There was a significance differences ($P<0.05$) between the diets. The protein rating (PR) recorded were highest in the fish fed diet D_5 with 0.67±0.63 while the lowest were found the fish fed diet D_1 (Control) with 0.35±.45.

Table 2: Growth Performance and Nutrient Utilizations of *H. bidorsalis* Fed Fermented Millet Bran Meal Diets

	Experimental Diets				
	D_1Control	D_2	D_3	D_4	D_5
Inclusion Levels %	0	25	50	75	100
Mean Initial Weight (g/fish)	6.08±0.37^a	6.01±0.65^a	6.23±0.73^a	6.37±0.28^a	6.14±1.32^a
Mean Final Weight (g/fish)	35.05±1.86^e	42.31±0.54^c	53.63±1.63^b	54.72±0.82^b	61.69±1.43^a
Mean Weight Gain (g/fish)	28.97±0.54^e	36.30±1.76^c	47.40±1.29^b	48.35±1.86^b	55.45±0.82^a
Average Daily Growth Rate (%/fish)	0.35±0.54^b	0.43±0.64^c	0.56±0.54^b	0.58±0.75^b	0.66±0.53^a
Specific Growth Rate (%/day)	0.91±0.65^b	1.01±0.73^c	1.11±0.29^b	1.11±0.57^b	1.19±0.62^a
Relative Growth Rate (%/fish)	476.48±1.05^e	603.99±1.94^c	760.84±0.92^b	759.03±1.85^b	888.62±0.63^a
%Survival Rate	86.67±1.37^a	90±0.74^a	83.33±0.75^c	83.33±1.94^c	76.67±0.81^d
Total feed intake (g)	659.42±2.54^e	728.77±1.32^d	819.50±2.52^c	834.03±1.43^b	863.26±2.32^a
Mean feed intake (g)	71.41±1.54^e	77.72±1.76^d	92.71±0.42^c	94.03±1.47^b	103.42±0.51^a
Feed conversion ratio (FCR)	0.41±0.24^b	0.47±0.65^b	0.51±0.74^a	0.51±0.27^a	0.54±0.83^a
Protein intake (g/100gdiet/fish)	29.99±0.71^d	36.53±0.43^d	43.57±0.54^c	46.08±0.65^b	50.19±0.64^a
Protein efficiency ratio (PER)	0.97±1.28^b	0.99±0.75^b	1.09±0.64^a	1.05±0.93^a	1.11±0.62^a
Protein rating (PR)	0.35±0.45^b	0.44±0.26^c	0.57±0.17^b	0.58±0.82^b	0.67±0.63^a

Means in the same row with different superscripts were significantly different (P<0.05)

DISCUSSION

The acceptance of the diet and its translation in to flesh by *H. bidorsalis*, indicate that the replacement of maize meal with fermented millet bran meal could be done by fish farmers. The presence of some phytochemicals like flavanoids in the diet as result of solid state fermentation adopted also improves the protein level of the diet and make it acceptable by the fish as a result of aroma originated from the fermentation as reported by Chakraborty *et al*. (2013) who reported that, application of phytochemicals as growth promoters and endocrine modulators in fish culture result in the enhancement of growth and diet acceptability by the culture fishes. The result obtained from this study agreed with Susan *et al*. (2021) who reported increase in growth parameters and survival rate in Nile Tilapia (*Oreochromis niloticus*) fed dried orange peel. The result also was in line with the findings of Afe *et al*. (2019) who reported increase in weight gain, specific growth rate, average daily growth and survival rate for *H. bidorsalis* fed *Eucalyptus globulus* leaf supplemented diets. The results on nutrients utilization obtained from this study revealed that fish fed diet containing 100% inclusion level had best feed intake, feed conversion ratio, protein intake, protein efficiency ratio and protein rating compared to others fed treatment diets and control. The results obtained from this study revealed that the experimental fish utilized the diet very well as observed in the results presented. The result obtained is in line with Wattana *et al*. (2021) who reported that, sex reversed Red Tilapia (*Oreochromis niloticus* x *Oreochromis mossambicus*) fed fermented palm kernel meal as protein source. The results obtained also is in line with Eyidi and Etim (2018) who reported better feed conversion ratio, protein efficiency ratio and protein conversion ratio in African catfish fed fermented Bambara nut meal as substitute of fishmeal.

CONCLUSION

This study revealed the positive effects of incorporating fermented Millet bran meal into the diet of *H. bidorsalis*. Feeding *H. bidorsalis* with diets incorporated with four days (96 hours) fermented Millet bran meal at 100% inclusion levels improved growth performance, survival rate and nutrients utilizations.

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