

Growth Response and Nutrient Utilization of *Heterobranchus Bidorsalis* Juveniles Fed Graded Levels of Melon Shell Meal

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Abstract: The study evaluated the effect of including maize offal with graded levels of melon shell in diets of *Heterobranchus bidorsalis* juveniles (15.30±1.20g). This study was conducted for 8 weeks. The diet constitute 42% crude protein content with melon shell at different inclusion levels of 0%, 25%, 50%, 75% and 100% respectively. One hundred juveniles were randomly stocked into ten tanks for the five treatments in duplicate. Fish in each tank was fed 3% body weight of diet twice daily. Weights of fish were taken weekly. Data collected were analyzed using one way Analysis of Variance (ANOVA). The result showed that the ash content ranged from 2.80% in fish fed diet one to 4.03% in fish fed diet four. Crude fibre content ranged from 8.52% of fish fed diet one to 12.99% in fish fed diet five. Also, Ether extract ranged from 7.90% in fish fed diet one to 17.45% in fish fed diet five while the crude protein content values ranged from 39.66% in fish fed diet one to 40.05% in fish fed in diet five. The proximate values of the experimental diets showed a significant differences ($P<0.05$) among treatments. Mean Weight Gain (MWG) ranged between 97.01g in diet one and 107.82g in fish fed diet five. The Specific Growth Rate (SGR) ranged between 11.00%/day in fish fed diet five and 12.98%/day in fish fed diet three. Feed Conversion Ratio (FCR) ranged between 2.01 in fish fed diet three and 2.68 in fish fed diet one. Survival Rate (SR) ranged between 95.00% in fish fed diet one, three and 100.00% in fish fed diet two, four and five respectively. Feed Intake (FI) ranged between 3.68g in fish fed diet one and 5.74g in fish fed diet five. Result of the present study demonstrated that growth and nutrient utilization of *Heterobranchus bidorsalis* juveniles was significantly ($P<0.05$) affected by the graded level of melon shell in diet fed. The nutritionist should look more inward in using non-conventional fish feed such as melon shell so as to reduce the cost of fish feed and also reduce the level of environmental pollution. Melon shell meal can be included in the diet of *Heterobranchus bidorsalis* up to 50% inclusion level without any adverse effects on the growth. Therefore, fish farmers can have significant save in the inclusion rate of maize offal in the diets of catfish production.

Keywords: *Heterobranchus Bidorsalis*, Melon Shell, Maize Offal

1. Introduction

Fish is very important in the diet of many Nigerians, high in nutritional value with complete array of amino acids, vitamins and minerals. In addition, fish products are relatively cheaper compared to beef, pork and other animal protein sources in the country [1]. Regrettably, the supply of fish has been on the decline, this is due to the consistent decline from the country's major source of fish [2]. The current domestic fish production is put at 620,000 metric tons as against the present national demand of about 2.66 million

metric tons [3]. Thus, Nigeria is force to spend 500 million a year on imported fish [4]. Recently, in Nigeria, statistics demonstrate the country's increasingly relies on importation of feed resources as a result of decline or diminishing output of certain traditional crops to meet the need of an expanding livestock and aquaculture sector [5]. This culminated in increase of prices of food and feeds resources which has aggravated the already precariously high cost of fish feed which has been a major problem to fish farmers in Nigeria, [6]. This high cost constitute about 40-60% of the recurrent cost of most intensive fish farm ventures which negates the

economic viability of the farm when cheaper alternatives are not available [7]. Small scale fish farmers account for over 70% of fish producers in Nigeria and this group divided into commercial and subsistent farmers most of whom are located in the rural areas with limited knowledge-based on fish production.

Melon called the *Citrullus colocynthis* is a West African oil seed, produced and processed in large tonnage in Nasarawa State particularly Lafia and Keffi LGA [8]. However, large quantities of the melon shell which are mostly discarded and burnt constitute one of the major sources of environmental degradation. Hence, the need to use it as a non-conventional feed ingredient for feed production which is relatively unsuitable for animal and human consumption, cheap and found in abundance. Therefore, this study was carried out to evaluate the nutritional potentials of melon shell in compounded diet, growth response of *H. bidorsalis* juveniles to different diets containing melon shell meal.

Heterobranchus bidorsalis is an omnivorous scavenger most active at night, feeding on any available food, including invertebrates and insects when small, fish and other small invertebrates when large. It scavenges off large carcasses and offal from riverside villages [9]. It undergoes a spawning migration from the normal dry season habitat into the tributary rivers and flood plains during the rainy season, eggs and juveniles found among plants roots in shallow water [10]. It lives for 12 or more years.

2. Materials and Methods

2.1. Location and Climate

The study was carried out at the Department of Aquaculture and Fisheries Management Faculty of Agriculture, Nasarawa State University Keffi, Shabu- Lafia Campus. Lafia is located on latitude 8° 35'N, longitude 8° 32'E, altitude 181.53m above sea level with a mean temperature of 34°C, relative humidity of 40-86% and average day light of 9-12h [11].

2.2. Experimental Fish

Juveniles of *H. bidorsalis* (15.30±1.20g) were obtained from a reputable fish farm in Mararaba-Karu of Nasarawa State. Fish were transported in a modified 50litres jerry can containing sufficient water and were acclimatized for 2 weeks during which they were fed twice daily at 3% body weight. Fish were starved for 2 days to empty their gastrointestinal tract to prepare them for the new diet.

2.3. Experimental Design

Ten rectangular tanks containing 20 litres of borehole water were used for this experiment. It contains five treatments and two replicates using the Completely Randomized Design (CRD). Ten juveniles of *H. bidorsalis* were stocked in each tank, each treatment contain graded level of melon shell. Treatment A was with no inclusion of melon shell, treatment B, C, D, and E in the order of 25, 50, 75 and 100% respectively.

One hundred and twenty (120) juveniles of *Heterobranchus bidorsalis* were kept for acclimatization for 2 weeks during which they were fed with commercial feed. Juveniles were randomly allocated into five dietary treatments; each treatment containing 10 juveniles in duplicate. Each experimental treatment contained graded quantities of melon shell. Treatment A (DT₁) was controlled with no inclusion of melon shell, treatment B (DT₂) with 25% of melon shell, treatment C (DT₃) with 50% of melon shell, treatment D (DT₄) with 75% of melon shell and treatment E (DT₅) with 100% of melon shell.

Fish in the treatment tanks were starved for 24hrs to prepare their appetite for the formulated diets. Feeding trail of the fish samples lasted for 8 weeks. Juveniles in each treatment tank were fed twice daily at 3% body weight.

2.4. Formulation of Diet

The feed ingredients were obtained at Lafia Modern market, Nigeria, these include; maize offal, fishmeal, soybean meal, groundnut cake, vitamin premix, bone meal, methionine, lysine, palm oil, vitamin C, salt and while melon shell was gotten from egusi mill at Keffi, Nasarawa State. The feed ingredients were milled separately with a hammer mill to ensure a homogenous size profile and the feedstuff were then analyzed for their crude protein, lipid (fat), ash and fiber content according to the method mentioned by A. O. A. C. [12]. The diet was formulated at 42% crude protein using Pearson square method of feed formulation to obtain five treatments containing 0%, 25%, 50%, 75%, and 100% respectively. It was mixed thoroughly in a bowl and little water was added at interval to gelatinized starch, hence, pelletized in a mechanically operated flat die pelletize of model APF 150-200 and 50kg-300kg/hr capacity. The moist pellets were spread and sundried for 24hrs, packed in a labeled air tight polythene bags and stored in a dry place at room temperature. The gross and proximate composition of the experimental diets is shown in Table 1.

Table 1. Gross and proximate composition of the experimental diets for *Heterobranchus bidorsalis* juveniles.

Diets and Inclusion level					
Ingredients	DT1 (0%)	DT2 (25%)	DT3 (50%)	DT4 (75%)	DT5 (100%)
Melon shell	0.00	5.30	10.25	15.19	20.49
Maize offal	20.49	15.19	10.25	5.30	0.00
Fishmeal	24.17	24.17	24.17	24.17	24.17
Soybean meal	24.17	24.17	24.17	24.17	24.17
Groundnut cake	24.17	24.17	24.17	24.17	24.17
Vitamin premix	1.50	1.50	1.50	1.50	1.50

Diets and Inclusion level					
Ingredients	DT1 (0%)	DT2 (25%)	DT3 (50%)	DT4 (75%)	DT5 (100%)
Bone meal	1.50	1.50	1.50	1.50	1.50
Methionine	1.00	1.00	1.00	1.00	1.00
Lysine	1.00	1.00	1.00	1.00	1.00
Vitamin C	0.50	0.50	0.50	0.50	0.50
Palm oil	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100

Proximate composition of melon shell (*Citrullus colocynthis*).

% Inclusion of Diet	% Moisture	% Ash Content	% Crude Fibre	% Ether Extract	% Crude Protein	% Nitrogen Free Extract
Control	10.34±0.21 ^c	2.80±0.07 ^c	8.52±0.22 ^d	7.90±0.19 ^d	39.66±0.22 ^a	30.36±0.18 ^b
25%	8.90±0.12 ^d	3.10±0.04 ^c	10.44±0.21 ^d	13.46±0.09 ^c	39.77±0.20 ^a	24.30±0.10 ^b
50%	8.52±0.03 ^d	3.90±0.16 ^c	11.21±0.20 ^d	15.40±0.05 ^c	39.98±0.18 ^a	22.00±0.16 ^b
70%	8.46±0.05 ^d	4.03±0.12 ^c	12.00±0.18 ^d	16.41±0.11 ^c	39.99±0.17 ^a	19.10±0.13 ^b
100%	7.68±0.11 ^d	4.03±0.13 ^c	12.99±0.10 ^c	17.45±0.07 ^b	40.05±0.10 ^a	17.99±0.09 ^b

Values with the same superscripts along the columns are not significantly different ($P>0.05$)

3. Data Analysis

The data obtained were subjected to One-way Analysis of

Variance (ANOVA) in a Completely Randomized Design (CRD) using SPSS Statistical Package and where differences existed among means, they were separated by Duncan's new multiple range test at 95% confidence level [13].

3.1. Proximate Composition of Melon Shell

Table 2. Proximate composition of melon shell from Nasarawa State, Nigeria.

Nutrients analyzed (%DW)	Mean composition (%±SD)
Crude Protein (CP)	19.14±0.45
Crude Fibre (CF)	8.12±0.85
Crude Fat (Lipid)	1.71±0.04
Ash Content	7.73±0.12
Moisture Content	2.42±0.70
Nitrogen (N)	3.19±0.25
Carbohydrate (CHO)	61.01±0.35
Fatty acid	1.37±0.03
Dry Matter (DM)	97.58±3.56
Energy value (Kcal/100kg)	1440.11±0.30

Table 3. Mineral composition of melon shell from Nasarawa State, Nigeria.

Elements	Mean composition (±SD)
Calcium (%)	2.10±0.13
Magnesium (%)	0.42±0.10
Potassium (%)	1.30±0.04
Sodium (ppm)	259.85±1.78
Iron (ppm)	98.42±1.55
Phosphorus (ppm)	30.11±0.20
Manganese (ppm)	58.83±0.54
Copper (ppm)	5.94±0.30
Zinc (ppm)	47.77±1.06

Table 4. Growth parameters of *Heterobranchus bidorsalis* juveniles fed graded level of melon shell based diet.

Parameter	DT1 (0%MS)	DT2 (25%MS)	DT3 (50%MS)	DT4 (75%MS)	DT5 (100%MS)
Mean initial weight (g)	15.48±0.63 ^b	15.35±0.60 ^b	15.95±0.61 ^b	15.83±0.40 ^c	15.30±1.00 ^a
Mean final weight (g)	112.49±0.70 ^a	120.45±0.10 ^d	113.62±0.20 ^c	121.71±0.50 ^b	123.12±0.50 ^b
Mean weight gain (g)	97.01±1.30 ^c	105.10±2.90 ^b	97.67±4.20 ^d	105.88±0.60 ^b	107.82±1.50 ^a
Specific growth rate (SGR) (%/week)	12.25±0.02 ^c	12.48±0.05 ^b	12.98.0.08 ^a	11.29±0.01 ^d	11.00±0.03 ^a
Survival rate (%)	95.00±7.07 ^a	100.00±0.00 ^a	95.00±7.07 ^a	100.00±0.00 ^a	100.00±0.00 ^a
Feed conversion ratio (FCR)	2.68±0.01 ^b	2.29±0.05 ^b	2.01±0.06 ^b	2.53±0.03 ^b	2.32±0.16 ^a
Feed intake (g)	3.68±0.73 ^b	3.81±0.80 ^b	5.12±0.17 ^a	5.61±0.67 ^a	5.74±1.11 ^a
Stocking density	20	20	20	20	20
Culture period (days)	56	56	56	56	56

Values with different superscripts across the rows are significantly different ($P<0.05$)

3.2. Water Quality Parameters

Table 5. Water quality parameters of catfish (*H. bidorsalis*) fed diets containing varying levels of melon shell meal.

Parameters	DT1 (0%)	DT2 (25%)	DT3 (50%)	DT4 (75%)	DT5 (100%)
Temperature (°C)	27.25	27.05	27.00	27.20	27.10
Dissolved oxygen (mg/l)	6.50	6.45	6.43	6.35	6.55
pH	7.04	7.15	7.20	7.02	7.11
Carbon dioxide (mg/l)	4.11	4.10	4.11	4.13	4.12

4. Results and Discussion

The growth performance of *Heterobranchus bidorsalis* juveniles fed the experimental diets in terms of Weight Gain (WG), Specific Growth Rate (SGR), Feed Conversion Ratio (FCR), Feed Intake (FI) and Survival Rate (SR) as shown in Table 5. Mean Weight Gain (MWG) ranged between 97.01g in diet one and 107.82g in fish fed diet five. The Specific Growth Rate (SGR) ranged between 11.00%/day in fish fed diet five and 12.98%/day in fish fed diet three. Feed Conversion Ratio (FCR) ranged between 2.01 in fish fed diet three and 2.68 in fish fed diet one. Survival Rate (SR) ranged between 95.00% in fish fed diet one, three and 100.00% in fish fed diet two, four and five respectively. Feed Intake (FI) ranged between 3.68g in fish fed diet one and 5.74g in fish fed diet five.

Result of the present study demonstrated that growth and nutrient utilization of *Heterobranchus bidorsalis* juveniles was significantly affected by the graded level of melon shell in diet fed ($P < 0.05$). Mean Weight Gain (MWG), Feed Conversion Ratio (FCR), Specific Growth Rate (SGR), and Survival Rate (SR) were significantly different ($P < 0.05$) among the treatments. This result goes in line with study carried out on utilization of melon shell as dietary energy source in the diet of Nile tilapia (*Oreochromis niloticus*) who reported that there is a significant difference in mean weight gain of Nile tilapia (*Oreochromis niloticus*) fed diet containing melon shell as dietary energy source by [14]. This is in agreement with the work on the utilization of potato peel as dietary carbohydrate source in the diet of *Oreochromis niloticus* of [15], as well as results, on the utilization of various dietary carbohydrate levels by the freshwater catfish of [16]. This study indicated that high inclusion of melon shell demonstrates poor performance in terms of FCR. Also observed that very high inclusion levels of unconventional dietary carbohydrate sources often result in poor performance of the fish by [15]. This was also confirmed in the work when potato peel was fed to *Oreochromis niloticus* of [16]. This study indicates that 50% inclusion of melon shell designates better Specific Growth Rate (SGR). Also discussed effectiveness of replacing maize with a non-conventional carbohydrate source Tamarind (*Tamarindus indica*) resulted in good growth of Nile tilapia and improved economic returns by [17]. Similar study mentioned the growth response of *H. longifilis* fingerlings fed diets containing melon shell meal of [18]. The result of the experiment showed that 50% melon shell inclusion level in the diet of catfish (*H. longifilis*) was utilized efficiently for its growth. This indicated that melon shell meal could replace maize up to 50% in the fish feed consumption without any adverse effect. Also mentioned on

growth performance and nutrient utilization of *C. gariepinus* fed graded levels of melon shell as replacement for maize which showed the effectiveness of replacing melon shell with maize at varying inclusion level by [19]. Fish fed diet three with 50% melon shell inclusion had the best Specific Growth Rate (SGR) among the treatments.

The proximate and mineral composition of this study indicated a significant difference among the treatments, which goes in line with the study carried out on growth response of *H. longifilis* fingerlings fed diets containing melon shell meal by [18], and the study carried out on growth performance and nutrient utilization of *C. gariepinus* fed graded levels of melon shell as replacement for maize mentioned by [19].

Water quality parameters of the present study showed no significant difference among the treatments. This goes in line with the findings on growth response of *H. longifilis* fingerlings fed diets containing melon shell meal of [18].

5. Conclusion

Based on the results of the experiment, all tested diets were actively fed upon and accepted by *Heterobranchus bidorsalis*. Melon shells are cheap source of non-conventional feed ingredient which can be included favourably in diets of *Heterobranchus bidorsalis*. From the results of this study it can be deduced that the partial inclusion of melon shell meal in the formulation of fish feed to supplement maize and other conventional carbohydrate sources is acceptable and useful in fish industry, though the complete replacement of maize offal at 100% appears to be unsuitable in the diet of *Heterobranchus bidorsalis* but inclusion rate up to 50% was found appropriate in the diets of *Heterobranchus bidorsalis* juveniles.

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