integrity Research Journals

Global Journal of Fisheries Science
Volume 6(2), pages 28-32, June 2024
Article Number: 143B514C2
ISSN: 2782-750X
https://doi.org/10.31248/GJFS2023.048
https://integrityresjournals.org/journal/GJFS

Full Length Research

Growth response and feed utilization of *Heterobranchus bidorsalis* juveniles fed graded levels of melon shell

I. M. Danwali[1]*, F.K. Abubakar[2], H. D. Mudi[2], W.D. Adamu[2] and I. O. Hafsat[2]

[1]Department of Aquaculture and Fisheries Management, Nasarawa State University Keffi, Shabu-Lafia Campus. Nasarawa State, Nigeria.
[2]Department of Fisheries Technology, College of Agriculture, Science and Technology, Lafia, Nasarawa State, Nigeria.

*Corresponding author. Email: danwaliismail@gmail.com; Tel: +2348033847329.

Received 5th December 2023; Accepted 23rd February 2024

ABSTRACT: The study evaluated the effect of including graded levels of melon shell in diets of *Heterobranchus bidorsalis* juveniles (15.30±1.20 g). This study was conducted for 8 weeks. The diet constitutes 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 proximate values of the experimental diets showed a significant differences ($p<0.05$) among treatments. Mean Weight Gain (MWG) ranged between 97.01g in DT_1 and 107.82 g in fish fed DT_5. The Specific Growth Rate (SGR) ranged between 11.00%/day in fish fed DT_5 and 12.98%/day in fish fed DT_3. Feed Conversion Ratio (FCR) ranged between 2.01 in fish fed DT_3 and 2.68 in fish fed DT_1. Survival Rate (SR) ranged between 95.00% in fish fed DT_1, DT_3 and 100.00% in fish fed DT_2, DT_4 and DT_5 respectively. Feed Intake (FI) ranged between 3.68 g in fish fed DT_1 and 5.74 g in fish fed DT_5. 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. It can be concluded that partial inclusion of melon shell in fish feed to supplement other carbohydrate sources is acceptable and useful in fish industry. Melon shell can be included in the diet of *Heterobranchus bidorsalis* up to 50% inclusion level without any adverse effect on the growth.

Keywords: *Heterobranchus bidorsalis,* melon shell, diet, inclusion level and feed.

INTRODUCTION

Worldwide, aquaculture is developing, expanding, and intensifying. In Africa, aquaculture output has been increasing rapidly, especially during the last 15 years. The feed cost had increased by 73% in 2013 compared with the price in 2005 (Hishamunda *et al.*, 2014). 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 (Ayinla, 2012). Thus, Nigeria is force to spend 500 million a year on imported fish (Oyakhilomen and Zibah, 2013). In Nigeria, statistics demonstrate the country's increasingly relies on importation of feed resources as a result of decline or diminishing output of carbohydrate source crops to meet the need of an expanding aquaculture sector (FAO, 2012). 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 (Udo *et al.*, 2011). This high cost constitutes 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 (Jabir et al., 2012).

Heterobranchus bidorsalis is one of the most cultured fish among the catfishes (FAO, 2012). It has an efficient

feed conversion ratio, demonstrates fast growth rate, high tolerance to low water quality, ease of spawning and resistance to diseases (FAO, 2012). Hence, there is need for the choice of this specie.

The shell of melon is usually considered as agricultural waste. The shell is light brown in colour and light in weight like a flake, hence usually floats when placed in water (Obi *et al*., 2011). 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 and growth response of *Heterobranchus bidorsalis* juveniles fed diets containing melon shell meal.

MATERIALS AND METHODS

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 181.53 m above sea level with a mean temperature of 34°C, relative humidity of 40-86% and average day light of 9-12 hours (NIMET, 2011).

Experimental fish

Juveniles of *H. bidorsalis* (15.30±1.20 g) were obtained from a reputable fish farm in Mararaba-Karu of Nasarawa State. Fish were transported to Departmental Farm in a modified 50 litres jerry can containing 40 litres of water and were acclimatized for 2 weeks during which they were fed twice daily at 3% body weight. Fish in the treatment tanks were starved for 12 hours to empty their gastro-intestinal tract to prepare their appetite for the formulated diets.

Experimental design

Ten rectangular tanks of 3 × 5 meters 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 *Heterobranchus 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 (DT_1) was controlled with no inclusion of melon shell, treatment B (DT_2) with 25% of melon shell, treatment C (DT_3) with 50% of melon shell, treatment D (DT_4) with 75% of melon shell and treatment E (DT_5) with 100% of melon shell.

Feeding trail of the fish samples lasted for 8 weeks. Juveniles in each treatment tank were fed twice daily at 3% body weight.

Formulation 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, sun-dried and grinded into powdery form. The feed ingredients were milled separately with a hammer mill to ensure a homogenous size profile and the melon shell was then analyzed for its crude protein, lipid (fat), ash and fiber content according to the method mentioned by AOAC (2000). 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% of the melon shell respectively. Other feed stuff were properly grinded, sun-dried and also mixed thoroughly in a bowl and little water was added at interval to gelatinized starch, hence, pelletized using 3 mm pellete disc 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 24 hours, packed in a labeled air tight polythene bags and stored using sacs in a dry place at room temperature. The gross and proximate composition of the experimental diets is shown in Table 1.

Statistical 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.

RESULTS AND DISCUSSION

The proximate composition of this study in Table 2 indicated a significant difference among the treatments. Moisture content (%) ranged between 7.68% in fish fed DT_5 and 10.34% in fish f ed DT_1. Ash content (%) ranged

Table 1. Composition of the 42% crude protein experimental feed.

Ingredients	Diets and Inclusion level				
	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	20.49	20.49
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
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

Table 2. 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^{e}	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^{e}	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^{e}	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^{e}	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^{e}	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).

Table 3. 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

between 2.80% in fish fed DT_1 and 4.03% in fish fed DT_4 and DT_5. Crude fibre (%) ranged between 8.52% in fish fed diet one and 12.99% in fish fed diet five. Ether extract (%) ranged between 7.90% in fish fed DT_1 and 17.45% in fish fed DT_5. Crude protein (%) ranged between 39.66% in fish fed DT_1 and 40.05% in fish fed DT_5. Nitrogen free extract (%) ranged between 17.99% in fish fed DT_5 and 30.36% in fish fed DT_1, which goes in line with the study carried out on growth response of *Heterobranchus longifilis* fingerlings fed diets containing melon shell meal by Alatise and Ajiboye (2013), and the study carried out on growth performance and nutrient utilization of *Clarias gariepinus* fed graded levels of melon shell as replacement for maize mentioned by Omovwohwovie *et al*. (2015).

Table 3 shows the proximate composition of melon shell from Nasarawa State. Crude fat (lipid) having the least mean value of 1.71% and highest mean value in Energy value (Kcal/100kg) of 1440.11. While Table 4 shows the mineral composition of melon shell. Potassium having the least value of 1.30% and sodium with the highest mean value of 259.85%.

The growth performance of *Heterobranchus bidorsalis* juveniles fed the experimental diets were shown in Table 5. Mean Weight Gain (MWG) ranged between 97.01 g in DT_1 and 107.82 g in fish fed DT_5. The Specific Growth Rate (SGR) ranged between 11.00%/day in fish fed DT_5 and

Table 4. 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 5. 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 ($p<0.05$).

Table 6. Water quality parameters of catfish (*Heterobranchus bidorsalis*) fed diets containing varying levels of melon shell meal.

Parameters	DT1 (0%)	DT2 (25%)	DT3 (50%)	DT4 (75%)	DT5 (100%)
Temperature (^{0}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

12.98%/day in fish fed DT_3. Survival Rate (SR) ranged between 95.00% in fish fed DT_1, and 100.00% in fish fed diet DT_2, DT_4 and DT_5 respectively. Feed Intake (FI) ranged between 3.68 g in fish fed DT_1 and 5.74 g in fish fed DT_5.

Result of the present study demonstrated that growth and feed utilization of *Heterobranchus bidorsalis* juveniles was significantly affected by the graded level of melon shell in diet fed ($p<0.05$). Fish fed DT_3 with 50% melon shell inclusion had the best Specific Growth Rate (SGR) 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 Orire and Ricketts (2013). Similar study mentioned the growth response of *Heterobranchus longifilis* fingerlings fed diets containing melon shell meal of Alatise and Ajiboye (2013), the result of the experiment showed that 50% melon shell inclusion level in the diet of catfish (*Heterobranchus 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.

Water quality parameters of the present study (Table 6) showed no significant difference among the treatments and falls within the recommended range of World Health Organisation. Temperature (°C) ranged between 27.00°C in fed DT_3 and 27.25°C in fish fed DT_1. Dissolved oxygen (mg/l) ranged between 6.35 mg/l in DT_4 and 6.55 mg/l in fish fed DT_5. pH ranged between 7.02 in DT_4 and 7.20 in

fish fed DT_3. Carbon dioxide (mg/l) ranged between 4.10 mg/l in DT_2 and 4.13 mg/l in fish DT_4. This goes in line with the findings on growth response of *H. longifilis* fingerlings fed diets containing melon shell meal (Alatise and Ajiboye 2013).

REFERENCES

Alatise, S. P., & Ajiboye, G. E. (2013). Effects of boiled Jatropha kernel meal as a substitute for soybeans meal in diet of African mud catfish (*Clarias gariepinus*) fingerlings. *Journal of Fisheries and Aquatic Sciences* 9(6), 374-379.

AOAC (2000). Official methods of analysis. Association of Official Analytical Chemists. Herrick K. (ed.) 17th ed. Washington-D. C. USA.

Ayinla, O. A. (2012, November). Aquaculture development and appropriate enterprise combination in the Braced States. In *the High level meeting of experts and the meeting of BRACED States Commissioners for Agriculture. Songhai Farms, Port-Harcourt. Oct* (pp. 1-41).

Food and Agricultural Organisation (FAO) (2012). The state of food insecurity in the world 2008. High food prices and food security threats and opportunities. Food and Agriculture organization of the United Nations Rome Pp. 8.

Food and Agricultural Organisation (FAO) (2012). The state of world fisheries and aquaculture. FAO Fisheries and Aquaculture Department, Food and Agriculture Organisation of the United Nations, FAO, Rome, Italy, 230.

Hishamunda, N., Ridler, N., & Martone, E. (2014) Policy and governance in aquaculture: Lessons learned and way forward. FAO Fisheries and Aquaculture Technical Paper 577. Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/3/i3156e/i3156e.pdf.

Jabir, M. A. R., Jabir, S. A. R., & Vikineswary, S. (2012). Nutritive potential and utilization of super worm (*Zophobas morio*) meal in the diet of Nile tilapia (*Oreochromis niloticus*) juvenile. *African Journal of Biotechnology*, *11*(24), 6592-6598.

NIMET (2011). Nigerian Metrological Agency. Synoptic office, Nasarawa State, Nigeria.

Obi, M. N., Kolo, R. J., & Orire, A. M. (2011). The production of floating fish feed using melon shell as a floating agent. *International Journal of Science and Nature, 2*(3), 477-482.

Omovwohwovie, E. E., Ekelemu J. K., & Akinyemi, A. A. (2018). Growth performance and nutrient utilization of Clarias gariepinus fed graded levels of melon shells as replacement for maize. *Global Journal of Agricultural Research*, *6*(4), 16-21.

Orire, A. M., & Ricket, O. A. (2013). Utilization of mellon shell as dietary energy source in the diet of Nile tilatia (*Oreochromis niloticus*). *International Journal of Engineering and Science*, *2*(4), 5-11.

Oyakhilomen, O., & Zibah, R. G. (2013). Fishery production and economic growth in Nigeria: Pathway for sustainable economic development. *Journal of Sustainable Development in Africa*, *15*(2), 99-109.

Udo, I. U., Ndome, C. B., & Asuquo, P. E. (2011). Use of stochastic programming in least-cost feed formulation for African catfish (*Clarias gariepinus*) in semi-intensive culture system in Nigeria. *Journal of Fisheries and Aquatic Science*, *6*(4), 447-455.