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Short Communication

Effects of dietary protein levels on the growth performance of *Heterobranchus bidorsalis* (Geoffroy-Saint-Hilaire, 1809) fingerlings from the Niger Delta

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Fingerlings of *Heterobranchus bidorsalis* were fed six isocaloric diets at different crude protein levels at 5% of body weight to determine the growth performance. Growth rate and weight gain increased progressively with dietary protein level to a maximum at 40%. Significant differences ($p<0.05$) were recorded for the growth indices. The nutrient utilization parameters had variable results among the treatments. There was no significant difference in apparent feed conversion ratio and the nitrogen metabolism but apparent protein efficiency ratio showed significant variations. The overall results indicated that fish fed 40% dietary protein diet performed best in weight gain, food conversion ratio and nitrogen metabolism.

Key words: Dietary protein, growth performance, *Heterobranchus bidorsalis.*

NTRODUCTION

Dietary protein is used by fish for growth, energy and maintenance (Kaushik and Medale, 1994). Protein requirement for maximum growth of any species is a logical step to the development of a cost-effective feed for the fish, and entails determining the minimum amount required to produce maximum growth and not be used for energy (Sang-Min and Tae-Jun, 2005). Thus, any reduction in dietary protein level without affecting fish growth can substantially reduce the cost of feed. However, management, environmental factors and fish size can affect dietary nutrient levels for optimum performance.

Heterobranchus bidorsalis is a freshwater catfish with great aquaculture potentials (Teugels et al*.,* 1990; Williams, 1997). The species is widely accepted by fish farmers and consumers because of its taste, fast growth rate and moderate price. This study was therefore designed to investigate the dietary protein requirement of the *H. bidorsalis* fingerlings.

It is hoped that the results will contribute significantly to the knowledge of culture requirements of the species. Nutritional studies have been conducted on the species and so the nutritional requirements of the species have not been elucidated. With its wide acceptance as culture species, there is the need to re-examine its nutritional requirement under different environment to assist fish farmers in the Niger Delta Area.

MATERIALS AND METHODS

Six isocalorific diets were formulated with 20, 25, 30, 35, 40 and 45% crude protein levels. Table 1 gives the formulation and composition of the experimental diets. The various ingredients were mixed and pelleted with a manual meat mincer and then air-dried. The fingerlings used for the experiment were procured from Jay-Ess Consultants Fish Farm in Port Harcourt, Rivers State. Individuals of fairly uniform size (cm) and initial body weight of 0.60 g were used.

The feeding trials were conducted in 62.5 x 29.5 x 30 cm^3 aquarium tanks supplied with aerated water. Ten fingerlings of the species were weighed and stock in each tank in three replicates. The experimental fish were fed their respective diets at 5% body weight per day in split dose at 0900 and 1600 h. The fish in each aquaria tank was batch-weighed fortnightly and the quantity of feed to be dispensed was adjusted to reflect the new weight. During this period undigested food particles and waste products were siphoned

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Table 1. Composition of experimental diets.

Feed items	(% Crude protein)					
	20	25	30	35	40	45
Fish meal	8.61	10.77	13.89	17.02	20.15	23.27
Shrimp meal	9.46	10.18	15.61	16.54	19.72	21.85
Soya bean meal	12.50	14.35	21.39	24.46	26.85	28.15
Yellow maize	34.74	33.05	20.69	19.32	15.74	11.60
Vitamin premix	0.60	0.60	0.60	0.60	0.60	0.60
Rice bran	27.82	24.75	20.76	15.75	10.73	8.65
Vegetable oil	5.00	5.00	5.00	5.00	5.00	5.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Starch (Binder)	1.00	1.00	1.00	1.00	1.00	1.00
Proximate composition (% Dry matter)						
Crude protein (%)	20.27	25.61	31.07	36.82	42.15	46.87
Crude fibre (%)	8.21	8.46	8.06	7.28	8.36	8.48
NFE	41.32	38.73	35.65	32.30	25.16	22.76
Ash (%)	22.75	19.64	18.73	18.24	19.54	16.74
Crude lipid (%)	7.45	7.56	6.49	5.36	4.79	5.15

Table 2. Summary of physico-chemical parameters.

Parameter	Initial reading	Final reading	Mean
Temperature (^oC)	26.00	27.00	26.2 ± 0.4
pH	6.97	7.45	7.1 ± 0.2
Dissolved oxygen (mg/l)	5.19	5.82	5.47 ± 0.4

out with rubber hose daily.

The experiment lasted for 12 weeks after which the fish were individually measured for standard length using a meter rule to the nearest centimeters (cm) and weight was obtained using a top loading balance measured to the nearest gram (g). Thereafter, growth indices and nutrient utilization parameters were calculated for each treatment. Weight gain, specific growth rate, apparent feed conversion ratio, apparent protein efficiency ratio, nitrogen metabolism. The indices were calculated using the following formulae:

Weight gain = Final average weight – initial average weight

Specific growth rate = $[(\text{Loge } W_2 - \text{Loge } W_1) \times 100]/T$

W_2 = Final body weight, W1 = Initial body weight of fish, and T = duration of study in days.

Average daily growth rate = Average wt gain (g) / T (days)

Apparent feed conversion ratio = Wt of dry feed dispensed / Live wt gained

Apparent protein efficiency ratio = wt gain (g) / Apparent protein intake

Nitrogen metabolism = $[(0.54)(b-a)h]/2$

a = initial weight, b = final wt, h = experimental period (days) and 0.54 = experimental constant.

The results of the feeding trial were statistically analyses using the one-way analysis of variance (ANOVA). The Duncan' multiple range test (Duncan, 1955) was also used in separating the means.

RESULTS AND DISCUSSION

The results of the physico-chemical parameters are shown in Table 2. Temperature was 26.22 ± 0.4^{o}C, pH was 7.1 ± 0.2 and dissolved oxygen 5.47 ± 0.4 mg/l. The water quality is thus considered suitable for fish production. The summary of growth responses is presented in Table 3. The results show significant differences among treatments in the growth indices-weight gain. Mean weight gain increases as protein level increases to a maximum of 1.65 g at 40% protein, thereafter decreased to 1.20 g when protein level was 45%. Specific growth rate follows the same trend, it increases as protein level increased to a maximum of 0.59 when protein was 35% and decreased to 0.51 when protein level was 45%. However, the values for the apparent protein efficiency ratio decreased with increasing dietary protein. Feed conversion ratio showed no significant statistical variation among the treatments. On the whole *H. bidorsalis* fingerlings fed with 40% crude protein diet performed better than fish fed at low protein level diets. The quadratic model (SAS software) analysis gave a good quadratic regression at protein level 40%.

Table 3. Growth performance and nutrient utilization of *H. bidorsalis* fingerlings fed at different crude protein level.

Parameter	% Crude protein					
	20	25	30	35	40	45
Mean initial body weight (g)	0.60	0.60	0.60	0.60	0.60	0.60
Mean final body weight (g)	1.29^{a}	1.56^{a}	1.84^{ab}	2.09^{a}	2.25^{b}	1.80^{a}
Mean weight gain	0.69^{a}	0.96^{a}	1.24^{ab}	1.49^{a}	1.65^{b}	1.20^{a}
Specific growth rate	0. 30^{a}	0. 40^{a}	0. 48^{a}	0. 58^{a}	0. 59^{a}	0.51^{a}
Apparent feed conversion ratio	2.45^{a}	2.76^{a}	2.82^{a}	2.84^{a}	2.95^{a}	2.48^{a}
Apparent protein efficiency ratio	1.24^{a}	1.12^{bc}	0.98^{c}	0.81^{ac}	0.67^{a}	0.59^{a}
Nitrogen metabolism	151.65^{a}	142.77^{b}	158.12^{a}	133.79^{ab}	167.42^{c}	120.22^{ab}

*Treatments with the same superscripts are not significantly different.

The mean water quality parameters values observed for temperature DO and pH within the recommended range for effective fish culture (Boyd and Lichtkoppler, 1979; Viveen et al., 1985). Also, the recorded increase in growth rate and nutrient utilization values with increase protein level are similar to the observations of Faturoti et al. (1986) for *Clarias lazera* fingerlings, Obasa and Faturoti (2000) for *Cryptocoryne walkeri* and Erondu et al. (2006) for *Chrysicthys nigrodigitatus*.

The dietary protein requirement of *H. bidorsalis* from the study on the growth and nutrient utilization indices from the quadratic regression is 40%. This deduction is in conformity with EIFAC standards on fish nutrition studies, which specifies that the optimal nutrient requirement of fish should be determined at the maximal possible rates of growth using polynomial regression analysis. The decline in growth performance at protein level above 40% can be attributed to the fact that beyond that limit, the fish body cannot use all of the available protein for protein purposes after the optimum level has been reached (Phillips, 1972). Akegbejo-Samsons (1999) reported that excess protein could reduce growth performance due to energy requirement for metabolism, rather for protein deposition. These postulations are applicable to the results of the present study as all the diets were isocaloric.

The low food conversion ratio values in all the treatments are indicative of the capability of this species to accept and utilize compounded diets as reported by Fagbenro et al. (1986) in a related study. The higher protein efficiency ration and nitrogen metabolism followed the same trend as the growth indices. Protein was more efficiently utilized by *H. bidorsalis* at 40% crude protein level than others. This trend is in tandem with results observed by Degani et al. (1989) on *C. lazera*.

In view of the results obtained in this work, it is obvious that *H. bidorsalis* fingerlings performed best when fed on 40% crude protein diet. It is believed that a compounded diet of 40% crude protein would provide nutrients that will ensure optimum growth of *H. bidorsalis* in production systems without natural food. The results of the present study therefore could provide useful assistance to fish farmers especially in the culture and management of *H. bidorsalis* in the Niger Delta area.

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REFERENCES

Akegbejo-Samsons Y (1999). Growth response and nutrient digestibility by *Clarias gariepinus* fed varying levels of dietary periwinkle flesh as replacement for fish meal in low-cost diets. Appl. Trop. Agric. 49(1): 37-41.

Boyd CE, Litchtkoppler F (1979). Water quality management in pond fish culture. International Centre for Aquaculture. Agric. Expt. Station, Auburn Univ. Auburn, Alabama. Research and Dev. Ser. No. 22. Projects: AID/DSAN-G 0039, p. 30.

Degani G, Yigal Ben-zri, Levanon B (1989). The effects of different protein levels and temperatures on feed utilization, growth and body composition of *Clarias gariepinus* (Burchell, 1822). Aquaculture 76: 293-301.

Duncan DB (1955). Multiple range and multiple F-test. Biometrics, 11: 1-42.

Erondu ES, Bekibele D, Gbulubo AT (2006). Optimum crude protein requirement of the catfish, *Chrysicthys nigrodigitatus*. J. Fish. Int. 1(1-2): 40-43.

Faturoti EO, Balogun AM, Ugwu LUC (1986). Nutrient utilization and growth responses of *Clarias lazera* fed different dietary protein levels. Niger. J. Appl. Fish Hydrobiol. 1: 41-45.

Kaushik SJ, Medale F (1994). Energy requirement utilization and dietary supply of salmonids. Aquaculture 124: 81-97.

Obasa SO, Faturoti EO (2000). Dietary protein requirement of brackish water Catfish *Chrysichthys walkeri* fingerlings. J. Field Aquat. Stud. 1(1): 1-6.

Phillips AM (1972). Calories and energy requirement. In: Halver JE (Ed) Fish nutrition. New York: Academic press, pp: 1-28.

San-Min T, Tae-Jun L (2005). Effects of dietary protein and energy levels on growth and lipid composition of juvenile snail. J. Shell Fish. pp. 50-65.

Teugels GG, Denayer B, Legendre M (1990). A systematic revision of the African catfish genus *Heterobranchus* Geoffroy-Saint-Hilaire, 1809 (Pisces: Clariidae). Zool. J. Linn Soc. 98: 237-257.

Viveen WJAR, Ritcher CJJ, Van Oordt PGWJ, Janssen JAL, Huisman EA (1985). Manual for the culture of the African catfish (*Clarias gariepinus*). The Netherlands: Directorate General for International Tech. Cooperation. The Hague, p. 93.

Williams NL (1997). Effects of stocking density and dietary protein level on the growth and survival of *Heterobranchus bidorsalis* and F_1-hybrid of *Clarias gariepinus* and *Heterobranchus bidorsalis*. M. phil. Thesis of the Rivers State University of Science and Technology, Port Harcourt, Rivers State, Nigeria, p. 91.