GROWTH RESPONSES AND YIELD OF HETEROTIS (HETEROTIS NILOTICUS) ON ARTIFICIAL DIET.

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ABSTRACT

The growth responses and yield of *Heterotis niloticus* on artificial diets of varying protein levels were studied in a bid to assess the implication of feeding Heterotis in intensive fish production venture for a rearing period of 84 days.

One hundred and twenty juvenile *H. niloticus* were fed for 12 weeks on 28%, 31%, 34% and 37% dietary crude protein levels. The fish were reared in four concrete tanks stocked at the rate of 10 fish per M^2 (100,00/hectare). Consequently, the weight gain, food conversion ratio, serum protein and albumin-globulin ratio were determined to assess the growth and state of health of the fish. The yield was appraised through economic considerations of cost of production of fish and diets (feed).

The varying crude protein levels significantly influenced ($P<0.05$) mean weight gain, percentage weight gain and food conversion ratio (FCR) however, the 37% crude protein in diet produced the best growth.

The serum protein was highest in fish raised on 31% crude protein diet while the highest value was recorded for albumin-globulin ratio on diet containing 34% crude protein.

The yield from treatments 1, 2, 3, and 4 were 114.38 of/84 days 571.9kg/g hect); 146.79g/ 84 days 733.95kg/hect), respectively. However, treatment 3 recorded the highest value for profit index.

INTRODUCTION

In a developing economy like Nigeria's, where aquaculture is also fast developing, placing priority on the feeding of cultured fish at intensive level is a move in the right direction. It is a common knowledge that fish feed development in Nigeria is still at the budding stage. One of the factors responsible for this is the dearth of data on the nutrient requirements of most fresh and brackish water species. Hence the need for persistent works on these requirements most especially on indigenous species.

Though considerable emphasis have been laid on nutrient utilization of several species of animals including fish, for growth and maintenance. However, information on the influence of the diets on the internal physiological system of the fish with particular reference to the blood components on indigenous fish species are scarce, unlike their temperate counterparts.

It is also note worthy that feeding fish for maximum benefit takes over 60% of the operating cost of a fish culture business, and survival of any business depends on the financial returns, hence, it may be necessary that any research on use of artificial feed be complimented by assessing its profitability as a business venture. This is more true in time like this when family or homestead fish ponds are seen as innovative investment ventures in the country. It is in line with these that this work is designed, to assess the growth responses and yield of fish *(Heterotis niloticus)* reared on varying dietary protein levels.

MATERIAL & METHODS

A total of one hundred and twenty juvenile *Heterotis niloticus* were disturbed randomly into four hapas set in a large concrete tank at the rate of 10 fish/m². (100,00 fish/hect.) They were fed with four different experimental diets of 28%, 31%, 34% and 37% crude protein contents respectively. Fish were fed twice daily at 4% body weight for a period of twelve weeks (84 days). Weighing of fish and records of feed consumption were taken weekly.

Water temperature was taken twice daily in the morning between the hours of 8.00 and 9.00 and in the evening between 16.00 and 18.00 hours. Dissolved oxygen was determined by using the method of Mackereth (1963). Water transparency followed the method described by Boyd (1981).

Proximate analysis of fish and experimental diets were performed using the standard AOAC (Association of Official Analytical Chemist, 1990) method. Weight gain was computed by using the method of Ishwata (1969) while specific growth rate (SGR) was determined using Brown (1957) method. Feed conversion ratio (FCR) was calculated from relationship of feed intake and wet weight gain.

Total protein serum and albumin concentration were determined using Buiret method as described by Gornall et al (1948) while the globulin was estimated by difference between the total protein concentration and albumin concentration..

All costs are based on current prices in Nigeria while the profit index was based on the following (Faturoti and Lawal 1986).

$$\text{Profit index} = \frac{\text{Value of fish (H. niloticus) Crop @ N30/kg;}}{\text{Cost of feed or fertilizer.}}$$

and (r) the incidence of cost was based on following formula (Vincke, 1969).

$$\text{Incidence of Cost} = \frac{\text{Cost of feed or fertilizer}}{\text{kg of fish produced.}}$$

Statistical analysis carried out include regression analysis, correlation and the analysis of variance (ANOVA) according to steel and Torrie (1960).

RESULT

The growth responses of juvenile Heterotis fed different dietary crude protein levels are shown in table 5. All fish fed actively and appeared healthy. The best growth response was achieved at 37% crude protein as shown by the results of the weight gained and final mean weight (Table 5).

There were significant differences ($P>0.05$) in mean weight gain per week (MWGW), food conversion ratio (FCR) and mean weight gain per fish. However there is no significant difference ($P>0.05$) in the specific growth rate (SGR) and gross efficiency of food conversion (G.E.F.C.).

There were significant difference ($P>0.05$) in the total mean yield of fish per hectare but none exist in the revenue from sale of fish between treatments 3(34% crude protein) and 4(37% crude protein). Treatment 3 had the highest profit index and the lowest incidence of cost (Table 7).

Total protein (TP) of 4.10 gm/100ml was highest in fish fed on diet 2 (31% protein), serum albumin has the highest value in, fish fed diet 3 (34% protein) serum globulin was highest in fish on diet 2 while albumin-globulin ratio has the highest value in fish fed 34% crude protein (Table 6).

TABLE 1: GROSS COMPOSITION OF EXPERIMENTAL DIETS

INGREDIENTS	DIET1 28% PROTEIN	DIET 2 31% PROTEIN	DIET 3 34% PROTEIN	DIET 4 37% PROTEIN
Yellow Maize	43.08	36.70	30.30	23.92
Grd. Nut Cake	28.72	32.97	37.23	41.49
Fish meal	14.36	16.48	18.64	20.75
Oil	5.0	5.0	5.0	5.0
Brewer's grain	5.0	5.0	5.0	5.0
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	0.50	0.50	0.50	0.50
AD-vit	0.60	0.60	0.60	0.60
Silt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00

TABLE 2: PROXIMATE COMPOSITION OF EXPERIMENTAL FISH (BEFORE AND AFTER THE EXPERIMENT)

Nutrients	Initial	1 28%	2 31%	3 34%	4 37%	S.E
Crude Protein (%)	52.19	53.41	58.29	62.98	63.18	2.31
Moisture (%)	1.28	5.93	4.98	6.37	6.06	0.94
Crude Fibre (%)	0.88	0.30	0.64	0.72	1.03	0.13
Fat (%)	1.21	10.14	0.44	4.17	3.27	1.76
Ash (%)	34.69	22.76	24.07	19.81	19.06	2.81
Nitrogen Free Extract (%)	9.75	7.46	11.58	5.95	7.40	0.57

TABLE 3: PROXIMATE ANALYSIS OF EXPERIMENTAL DIETS (PROTEIN LEVELS)

Nutrients	28%	31%	34%	37%	S.E
Moisture (%)	5.49	5.71	5.02	5.47	0.13
Crude Protein (%)	27.45	30.50	33.58	36.87	1.17
Fat (%) (Ether Extract)	7.62	7.93	8.09	8.53	0.16
Crude Fibre (%)	6.15	5.23	6.37	5.06	0.28
Ash (%)	9.49	9.61	9.80	9.85	0.07
NFE (%)	43.80	41.02	37.14	34.22	1.82

TABEL 4: THE MEAN VALUES OF THE PHYSICO-CHEMICAL PARAMETERS OF WASTER UNDER VARIOUS TREATMENTS

PARAMETERS	PROTEIN LEVEL				S.E.
Temperature	27.45	27.52	27.30	27.52	0.04
(°C) Morning)	28.55	28.72	28.53	28.95	0.08
Temperature (°C Afternoon Mean)	28.00	28.12	27.92	28.24	0.06
P^H (Morning)	7.09	7.28	7.12	7.72	0.13
P^H (Afternoon)	8.52	8.32	8.45	9.15	0.16
Mean	7.81	7.76	7.79	8.44	0.14
Dissolved Oxygen (Morning)	7.85	7.83	7.85	7.78	0.01
Dissolved O_2 (Afternoon)	12.72	13.12	13.53	13.26	0.15
Mean	10.29	10.48	10.69	10.52	0.07
Transparency (CM)	25.53	25.42	25.62	25.32	0.06

TABLE 5: EFFECT OF VARIOUS NUTRIENTS ON SERUM PROTEIN COMPONENTS

NUTRIENTS	PROTEIN LEVELS				
	28%	31%	34%	37%	INITIAL
Total Proteins gm/100 ml.	2.90	4.10	3.40	3.40	1.10
Serum Albumin gm/100 ml.	0.70	0.90	1.10	1.00	0.20
Albumin Globalin Ration (A/G Ratio)	0.33:1	0.28:1	0.48:1	0.46:1	0.22:1

TABLE 6: PERFORMANCE OF H. NILOTICUS ON DIFFERENT PROTEIN LEVELS

Parameter	28%	31%	34%	37%	Se of Mean	Sign (0.05) Level
Feed Intake/Fish /Week (g)	56.78	63.22	65.81	69.69	2.35	N.S
Mean Wt. Gain (g)	114.38^{a}	146.79^{b}	197.55^{c}	221.40^{d}	21.90	**
Specific Growth Rate	0.78	0.92	1.44	1.23	0.13	N.S
Mean Feed Intake/ Fish/Day (g)	8.11	9.03	9.40	9.86	0.32	N.S
Food Conversion Ratio	5.86^{d}	4.42^{cd}	$3.46b^{c}$	3.09^{abc}	054	**
Gross Efficiency of Food Conc ersion (%)	21.31	23.79	25.44	25.40	0.84	N.S
Percentage Mean Weight Gain	74.39^{a}	86.59^{b}	123.12^{c}	136.08^{d}	12.68	**

S.E = Standard error of mean
N.S = Not signigicant at (P>0.05)
** = Significant at 5% probability and figures followed by different alphabet differ.

TABLE 7: PRODUCTION FIGURES OF H. NILOTICUS RAISED ON VARYING PROTEIN DIETS.

	TRT.1	TRT.2	TRT.3	TRT.4	S.E	
Total wt. of fish produced/M2(g)	d 268.13	c 315.88	b 358.00	a 384.09	21.97	**
Total wt produced /hect. (84 days). (kg)	d 134.65	c 1579.40	b 1790.00	a 1920.45	109.89	**
Total amt of feed (4% body wt) for 84 days	53.63	63.18	71.60	76.82	4.40	N.S
Mean yield/hect (for 84 days) kg	571.9	733.95	987.75	1107.00	104.83	**
Cost of feed used for 84 days	d 13.12	c 14.04	ab 15.96	a 15.87	0.52	**
Cost of feed used for 84 days (N)	d 703.63	c 887.05	ab 1071.14	a 1219.10	96.86	**
Revenue from fish sale at N30.00/kg	d 17157.00	22018.50	29632.50	33210.00	3144.92	**
Profit index	24.38	24.82	27.66	27.24	0.72	NS
Incidence of Cost	1.23	1.21	1.08	1.10	0.03	NS

S.E.M. Standard error of the mean
N.S Not significant at 5% protability
* * Significant at 5% probability and figures followed by different alphabets differ.

DISCUSSION

The proportional increase in the growth of the fish (juvenile *Heterotis niloticus*) in this experiment favourably agrees with the results of many previous workers such as Ejike and Ofojekwu (1982) for *Cyprinus carpio* and Dabrowski (1977) for grass carp *(Ctenopharyngodon idella)*. It also agrees with authors like Bardach *et al* (1972), Huet (1970) and Kolawole (1982) that Heterotis is a fast growing species most especially when fed with protein rich diets.

The linear increase in specific growth rate of *H. niloticus* is in line with Janucey (1982). He obtained values ranging from -0.29 for 0% protein to 3.85 for 32% and 40% protein levels in *Sarotherdon niloticus*. The inverse relationship between the food conversion ratio and the protein levels (Table 5) is similar to that of Jauncey (1982) for *Sarotherodon mossambicus* and

Mazid *et al* (1982) for *T. zilli.* though values obtained by these workers were rather higher than values obtained for *H. niloticus* in this study, suggesting that *H. niloticus* is a better converter of food.

The increase in Serum protein as the protein level increased was an indication that the dietary protein levels have effect on the serum protein components of the fish. However, a similar trend was observed by Poston (1965). He observed a significant increase in the total pretein of fish fed with high protein and high calorie diets over those fed with high protein and high calorie diets over those fed with low protein - low calorie diets. The worker also observed a 75% increase in the serum albumin and a 73% increase in their albumin - globulin (A/G) ratio.

Incidence of cost recorded in this study was rather low judging from values recorded by Faturoti and Lawal (1986) on *Orechromis niloticus*. However, higher values of profit indices were recorded over those recorded by the aforementioned workers. These are even higher than vales obtained by Vander Linger (1967) for fertilizer and feed (7.5 and 2.0 respectively).

In conclusion, *Heterotis niloticus* has a great potential in being suitable for farming enterprises either on large scale or in homestead level of operation. The yield figure coupled with efficiency of food conversion further confirms this assertion.

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