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Growth Performance and Nutrient Utilization of the Cichlid, Commonly Called 'Wesafu' Reared In Hapa

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Abstract: *The ecotype cichlid, 'wesafu', as it is commonly called, grows to a massive size of 1.5kg and 414mm total length in the wild, which makes it a fish of great aquacultural importance in Lagos, Nigeria. The study was conducted to evaluate its growth performance and nutrient utilization when reared in hapa. 50 Fingerlings with average weight of 7.73g were allocated into $1m^3$ m hapa installed in a 0.025ha pond and replicated. Four experimental diets (T_1, T_2 , T_3 and T_4) were formulated with crude protein levels of 15%, 25%, 35% and 45% respectively, using a locally fabricated pelletizing machine, with particle sizes of 1.5- 2.0 mm. Fish were fed 3% of their body weight twice daily while samplings were carried out forthnightly. The results showed that fish fed T_4 (Crude protein of 45%) recorded the highest growth performance and nutrient utilization. This was followed by T_3, T_2 while T_1 had the least of these indices. No significant difference ($P< 0.05$) was observed in fish survival and the range was 78.7- 87.8. It showed that final weight gain was significantly higher while FCR was significantly lower in T_4 and T_3 when compared to T_1 and T_2. The Food Conversion Ratio was least in T_4 and T_3 indicating better nutrient utilization. Similarly, protein efficiency was enhanced when the crude protein was increased. There was however no significant ($P< 0.05$) variation in the growth performance and nutrient utilization between T_3 (35%) and T_4 (45%) crude protein levels. It can therefore be inferred that the optimum protein requirement for the studied fish ('wesafu') is 35% crude protein. The extra cost incurred on the addition protein (T_3 to T_4) did not produce any appreciable increase in growth. Feeding above this level will lead to increased cost with little or no proportionate benefit.*

Key Words: *Growth, Performance, Nutrient utilization, cichlid, 'wesafu'*

I. Introduction

Aquaculture is growing rapidly to provide food fish for the world's growing population and presently provides approximately 40% of food fish consumed by man (FAO, 2006). It is presently the fastest growing sector of food production globally (FAO, 2004). Many capture fisheries are presently fished at or above maximum sustainable yields (MSY), and there is, therefore a tremendous global decline because of over exploitation and habitat degradation (FAO, 2004). The total production from aquaculture in 2009 was 55.1 million tons/year and freshwater aquaculture accounted for 35.0 million tons/year of this production (63.5%). The present global population of 6.91 billion consumes about 118million tons/year of fisheries products. It is predicted that a population of 9.15 billion would need about 156 million tons/yr (an additional 34 million tons/year) by 2050. Because fisheries production from the wild is on decline, aquaculture is expected to supply the entire future increase in demand of fisheries products. In order meet the increase in fish demand, it is expected that aquaculture production should be increased by 50 million metric tons by 2050.

Tilapias represent an important freshwater species of fish for aquaculture in different regions of the world. They are characterized by fast growth, adaptability to a wide range of environmental variables, disease resistant and high flesh quality. They have the ability to reproduce under varying culture conditions and readily convert food low in plant protein to high quality flesh (El-Sayed, 2006). In Nigeria there exist an ecotype cichlid, called 'wesafu' in Epe lagoon, Lagos state where it is highly priced and grows to a size of over 1,500g in the wild (Bombatta *et al*,2005, 2007, 2008, Fashina-Bombata and Megbowon, 2012). This makes it a fish of great aquaculture potential in Lagos where it is abundantly caught and farmed. The large size of 'wesafu' coupled with deep body equally makes it a fish of great potential for filleting (Megbowon, 2010 and Megbowon *et al*, 2009). In Nigeria a kilogram of the fish sells for over 6.5 US Dollar equivalents (Megbowon and Fashina-Bombata, 2010). Many studies have been carried out on 'wesafu'. These include genetic characterization, amino acid profile, food and feeding habit and morphometrics. Although 'wesafu' is assumed to be a fish of great aquaculture potential, no work has been reported on the protein requirement when reared in hapa. The present study therefore seeks to find the optimum protein requirement for the culture of the ecotype cichlid, 'wesafu' in hapas.

II. Methodlogy

This study was conducted at a fish farm in Lagos, Nigeria, where hapas were installed in a 0.025ha pond. The experiment lasted 12 weeks.

Rearing And Experimental Fish

The experimental rearing facility consisted of series of hapas (1m x 1m X 1m). The depth of water in the hapas was maintained at 0.75m by fixing the hapas to a rectangular framework of PVC pressure pipes, each carrying four hapas. Each rectangular framework carried 4 nos of 30 litre plastic keg at opposite ends to ensure floatation. Each rectangular framework was placed in the 0.025ha pond using 300g weight sinker at the four edges of the lower ends of the hapa. The experimental fish were bred on the farm and they were apparently healthy. The average weights of the fish were 7.73g/fish.

Feed And Feed Ingredients

The main feed ingredients used in the present study were herring fish meal, soya bean meal, wheat offal, yellow maize, vitamins and minerals mixture. All the feed ingredients were purchased from the local market in Lagos. The chemical compositions of ingredients used in the experimental diets are presented in table (1).

Table 1: The chemical composition (%) of the ingredients used in formulating the experimental diets.

INGREDIENTS	Moist.	CP	EE	CF	Ash	NFE	GE (Kcal/kg
Yellow corn	11.2	8.46	3.82	2.62	1.34	83.1	4185
Fish meal	8.9	71.97	8.39	0.71	10.50	8.38	5128
Soyabean meal	11.96	44.75	1.20	7.31	5.38	41.30	4253
Wheat offal	10.96	14.97	3.95	12.10	6.30	62.69	4782

Four experimental diets (T_1, T_2, T_3 and T_4) were formulated with crude protein levels of 15%, 25%, 35% and 45% respectively, using a locally fabricated pelletizing machine, with particle sizes of 1.5- 2.0mm. The experiment was replicated. Fish were fed 3% of their body weight twice daily. Samplings were carried out biweekly.

Table 2: Formulation and chemical composition of Experimental diets

INGREDIENTS	T_1 (15%)	T_2 (25%)	T_3 (35%)	T_4 (45%)
Yellow corn	38.30	33.76	29.26	24.81
Fish meal (71.97%)	21.80	19.51	19.44	18.90
Soyabean Meal (44.75%)	21.79	22.13	21.10	21.40
Wheat offal	14.61	21.10	26.70	31.39
Soybean oil	2.00	2.00	2.00	2.00
Vitamin and mineral mix	1.50	1.50	1.50	1.50
Total	**100**	**100**	**100**	**100**

Each kilogram of vitamin/mineral mixture contained; Vitamin A 4.8 I.U, Vitamin D_3 0.8I.U, Vitamin E, 4.8g, Vitamin K, 0.8g, vitamin B_1, 0.3g, vitamin B_2, 1.5g, vitamin B_6 0.5g, vitamin B_{12}, 3.5g, Pantothetic acid, 4.0g, Nicotinic acid, 7.5g, Folic acid, 350mg, Biotin, 20g, Sodium Chloride 200g and Iodine, 4g.

Growth Performance

Mean weight gain, Specific growth rate (SGR), food conversion rate (FCR), and survival were calculated as follows:

1. Weight gain $=W_1 - W_0$
2. Specific growth rate = $(\ln W_{1-} \ln W_0 / T) \times 100$
3. Average daily Growth rate =Weight gain / T)
4. Food conversion rate = Feed intake (g) /Weight gain (g)
5. Protein Efficiency Ratio (PER)= Weight gain/protein intake
6. Survival (%)= $\frac{\text{Number of experimental fish at the end of experiment}}{\text{Number of experimental fish at the beginning of experiment}}$

Where:
W_0= Mean initial weight (g)
W_1= Mean final weight (g)
T= Experimental period (days)

Stastical Analysis

Growth and survival rates were compared using one-way analysis of variance (ANOVA) and Fisher's LSD to determine significant differences between means. Because mean initial weights differed significantly among the groups studied, the specific growth rate (SGR) of the fish were compared using Analysis of covariance with the initial weight serving as covariate.

III. Results

Table 1 showed the mean initial weight, mean final weight, weight gain, specific growth rate (SGR), food conversion rate (FCR) and survival rate (SR) for 'wesafu' fed varying crude protein levels and reared in hapas for 12 weeks. The fish fed T_4 (Crude protein of 45%) recorded the highest growth performance and nutrient utilization. This was followed by $T_{3,}$ T_2 while T_1 had the least of these indices. No significant difference (P.0.05) was observed in fish survival and the range was 78.7- 87.8.

Furthermore, final weight gain was significantly highest while FCR was significantly lower in T_4 and T_3 when compared to T_1 and T_2. The Food Conversion Ratio of were least in T_4 and T_3 indicating better nutrient utilization. Similarly, protein efficiency was enhanced when the crude protein was increased (Table 1).

The growth pattern revealed substantial increases in weight gain in every bi-weekly reading (Fig. 1) with T_4 showing better growth still.

Table 1. Mean Growth and survival rates of 'wesafu' fed varying levels of crude protein and reared in hapas

PRODUCTIVE INDEX	T_1 (15%)	T_2 (25%)	T_3 (35%)	T_4 (45%)
Initial Weight (g) ± S.E.	7.73 ± 0.97^a	7.73 ± 0.95^a	7.73 ± 0.99^b	7.73 ± 0.93^b
Final Mean weight (g) ± S.E.	31.8 ± 1.87^a	38.91 ± 2.75^b	$40.97 \pm 3.8.^b$	42.04 ± 2.84^b
Weight Gain (g) ± S.E.	24.07 ± 2.0^a	31.18 ± 2.2^b	33.84 ± 2.5^b	34.31 ± 2.6^a
PER	2.61 ± 0.05^b	2.65 ± 0.03^a	$2.\ 69 \pm 0.06^a$	2.71 ± 0.05^a
SGR (% /day) ± S.E.	4.82 ± 0.17^a	4.85 ± 0.27^a	4.86 ± 0.17^a	4.89 ± 0.24^a
FCR ± S.E	2.65 ± 0.21^b	2.46 ± 0.19^b	2.39±0.27a	2.37±0.17a
Survival Rate (%) ± S.E)	87.8 ± 2.32^a	86.4 ± 2.91^a	82.4 ± 2.73^a	78.7 ± 3.36^a

Means (n=3) in each row with same superscript were not significantly different (P>0.05)

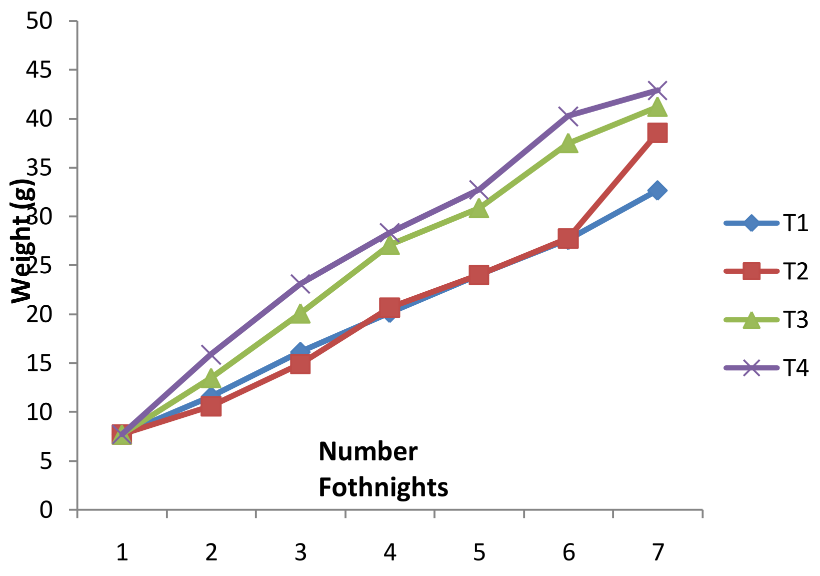

Fig 1: Growth pattern of the ecotype cichlid, 'wesafu' reared in hapas

IV. Discussion

Prepared diet provides essential nutrients that are required for normal growth and physiological functions of cultured fish. Protein requirements of cichlid fishes, particularly tilapia have been extensively studied using dose–response procedures (El-Sayed, 2006). However, the utility of the results of many studies is questionable, because they were indoor, short-term studies and the outcomes may not be directly applicable in commercial rearing facilities.

The results of the present study (involving hapa installed in pond) indicated that the highest performance and nutrient utilization was obtained when fish were fed a diet $T_{4,}$ containing 45% crude protein. All the growth parameters (weight gain, SGR, PER and FCR) indicated better performance. There was however no significant ($P < 0.05$) variation in the growth performance and nutrient utilization between T_3 (35%) and T_4 (45%) crude protein levels. It can therefore be inferred that the optimum protein requirement for the studied fish ('wesafu') is 35% crude protein. The extra cost incurred on the addition protein did not bring any appreciable increase in growth. Feeding above this level will lead to increase cost with little or no proportionate benefit.

Several authors have reported that protein is the most expensive dietary source in intensive aquaculture. It represents about 50% of total feed costs (El-Sayed, 2006). Other workers such as Abdelghany (2000) reported 35% crude protein as the optimum requirement for fingerlings of *Oreochromis niloticus*. Jauncey and Rose (1982) on the other hand reported 30-35% for *O.mossamicus* while El-Sayed (1987) reported 35% for *Tilapia zilli* fingerlings. Generally, for tilapia juveniles, the protein requirement ranges from 30 to 40%, while adult tilapias require 20–30% dietary protein for optimum performance (El-Sayed, 2006). Protein requirements of tilapia depend, among other things, on fish size or age, protein source and the energy content of the diets. Generally speaking, protein requirement decreases with increasing fish size.

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