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GROWTH PERFORMANCES AND ECONOMIC ANALYSIS OF AFRICAN CATFISH, *Clarias gariepinus (Burchell, 1822)* FINGERLINGS FED GRADED LEVELS OF TILAPIA, *Coptodon zilli* WASTE MEAL DIETS

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ABSTRACT

Feeding trial was conducted to investigate the effect of fish waste meal on growth performance and nutrient utilization, of Clarias gariepinus. 100 fingerlings of C. gariepinus of were stocked. Five (5) iso-nitrogenous diets containing 40% crude protein in which fish meal protein (70%) was replaced by fish waste meal protein (52%) at 0%, 25%, 50%, 75% and 100% levels were formulated. The fingerlings were fed at 5% body weight per day for 56 days where each Diet had two replicates. Growth performance and nutrient utilization parameters revealed that fish fed 0% waste meal gave the best weight gain (11.61%) the least was obtained in those fed 75% (6.20) diet. Feed intake showed where highest value was obtained in fish fed diet with 0% inclusion level (18.34g) while the lowest was obtained in fish fed 100% fish waste meal as 5.08g. Net protein utilization fish fed diet containing 50% Fish waste meal had higher value (1129.17) among other diets. From the study, it is concluded that fish waste meal can replace as much as 50% of fish meal in the diet of African catfish, C. gariepinus.

Key Words: African catfish, fingerlings, Growth performances, Tilapia, Meal Diet.

INTRODUCTION

Fish is very important to human due to its high quality protein as well as the essential amino acids needed by the body for growth and tissues maintenance. Around the world, fish protein makes up complete protein source in many people's diets and can also be used to maintain an active metabolism (Ayoola, 2011). According to Mahmud *et al.*(2011) one of our most valuable protein sources is fish which makes up about 25% of animal and rich in Omega-3 fatty acids, that is needed for normal growth, healthy living and body development. It is also essential for blood vessels and the nerves development according to Ayoola(2011). In order to produce cheap balanced diet feed for fish, locally available ingredients such as agricultural by-products, processing products and plant proteins could be included in the diet or substituted for expensive animals and plant protein sources (Sogbesan and Ugwumba, 2008). Many scientists have reported the possible use of some alternative animal protein feedstuffs to fish meal such as Earthworm meal (Sogbesan *et al*., 2005), Toad meal (Sogbesan *et al*., 2007), Live maggot (Sogbesan, 1998), Dry Maggot meal (Ugwumba *et al*.2001 and Sogbesan *et al*., 2005), Poultry dung meal (Fasakin*et al*., 2000), Garden snail meal (Sogbesan and Ugwumba, 2006), Termite meal (Sogbesan and Ugwumba, 2008).The projected human population in Nigeria from year 2000 to year 2019 is 114.4 to 200 million. Nigeria is the 8th leading country in inland capture fisheries in 2016 with 337,632MMT and the second largest in Aquaculture production in Africa after Egypt (SOFIA, 2018).

MATERIAL AND METHOD

Experimental Site: The experiment was carried out in the Department of Fisheries Research farm of Kano University of Science and Technology Wudil.

Collection of Fingerlings*:* One hundred and fifty fingerlings of catfish, *Claries gariepinus* with average weight of 4.25±0.15g were obtained from a reputable Hatchery in Kano State, Nigeria. The fish were transferred to the wet laboratory and acclimatized for one week. They were then starved for 12hours prior to being placed on the experimental diets.

Diet Formulation*:* Diets were formulated to contain 40% crude protein. Fish-meal was replaced by Tilapia waste meal (TWM) at 0% TWMD – control, 25% TWMD, 50% TWMD, 75% TWMD and 100% TWMD. Dried Tilapia waste was collected from Wudil market, Kano, Nigeria. They comprised discarded heads, fins, skin and entrails of smoke fish (*Coptodon zillii*).The ingredients for each diet were mixed thoroughly in a bowl and pelletized in a manually-operated pelletizer. The moist pellets were shade-dried, Packaged in tagged air-tight

polythene bags and stored in a dry place at room temperature. After preparing the ingredients, they were weighed and mixed in appropriate proportions to give the desired protein level required by the fish.

Statistical Analysis: Raw data generated were subjected to descriptive analysis while means were separated using One way analysis of variance (ANOVA) for significance difference at 5% with Minitab Statistical package for windows 10.

Table 1: Feed compositions of the experimental diets (% dry matter weight)

Ingredients	Control 0% TWMD	25% TWMD	50% TWMD	75% TWMD	100% TWMD
Inclusion levels	0%	25%	50%	75%	100%
Fish meal	21.91	16.42	10.96	5.48	0.00
Fish waste meal	0.00	5.48	10.96	16.43	21.91
Groundnut cake meal	21.91	21.91	21.91	21.91	21.91
Soybean meal	21.91	21.91	21.91	21.91	21.91
Maize meal	27.76	27.76	27.76	27.76	27.76
Vitamin premix	1.00	1.00	1.00	1.00	1.00
DCP	0.50	0.50	0.50	0.50	0.50
Salt	1.0	1.0	1.0	1.0	1.0
Palm oil	5.00	5.00	5.00	5.00	5.00
Total	100	100	100	100	100
Calculated Crude Protein	40.00	40.00	40.00	40.00	40.00
Cost of Feed (N/kg)	185.04	180.66	176.30	171.90	167.51

RESULTS AND DISCUSSION

Proximate Composition of the Ingredients

Table 1 showed the proximate composition of the ingredients used for the feed formulations. Fish meal had the highest crude protein content of 72.10% while Tilapia waste meal recorded 60.12 % crude protein and the least was from mail meal.

Growth Performance of Clarias gariepinus fed Experimental Diets

The growth pattern of the *C. gariepinus* fed the experimental diets shows a continuous increase from the first week to the end of the experiment. The graph also showed that fish fed control diet have the highest peak meaning the highest final weight at the end of the experiment and the lowest was recorded in the fish fed 75% TWMD (Figure 1). The final mean weight of the experimental fish ranged between 10.48 g/fish to 15.85g/fish. There were significant differences ($p \leq 0.05$) between the weight of the fish at lower inclusion and higher inclusion levels (Table 2). The highest relative weight gain of 273.85% was recorded in the control and the lowest of 144.86% in fish fed 75%TWMD and these were significantly difference ($p \leq 0.05$). The specific growth rate ranged between 1.023%/day to 0.694%/day and these were significantly different ($p \leq 0.05$). The initial condition factors are lower than the final condition factors and survival rate were between 80% to 100%.. The feed intake ranged from 5.08 to 18.34g/fish and these were significantly different ($p \leq 0.05$) as shown in Table 3. The highest feed conversion ratio was recorded in fish fed control diet followed by those fed 25% TWMD and the lowest in the fish fed 75% TWMD. There were significant differences ($p \leq 0.05$) between feed conversion at the lower inclusion levels but not in 75% and 100% inclusions. The protein intake, and PER also varied among the inclusions compared to the control. The highest Net profit value was recorded in fish fed 50% TWMD followed by those fed 25% diet and the lowest in 75% diet. The highest investment cost analysis value of N595.05 was recorded in fish fed control diets and the lowest in those fed 100% TWMD and these values were significantly difference ($p \leq 0.05$). The benefit cost ratio ranged from 1.96 to 1.36 and were all significant different ($p \leq 0.05$) with the control apart from 25% TWMD.

Table 2. Growth performances and survival rate of *Clarias gariepinus* Fingerlings Fed with Tilapia Waste Diets for 56 Days

Parameters	Control	25%TWMD	50%TWMD	75%TWMD	100%TWMD
Total Initial Weight (g)	42.41	42.43	42.55	42.79	42.71
Mean Initial Weight (g)	4.24	4.24	4.26	4.28	4.27
Total Final Weight (g)	158.50^{a}	143.60^{a}	126.54^{b}	94.32^{c}	88.32^{c}
Mean Final Weight (g)	15.85^{a}	14.36^{a}	14.06^{a}	10.48^{b}	11.04^{b}
Mean Weight Gain (g)	11.61^{a}	10.12^{a}	9.86^{a}	6.20^{b}	6.77^{b}
Relative Weight Gain (%/fish)	273.82^{a}	237.56^{a}	231.46^{a}	144.86^{b}	158.55^{b}
Specific Growth Rate (%/day)	1.023^{a}	0.946^{a}	0.926^{a}	0.694^{b}	0.737^{b}
Initial Mean Length (cm/fish)	5.20^{a}	5.10^{a}	5.20^{a}	5.30^{a}	5.10^{a}
Final Mean Length (cm/fish)	11.50^{a}	11.30^{a}	11.00^{ab}	10.90^{b}	11.10^{ab}
Initial Condition factor (K_1)	3.02^{a}	3.20^{a}	3.03^{a}	2.87^{b}	3.22^{a}
Final Condition factor (K_2)	1.04^{a}	1.00^{a}	1.06^{a}	0.81^{b}	0.81^{b}
Survival rate	100^{a}	100^{a}	90^{b}	90^{b}	80^{c}

Means of data on the same row with different superscripts are significantly different ($p \leq 0.05$)
Keys: Control = 0% Tilapia waste meal diet 25%TWMD = 25% Tilapia waste meal diet
50%TWMD = 50% Tilapia waste meal diet75%TWMD = 75% Tilapia waste meal diet
100%TWMD = 100% Tilapia waste meal diet

Table 3.Feed Utilization and Economic Indices of *Clarias gariepinus* Fingerlings Fed with Tilapia Waste Diets for 56 Days

Parameters	Control	25%TWMD	50%TWMD	75%TWMD	100%TWMD
Mean Protein Intake	7.33^{a}	4.86^{b}	4.06^{b}	2.13^{c}	2.03^{c}
Protein Efficiency Ratio	1.58^{d}	2.08^{c}	2.43^{b}	2.91^{b}	3.33^{a}
Mean Feed intake	18.34^{a}	12.14^{b}	10.16^{b}	5.33^{c}	5.08^{c}
Feed conversion ratio	1.58^{a}	1.20^{b}	1.03^{c}	0.86^{d}	0.75^{d}
Net profit value (N/kg)	1037.24^{c}	1091.20^{b}	1129.17^{a}	778.86^{e}	814.43^{d}
Investment cost analysis (N)	595.04^{a}	580.66^{b}	576.30^{c}	571.90^{cd}	567.51^{d}
Gross profit/loss (N)	442.2^{c}	510.52^{b}	552.87^{a}	206.04^{d}	246.92^{d}
Incidence of cost	100.02^{a}	85.18^{b}	62.29^{c}	58.12^{cd}	48.71^{d}
Profit index	2.162^{b}	2.294^{a}	2.298	2.126^{b}	2.147^{b}
Benefit Cost ratio (r)	1.77^{b}	1.86^{ab}	1.96^{a}	1.36^{c}	1.43^{c}

Means of data on the same row with different superscripts are significantly different ($p \leq 0.05$)
Keys: Control = 0% Tilapia waste meal diet 25%TWMD = 25% Tilapia waste meal diet
50%TWMD = 50% Tilapia waste meal diet 75%TWMD = 75% Tilapia waste meal diet
100%TWMD = 100% Tilapia waste meal diet

DISCUSSION

The facts that Tilapia waste meal crude protein is above 20% which is the lowest margin for any ingredient that can be used as protein source, the meal is qualify and could substitute for fish meal (Sogbesan, 2014). The crude protein content of the tilapia waste meal animal proteins were high enough to serve as single dietary protein source for *C. gariepinus* as suggested by Zeitler*et al.* (1984).Tacon (1985) and Sogbesan *et al*. (2006) suggested that protein deficiency is common in fish fed either protein depleted feed or low protein valued feed. The nutrient values of each of these ingredients were within the range of what will enhance growth and improve the health of cultured tropical fish. (NRC, 1993)The fact that all the fish grew is an indication the experimental diets tested contained the required nutrients needed by the fish. The fact that weight gain was reported in all the treatments was an indication that the fish responded positively to all the diets and that the protein content of the experimental diets adequately provided for growth and dietary energy supply of the fish (Fagbenro and Arowosoge, 1991).This was in accordance with the report of Tacon (1994) that fishmeal could be replaced with tilapia waste meal in fish feed without any adverse effect on the weight gain by the fish fed. The fact that all the fish grew is an indication the experimental diets tested contained the required nutrients needed by the fish. The fact that weight gain was reported in all the treatments was an indication that the fish responded positively to all the diets and that the protein content of the experimental diets adequately provided for growth and dietary energy supply of the fish (Fagbenro and Arowosoge, 1991).This was in accordance with the report of Tacon (1994) that fishmeal could be replaced with tilapia waste meal in fish feed without any adverse effect on the weight gain by the fish fed

CONCLUSIONS

Based on the findings of the study and with respect to the earlier stated hypotheses, there was significant difference between growth and nutrient utilization of *C. gariepinus* fingerlings fed varying inclusion levels of fish waste meal. Therefore, the null hypotheses is hereby rejected and it is inferred that the usage of fish waste meal do not in any way conflict with human food security interests. This study has demonstrated that the fish waste meal have the potential to partly replace fish meal at 50%. This would considerably reduce expenditure on feed meal without compromising growth performance and feed utilization of the African catfish.

RECOMMENDATION

Based on the findings in the study, it is therefore recommended that 50% inclusion level of fish waste meal can be adopted in the formulation of feed for *C. gariepinus* fingerlings using shade dried method of processing.

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