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PERFORMANCE OF NILE TILAPIA (OREOCHROMIS NILOTICUS) FED FISH MEAL AND POULTRY BY-PRODUCT

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ABSTRACT: *This study was conducted at the Department of Fisheries and Wild life Science, College of Science and Technology of Animal Production, Sudan University of Science and Technology, to determine the feed efficiency of two locally formulated diets (A and B) on performance of Nile Tilapia (Oreochromis niloticus). Two iso-caloric iso-nitrogenus diets were formulated by adding 60% wheat bran, 30% cotton seed cake and 10% poultry by-product (offal+intestine), while the diet (B) contained 60% wheat bran, 30% cotton seed cake and 10% fish meal. The fish were fed twice a day at affixed feeding rate of 5% body weight of fish per day for 90 days. The total body weight, total length and standard length were measured every 10 days throughout the experimental period. The growth response and performance data of the studied fish (Oreochromis niloticus) fed with diet (B) containing fishmeal recorded a better growth response than that fish fed poultry by- product meal (diet A). The final weight increment, specific growth rate (SGR), feed conversion ratio (FCR) and protein efficiency ratio (PER) over the experimental period showed lowest value for the group fed the diet with poultry by-product (Diet A) compared to those fed with the fishmeal (Diet B). Except the apparent protein utilization (APU) was recorded higher for those fed with Diet A (23.31) than Diet B (11.99). The groups fed diet (A) attained SGR 0.24, FCR 1.9, PER 0.75, APU 23.31, while it recorded in group (B), SGR 0.34, FCR 1.2, PER 1.06, APU 11.99. Therefore, fish meal is better as compared to poultry by-products for Nile Tilapia (Oreochromis niloticus) nutrition.*

ORIGINAL ARTICLE

Keywords: *Nile Tilapia, performance, fish meal, poultry byproduct*

INTRODUCTION

The Nile tilapia (*Oreochromis niloticus*) was one of the important fish species cultured in the Sudan. All illustrations from Egyptian tombs, suggest that Nile tilapia were cultured more than 3000 years ago. It is still the most widely cultured fish species in Africa, and it is an important cultured fish group in the world, after carps and salmonids.

Tilapia rearing is also one of the fastest growing farming activities, with an average annual growth rate of 13.4% during 1970-2002 (FAO, 2004), as well as widely cultured in more than 100 countries in tropical and subtropical regions in the world. As in reports, the production of farmed tilapia increased from 383.654 in 1990 to 1.505.804 Mt in 2002 representing about 6% of total farmed finish in 2002 (FAO, 2004).

Tilapia is a hardy prolific, fast growing tropical fish, and it can survive on a diversity of food. Algae is probably their most common food in the wild. On fish farms they are fed a high-protein pelleted feed. They can be fed by hand or with sprinkler mechanism, and generally fed twice per day.

Nutrition is the most expensive component in the intensive aquaculture industry, where it represents over 50% of operating costs. Moreover protein itself represents about 50%of feed cost in intensive culture, therefore, the selection of proper quantity and quality of dietary protein is a necessary tool for successful tilapia culture practices. Several factors including fish size or age, dietary protein source, energy content, water quality and culture conditions have been reported to affect protein requirements of tilapia (Elsayed, et al., 2003). Fishmeal (FM) has been traditionally used as the main protein source in the aqua feed industry. However the increased demand for FM coupled with a significant shortage in global and the supply of fishmeal is not growing worldwide (Rumsey, 1994). FM production has created sharp competition for its use by the animal feed industry. As a result, FM has become the

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most expensive protein commodity in aquaculture feeds in recent years (Tacon, 1993). Moreover the price of fish meal is often high, these necessitate replacing FM with cheaper protein sources (Shepherd, 1998) therefore, and many attempts have been made to partially or totally replace FM with less expensive, locally available protein source.

Terrestrial animal byproducts including poultry by-product meal, blood meal, meat and bone meal have been widely used as protein sources for many fish species, due to their high protein content and good essential amino acid (EAA) profiles (Tacon, 1993). Cost beneficial analyses indicated that these sources can be used as single dietary protein sources for *Nile tilapia* profiles (Elsayed, 1998). On the contrary poultry by-product is not efficiently utilized by profiles due to low digestibility and poor essential amino acid profiles (Viola and Zohar, 1984; Davies et al., 1989). Cottonseed, groundnut and sun flower cakes are one of the best plant protein sources for tilapia in developing countries due to its high availability, relatively low price, good protein content not less than 26.54% depending on processing methods and amino acid profile (FAO, 2004). Replacement of fishmeal by cheaper ingredients of either animal or vegetable origin in aquatic animal feed is necessary because of the rising cost and uncertain availability of fishmeal (Kaushik, 1995; Higgs et al., 1979). The main objective of this study to determine and comparing growth performance of *Oreochromis niloticus* fed with formulated different supplementary feed (fish meal, poultry by product).

MATERIALS AND METHODS

Experimental area and Fish Samples

The experiment was carried out at Sudan University of Science and Technology, College of Science and Technology of Animal production, Department of Fisheries and Wildlife Science. The fish fingerlings used in this experiment were two hundred forty eight (248) of Nile tilapia (*Oreochromis niloticus*) collected from the fish farm of the Fisheries Department using gill nets.

Experimental diets

Ingredients used in the study were purchased from the local market to formulated a two iso-caloric and iso-nitrogenous deits. Diet (A) containing 60% wheat bran, 30% cottonseed cake, 10% poultry byproduct (Offal +Intestine). Diet B, 60% wheat bran, 30% cottonseed cake, 10% fishmeal to attained a desirable calorie for studied fish 4755Kcal/kg.

The experimental diets (A&B) were prepared by mixing the above dry ingredients followed by the addition of hot water (90^{o}C) until a stiff tough paste was obtained. The tough paste was extruded through grinding machine to give pellets, and then dried on the shelves at room temperature. The diets were stored in plastic bags under ambient conditions over the experimental periods. Chemical composition of the experimental diets was shown in Table (1).

Table 1 - Chemical composition of the experimental diets

Diet	DM	CP	CF	EE	Ash
A	93.09	17.93	30.51	7.8	8.85
B	92.52	18.84	27.55	5.65	5.74
ME (Kcal/kg)			4755		

ME=Metabolizable energy, calculated according to MAFF(1977); DM=Dry matter; CP=Crude protein; CF=Crude fiber; EE=Ether extract

Experimental trials

The initial mean weight of Nile Tilapia fingerlings was 41.9 gm with total length 12.7 cm and standard length 10.57 cm. The fish was randomly allocated at a stocking rate of 28 fishes per hapa (Mosquito net) (190 × 100 × 90 cm) with three replicates for each experimental diet, fitted in the fish farm pond (20 × 15 m)^{2}. All fishes were fed two times daily at a fixed feeding rate of 5% body weight per day for 90 days. Total biomass of the fish from each hapa was weighed at 10 days as intervals and feeding rates adjusted accordingly. At the end of the trial nine fishes per hapa were sacrificed and sent to the laboratory to determine the proximate analysis of the whole body of studied fish. Over the experimental period the water temperature and pH levels were measured and recorded every week using normal thermometer and digital pH meter.

Proximate analysis was done according to the AOAC (1980) to determine protein, fat, ash fiber and moisture content. The protein content of the diets and the whole body weight composition was determined by Kjeldalh, method. Fat using solvent extract method. Ash content was obtained by placing the samples in a muffle furnace (550^{o}C for 12 h), fiber by placing the sample remaining in muffle furnace 550^{o}C for 6 h after acid and alkali hydrolysis, moisture by drying the sample in (105^{o}C) until consistent weight has been attained.

Statistical analysis

The data of this study was analyzed using computer statistical package of social science software (SPSS, version 10, one way ANOVA to test for significance according to Gomez and Gomez, 1980).

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RESULTS AND DISCUSSION

The growth response and performance data of Nile Tilapia *(Oreochromis niloticus)* fed with experimental diets containing poultry by-product and fish meal (diets A and diet B) are presented in Table (1, 2 and 3). Results showed a variability in growth rate responses to studied fish (*Oreochromis niloticus)*.The final increment weight and specific growth rate (SGR), feed conversion ratio FCR) and protein efficiency ratio (PER) over the experimental period showed a lower rate level in group fed diet with poultry by-product (Diet A) compared to those fed fish meal (Diet B). While the better apparent protein utilization (NPU) was recorded for those fed with Diet (A).

The results revealed that the better growth rate and feed conversion ratio (FCR) in the fishes fed diet (B) than the other group fed with diet (A). The feed conversion efficiency (FCE), and protein efficiency ratio (PER) also better in the group fed the fish meal diet (B) compared to the other group fed poultry by-product diet (A), while the apparent protein utilization was better in the fishes fed poultry by-product diet (A) than those fed fish meal diet(B). This is in agreement with study of Lim and Domany (1989), they reported that, the main source of the fish diet for protein is the fish meal which still constitute subsistent part of the feed formulation for Nile Tilapia (*Oreocromis niloticus) in* many fish farms. Olvera (2002) evaluated the effect of substituting animal protein (fishmeal) with mixture of plant feed stuffs Soybean meal and Alfalfa leaf in diets of Nile tilapia (*Oreochromis niloticus*) fingerlings showed the best growth performance on this species.

Table 2 - Chemical composition (%) of the studied fish at the end of experiment

Fish groups	DM	EE	CP	CF	Ash
Control	23.59	1.61	19.10	3.98	1.31
Diet A	25.95	1.70	23.28	2.55	2.32
Diet B	27.97	2.24	21.36	3.16	5.00

Table 3 - The effect of diets on the fish growth performance during the trial periods

Parameter	Diet A	Diet B
Specific growth rate (SGR)	0.24	0.34
Feed conversion ratio (FCR)	1.9	1.2
Feed conversion efficiency (FCE)	5.40	8.49
Protein efficiency ratio (PER)	0.75	1.06
Apparent protein utilization (NPU)	23.31	11.99
Weight gain	113.43	120.11

Table 4 - Summary of the main effect of the two formulated diets (A & B) on total bodyweight of studied fish (*Oreochromis niloticus*)

Period \ Diet	A	B
P_1	43.71	40.01
P_2	47.88	45.35
P_3	50.80	50.94
P_4	54.31	55.12
P_5	55.59	57.39
P_6	57.14	60.89
Main effect:		
Diet (A):	51.57^{a}	
Diet (B):	51.61^{b}	
Sig. level	**	
Period:		
P_1:	41.86^{b}	
P_2:	46.61^{c}	
P_3:	50.87^{bc}	
P_4:	54.71^{bc}	
P_5:	56.49^{b}	
P_6:	59.01^{a}	

Where, a, b, c means within the same column followed by different superscript are significantly (P<0.05) different

Hassan and Amin (1997) found that processing technique greatly affected the nutritional quality of poultry by-product and it could replace 50% of fishmeal in the diet, these findings were in the line of Fowler (1991) and Sevgili (2002) and the results of this study.

In Pacific white shrimp and Sun shine bass diet could be replaced by about 80% and 100% of fishmeal by poultry by-product and has no negative effect on the weight gain and feed conversion ratio of the fish species. The results obtained in this study are agreement with many authors such as Elsayed (1998); Catla sp. Hasan et al.

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(1993); Rohu sp. Hasan and Das (1993); Steffens (1998), who indicated that the total replacement of fish meal with poultry by-product could be possible and significantly increased the final weight of fish.

This study might be explained the poorest growth rate of the fish in group (A) could be attributed to a lack of some essential amino acid or the quality of the ingredient itself.

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