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NUTRITIONAL EFFECTIVENESS OF WATER HYACINTH LEAVES COMBINED WITH WHEAT BRAN AND COTTON SEED CAKE ON THE PERFORMANCE OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*)

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ABSTRACT: *The aim of this study to evaluate the different levels of water hyacinth plant leaves in the diet of Nile Tilapia and their effect on growth performance so as to eliminate the water hyacinth plant from the Nile and provide a cheap food for fish. In this experiment the dried water hyacinth leaves (Eicchornia crassipse), wheat bran and cotton seed cake were used in different ratio to formulate two experimental diets (A and B). Diet (A) contains 70% wheat bran, 20% cotton seed cake and 10% water hyacinth leaves, while diet (B) contains 65%, 20% cottons seed cake and 15% water hyacinth leaves. These diets were fed to studied fish with 5% per their body weight for 105 days. The results of this study revealed that the diet (A) has higher growth performance on studied fish than those fed on diet (B). The results of food conversion ratio (FCR, 4.04) in diet (A) and food conversion ratio (FCR, 5.73) in diet (B), and the increment of growth rate in fish fed with diet (A) more efficient on the growth performance of studied fish than diet (B) except in the case of protein efficiency rate (PER) it's found to be more in diet (A) than diet (B). It was concluded that the diet (A) had better growth performance than diet (B) on the feeding regime of Nile tilapia (Oreochromis niloticus).*

ORIGINAL ARTICLE

Keywords: *Nutritional effectiveness, water hyacinth leaves, wheat bran cotton seed cake, Nile tilapia*

INTRODUCTION

Africa has been a large potential for fish farming with 56–70% of its land having the highest yield potential for tilapia, catfish and common carp (Aguilar- Manjarrez and Nath, 1998). The farming of tilapia in Africa has been expanding slowly (about 2.5% per annum) over the past decade and production in 1996 was estimated at 39.348 metric ton (FAO, 1998).

During the same period, total aquaculture production in Africa increased at a rate of 11% per annum. Ponds remain the most common tilapia production system in Africa, contributing about 38–93% of total tilapia production from aquaculture in many Africa countries (FAO, 1995). 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 (Fathia, 2010).

The Sudan has often been described as the largest country in Africa, at present the population is about 40 million people. The Sudanese consume a substantial amount of meat in their diet, but the country demand for fish is not yet satisfied the present per capita consumption at 1.38 kg/year (Yousif, 1988). This level is low when compared to the neighboring countries.

Aquaculture is the fastest growing sector of word human food production and has an annual increase of about 10% (FAO, 1997). To sustain such a high rate of growth a matching increase in fish feed production is imperative (AIFA, 2004).

The feed is the most expensive component in the intensive aquaculture where it represents over 50% of the operating cost, moreover protein itself represents about 50% of feed cost , therefore the selection of proper quality of dietary protein is a necessary tool for successful fish culture practices (El – Sayed, 2003) .

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Fish meal is considered the most desirable animal protein ingredient in aquaculture feeds because of its high protein content, balance amino acid profile, high digest ability and palatability, and as a source of essential fatty acid (Hardy and Tacon, 2002) .Therefore, fish nutritionists have made several attempts to partially or totally replace fish meal with less expensive and locally available protein sources.

In this aspect, a several feed ingredients have been investigated in an attempt to find substitutes for fish meal in the diets of tilapia.

These include animal protein sources such as, the fishery by- products, shrimps meal, and feather, bone meal and blood meal. Plant protein sources including soy bean meal cotton seed meal, ground nut meal, wheat bran meal, sunflower cake and water hyacinth plants (Ogunji, 2004; El–Sayed, 1999; El–Sayed and Tacon, 1997). 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). These feeds are not only considerably cheaper than fish meal but also enjoy high availability and accessibility in certain regions of the world. Soy bean meal and wheat bran meal has been used as a protein source in diets of various fish species (Jackson et al., 1982 and Xie et al., 2001).

The protein of plant leaves can be used after it has been extracted; water hyacinth is a warm water aquatic plant widespread in many countries, such as Sudan in Africa and other countries particularly during the summer months with its highest growth in July. Which was a very widely distributed weed in the River Nile, could double its population every seven days to yield an annual productivity of 930–2900 tons/hectares (Laro and Bressani, 1982). Water hyacinth has a multitude of direct and indirect effects on almost all aspects of human life once a water body on which man so much depends is invaded and covered by the weed mats (Schneider, 1996): fisheries; water supply; hydroelectric power generation; human health; agriculture; transport; biodiversity; evapo-transpiration and increased cost of water treatment are some of the adverse effects.

Hence, research in fish nutrition that will utilize locally available ingredients plant protein sources and fabricated equipment without reducing the quality of the feed is urgent and crucial to the overall success of aquaculture development, growth and expansion in Africa. The main aims of this study to study the different levels of water hyacinth plant leaves protein in the diets of Nile tilapia and their effect on growth performance so as to eliminate the water hyacinth plant from the Nile and provide a cheap food for fish.

MATERIALS AND METHODS

Diet formulation

Water hyacinth leaves (*Eichhornia crassipes*) weeds were collected from Blue Nile and White Nile near to Sennar and Juba cities (Sudan). The roots and stems of plant were removed and the rest of plants were washed with running tap water to minimize the adhesive materials, then dried under natural sunlight and stored at room temperature until used. The ground dried water hyacinth plant leaves, were added in to the diets by different ratio (in percentage) 10% and 15% in diet A and B respectively, to formulate two different experimental diets (A) and (B).

Scarified fish samples at the beginning and at the end of experiment from each groups randomly were selected and ground homogenously, in addition to samples of experimental diets (A and B) were taken both to Lab of Nutrition of Khartoum University, to determine the proximate analysis (Moisture, Dry Matter, Ash ,Fat, Crude Protein using the method of AOAC (1980). Nitrogen free energy (NFE) was determined according to Halver (1997) formula (NFE%= 100 - (Crude protein %+ fat %+ash % + moisture %)

Table 1 - Shows the proximate analysis of fish samples at the beginning of experiment and samples of experimental diets (A and B)

Parameters / Treatment	Moisture %	Dry matter %	Crude Protein %	Ash %	Fat %	NFE %
Initial fish flesh	67.2	32.80	20.41	7.07	0.28	39.42
Diet (A)	7.8	92.20	31.75	7.53	1.54	51.38
Diet (B)	5.63	94.37	29.40	7.06	1.56	56.35

NFE=Nitrogen free energy

Table 2 - Shows the levels of different ingredients of experimental diets (A) and (B)

Parameters	Diet (A)	Diet (B)
Water hyacinth leaves	10%	15%
Wheat bran meal	70%	65%
Cotton seed cake	20%	20%
Total	100%	100%

Experimental Trial

Total number of (150) fingerlings of Nile tilapia with an average initial body weight of (22.95 g), standard length (7.8 cm) and total length (13.12 cm) were collected from the fish farm of the department of fisheries and

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wildlife science, College of Veterinary Medicine and Animal production, Sudan University of Science and Technology using suitable gillnet and distributed in to experimental aquaria.

Aerators were used for aerating the water of experimental aquaria. The pH and temperature were recorded every day, using pH electronic meter (model, No. 201) and thermometer.

The fingerlings were acclimatized for ten days to the experimental aquaria conditions and feeding regime. Fish were daily offered the diets at a rate of 5% biomass per day for the studied period. Fish were weighed every fifteen days and the amount of feed for each aquarium was adjusted accordingly. The daily ration was introduced at 9 am and 3 pm. The water of aquaria was changing half of the water in each aquarium every day.

RESULTS AND DISCUSSION

The nutritional effectiveness of different levels of water hyacinth leaves (10% and 15%) combined with wheat bran meal in two experimental diets A and B on the performance of Nile tilapia (*Oreochromis niloticus*) were showed in the Tables 3 and 4.

The result of diets (A) on growth performance of studied fish was showed a better value than the diets (B) as recorded in Tables 3 and 4.

Table 3 - Shows chemical analysis of final fish flesh that fed on experimental different diets (A and B)

Experimental Diet	Proximate Parameters					
	DM	MO	ASH	CP	EE	NFE
Diet (A)	22.4	77.6	7.89	17.5	1.5	50.61
Diet(B)	20.9	79.1	6.90	14.0	1.90	56.3

Values are means of 14 fish for each group. DM= Dry matter. MO= Moisture content. CP = Crude protein. EE = either extract. NFE=Nitrogen free energy

Table 4 - Shows the average values of fish growth performance of the two fish groups fed with diets (A and B) during the experimental period

Parameters	Diet (A)	Diet (B)
Initial total length	10.9	10.9
Final total length	17.57	17.21
Increment in total length	7.67	7.31
Initial standard length	9.00	8.95
Final standard length	15.57	15.21
Increment in standard length	6.57	6.21
Initial weight	22.95	24.6
Final weight	135.57	133.14
Increment weight	112.62	108.54
Food conversion ratio	4.04	5.73
Food conversion efficiency	0.25	0.18
Specific growth rate	0.55	0.35
Protein efficiency rate	0.39	0.29
Daily weight gain	0.360	0.244

The study investigates the nutritional effectiveness of water hyacinth leaves combined with wheat bran meal on the performance of Nile tilapia (*Oreochromis niloticus*). The results of this study were analyzed as in Table 4.

The study revealed that the diet (A) with lower plant component have a better values performance on studied fish than the diet (B) which have higher plant content. This finding is in agreement with Lim and Doming, (1989) they reported that high levels of plant protein in fish diets in many cases resulted in reduced growth and poor efficiency, or decrease of palatability and pellet water stability value.

The diet (A) showed the highest values in weight increment, this indicated that the levels (10%) of water hyacinth were suitable for Nile tilapia fingerlings than the levels (15%). This might be in the line of (Lim and Doming, (1989).

In spite of high levels (15%) of water hyacinth leaves in diets (B), but the growth rate parameters showed lowest results than the levels (10%) of water hyacinth leaves in diets (A). Because the water hyacinth leaves has is consists of little protein levels.

That means the highest levels of water hyacinth leaves in fish diets it has negative result in the growth performance of fish. The present findings were in agreement with those reported by Muri *et al.* (2005), who found plant component has lower crude protein and ash and higher crude fibers contents.

The highest levels of water hyacinth leaves in diets of Nile tilapia may reduce the crude protein levels. So the food conversion efficiency (FCE), Specific growth rate (SGR), and Protein efficiency ratio (PER), (0.25, 0.18), (0.55, 0.35) and (0.39, 0.29) respectively values were recorded higher in studied fish group (A) than the group (B). It could

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be concluded that the leaves of water hyacinth could be tried as one of conventional feedstuff. Also the study suggested that, the usefulness of low water hyacinth leaves more than high quantity in the fish diet.

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