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Effect of Garlic on Growth Performance, Nutrient Utilization and Survival of an Ecotype Cichlid, 'Wesafu'

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Abstract: *Garlic (Allium sativum) is probably one of the earliest known medicinal plants and has been used to improve growth and resistance of a number of livestock and fish. This study was conducted to show the effects garlic on the growth performance and nutrient utilization of fingerlings of an ecotype cichlid commonly called 'wesafu' in Nigeria. A total of 600 fingerlings (1.4 ± 0.12 g) were obtained from the hatchery of the Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos and used for the study. They were randomly assigned to 12 plastic tanks each, 0.5 m^3 with a flow-through water system. Five doses of garlic,0 (control), 10g, 20g and 30g of fresh clove of garlic were mixed with 1kg feed. The control diet was free from garlic. The experiment extended lasted for 12 weeks. The results showed significantly increased weight and growth performance of the ecotype cichlid (P<0.01) in all groups fed on garlic. The mortalities were lower in diet supplemented with garlic than in the control group. The improve survival rate may be due to the enhanced immune response resulting from improved defense mechanism.*
Key Words: G*arlic, Growth, Nutrient utilization, Survival, 'wesafu'*

I. Introduction

There has been a growing concern on the use of antimicrobial agent in Aquaculture, as these substances increase the selective pressure they exert on the microbes and brings about the emergence of resistant bacteria. This is achieved by transferring resistant genes to bacteria which are not exposed to antibiotics. Hormones, antibiotics and many other chemical substances have been tested as growth promoters, antibacterial agent and for other purposes in aquatic animals (Jayaprakas and Sambhu, 1996; Masahiro, 1999), but their use in aquaculture production cannot be recommended because of the residual effects in the muscle of fish as well as prawns.

Plants are natural sources of safer and cheaper chemicals. Plant products have been reported to promote various activities like anti-stress, growth enhancement, appetite stimulation and immune-stimulation in aquaculture practices (Citarasu *et al*., 2001, 2002; Sivaram *et al*., 2004). Furthermore, the antimicrobials normally lead to drug residues in the fish in addition to having negative impact on the environment (FAO/WHO/OIE, 2006). It has also been reported that antimicrobial agents can generate cross-resistance against human antimicrobials, which has the potential of health harzard on man (Witte *et al*., 1999).

Garlic (*Allium sativam*) has been proven to control pathogens, particularly bacteria and fungi, thus improving the health of fish (Corzo-Martinez *et al*., 2007). It has been used in ancient Egypt in treating many ailments such as heart diseases, headache, bites worms and tumors (Salah *et al.,* 2008). Garlic has many beneficial effects on livestock and man. These include exhibiting antimicrobial, antioxidant, anti-hypertensive properties (Sivam, 2001). Previous work suggested that these functions are attributable to the bioactive components of the plant, garlic which include allin and allicin. Allicin is the most abundant compound representing almost 70%of all thiosulfinates present (Han *et al.,* 1995). : 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). At present 1 kg of wesafu is sold for N1,200 and N1,500 in Epe,Lagos (Megbowon and Bombatta,2009). The present study was conducted to evaluate the efficiency of the garlic (Allium sativum L) in improving growth performance and survival in this cichlid fish

II. Materials And Methods

1. Fish

A total of 600 fry (mean individual initial weight = 1.4 ± 0.12 g) of the ecotype cichlid 'wesafu' were divided into four equal treatments. Each treatment and the control consisted of three equal replicates (50 fish per replicate) that were randomly assigned to 20 plastic tanks 0.5m^3 each. Fish were fed on a base diet of 35% crude protein at 3% body weight per day, divided into two feeding times.

2. Garlic and diet

Garlic (*Allium sativum* L) was procured from the local market in Lagos Island, Lagos, Nigeria, crushed and five doses, A (0%), B (10%), C (20%) and D (3%) of garlic kg^{-1} feed were produced. A balanced ration was prepared (Table 1). The ingredients were obtained from specialized suppliers and prepared locally in the Fish Technology department of Nigerian Institute for Oceanography and Marine Research, Lagos in the form of pellets. The basal diet was prepared by grinding the feed ingredients to meal, mixed and pelletized using locally fabricated pelletizing machine after Oil (vegetable) was added gradually to assure the homogeneity of the ingredients. The pellets were prepared biweekly, air-dried at room temperature for 24 hours and stored in a refrigerator (4ºC).

3. Experimental design

The study was conducted over a period of twelve weeks to evaluate the efficiency of garlic in promoting growth and survival of the cichlid. 'Wesafu' fry were divided into four equal groups A 0g garlic/kg feed), B (10g garlic/kg feed), C (20g garlic/kg feed), D (30g garlic/kg feed). Three replicates were used in each group and were randomly assigned to 12 plastic tanks each, 0.5 m^3. Treatment A (0g garlic /kg feed) served as the control.

Table 1: Composition of the basal die used for the study

Ingredients	Diet (%)	Protein (%)	
		Ingredient	Feed
Fish meal	8.2	72	5.77
Soybean meal	53.1	47	25.43
Wheat flour	5.3	13.2	.67
Ground corn	29.2	11.0	3.18
Vitamin mix	0.05	0.00	0.00
Mineral mix	0.07	0.00	0.00
Vegetable oil	2.00	0.00	0.00
NaCl	2.00	0.00	0.00
Total	99.92	0.00	35.05

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 (SGR) = $(\ln W_1 - \ln W_0 / T) \times 100$
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 (%)= Number of experimental fish at the end of experiment / 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 genetic 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. Growth performance and nutrient utilization of the ecotype cichlid, 'wesafu' reared in plastic tanks

Items	Garlic level (g/kg feed)			
	A (0%)	B (10%)	C (20%)	D (30%)
Initial weight (g)	1.39±0.012 a	1.39±0.011a	1.39±0.011a	1.39±0.043a
Final weight (g)	8.03±0.057 c	8.17±0.87a	9.03±0.211a	9.22±0.13a
Weight gain (g)	6.64±0.047c	6.78±0.034	7.64±0.065	7.83±0.012
SGR (%/day)	1.84±0.035c	1.86±0.022ab	1.96±0.012a	1.97±0.031a
Survival rate (%)	91.6±2.3b	93.6±2.52a	94.3±2.91a	95.4±5.33a
Feed Intake (g)	11.21±0.54a	11,21±0.61a	11.27±0.55a	11.35±0.37c
FCR	1.68±0.11a	1.65±0.13a	1.63±0.16a	1.63±0.15c
PER	1.97±0.012	1.96±0.014	1.99±0.013	1.99±0.013

Mean ± S.E having the same letter in the same row are not significantly different at P<0.05

Table 1 showed that fish supplemented with garlic B, C and D performed better than the control 0g/kg feed) in terms of growth performance and nutrient utilization. The survival rate was least in the control compared to the three other treatments. The survival was significantly greater in B, C and D where they were supplemented with garlic. In the present study there was slight variation but not statistically significant (α=0.05), in the survival among the various treatments.

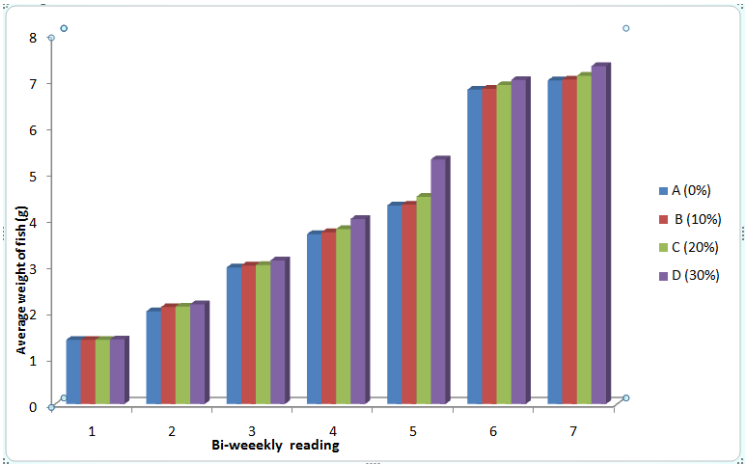

Fig. 1: Bi-weekly growth of 'wesafu' fed varying levels of garlic

Table 1 showed progressive increase in weight of the three treatments and control. The finding showed the weekly growth in A (control) was lower throughout the experimental period than for B, C and D.

IV. Discussion

Garlic has found its usage as food by man as well as livestock for centuries. They are often used for the cure of a number of animal diseases (Shalaby *et al.,* 2006). . Several herbs such as garlic, onion among others have been tested and evaluated for promoting growth promoting (Citarasu *et al.,* 2002; Sivaram *et al*., 2004), feed conversion ratio (Shalaby *et al*., 2003, enhancement of protein digestibility (El-Dakar *et al.,* 2004) in fishes and other aquatic organisms. Khalil *et al*, (2001) reported that garlic contains allicin, which improves the performance of intestinal flora, thus improving digestion. This consequently enhances the utilization of energy, bringing about improved growth.

In the present study, fish feed containing garlic had significantly better growth and feed utilization as compared to fish fed the control diet with 0% garlic. This proved that dietary supplementation of garlic enhanced the fish growth and survival. This is in agreement with Shalaby *et al.* (2006) who reported significant increased weight gain, feed efficiency, protein efficiency ratio (PER) and specific growth rate (SGR) in the Nile tilapia (*Oreochromis niloticus*) when fed diet containing garlic powder of 30g/kg diet. Furthermore, Diab *et al*. (2002) reported that feeding diet with 2.5% garlic resulted /kg diet in the highest growth performance in the Nile tilapia (*O. niloticus*). Abou-Zeid (2002) observed a positive improvement in biomass and specific growth rate with garlic supplementation. However, Metwally (2009) reported that the best performance in terms of growth was observed when *Oreochromis niloticus* was fed with diet containing 32g/kg diet of garlic powder. Although growth is enhanced with garlic supplementation, high dose of garlic in fish may reduce feed intake as a result of its unpleasant odour. Wanapat *et al*. (2008) found significantly higher digestibility, absorption and retention of N in garlic powder supplemented groups compared to control group without garlic. Although there is constant controversy concerning the effect of garlic as growth promoter for fish, the present results suggest that dietary garlic for juvenile of ecotype cichlid, 'wesafu' could positively affect growth and survival. Garlic have been

reported to control pathogens, combat stress, increase the welfare of fish (Ress *et al.,* 1993) and enhance the immune response (Corzo-Martinez *et al.,* 2007) and consequently this will have a positive effect on the survival rate. The improve survival rate may be due to the enhanced immune response resulting from improved defense mechanism.

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