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An assessment of growth and immunity in *Oreochromis niloticus* under the effect of diet supplemented with *Aloe barbadensis* extract

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Abstract

Aloe barbadensis was used as a feed supplement to enhance the growth performance and act as an immunostimulant in fish. In this view, the present study was conducted to investigate the variation in growth rate and hematology of Nile tilapia under 1% and 2% *Aloe barbadensis* (*Aloe vera*) supplementation in the feed. In glass aquaria, ten fish was stocked for 2 months. Fish was feed two times daily according to their body weight with feed containing 35% crude protein. The *Aloe vera* was most effective at 1% concentration and gave maximum growth. The initial average weight in T₀, T₁, and T₂ was 27.2, 19.7, and 20.5 g respectively. The final average weight was 37.4, 41.7, and 40 g correspondingly in three treatments. The highest weight gain was observed in T₁ was 41.7g. Moreover, the average specific growth rate was at a peak for T₁ as compared to T₀ and T₂. Blood parameter analysis also favored T₁ to be most useful as a feed supplement. Overall, the 1% *Aloe vera* group showed enhanced growth and immunological parameters, while *Aloe vera* 2% was proven dangerous for Tilapia.

Keywords: fish feed, aquafeeds, fisheries, aquaculture, supplemented diet

Introduction

Fisheries and aquaculture made crucial contributions to the world's wellbeing and prosperity [4]. In the last five decades, the world fish food supply has outpaced global population growth, and today fish constitutes an important source of nutritious food and animal protein for much of the world's population [2]. Fisheries and Aquaculture can have a significant effect on countries' trade balances and economic growth when directing trade fish markets. The use of formulated feed in fish culture results in a significant increase in aquaculture production as well as enhancement of flesh quality [10].

Fish feed is often supplemented with growth stimulators to promote the growth of fish [5]. They may be the antibiotics, growth hormones enzymes that significantly promote the fish growth and quality of fish meat. The natural herbs based upon their application in fish growth and physiology are most favorable [1].

Nile tilapia is widely used in aquaculture due to the ability to bear the environmental fluctuations and better reproductive rates. It is omnivorous species and feeds on the debris, zooplankton, phytoplankton, and dead material present in its habitat. The Nile tilapia has been brought in more than a hundred subtropical and tropical states [8].

In the field of aquaculture, the potential alternative of synthetic drugs is medicinal herbal extracts. These alternative herbs offer essential biologically active metabolites and act as a growth promoter, immune modulators improving antioxidant effect, antidepressant, promote digestion of feed [9], affect the appetite-stimulating and also hepatoprotective effects [6]. One more reason is that herbs are easily available, less expensive than synthetic, and more biodegradable [11].

Aloe barbadensis (*Aloe vera*) contains thick gel and grows in a warm and dry environment. It is native to Nile region of Sudan and North Africa. *Aloe vera* has several biological effects including immuno-stimulation, increasing the growth performance in fish, and improve wound healing in fish. Extract of *Aloe vera* enhanced the performance of growth in tilapia, common carp, and rainbow trout [7].

The supplemented diet of *Aloe vera* extract has good effects for improving growth performance, consumption of food, and healthiness conditions of Nile tilapia immature.

Aloe vera extracts can be used instead of growth promoters, synthetic antibiotics, and immunostimulant count for Nile tilapia^[3].

A study was performed to evaluate the growth and blood parameters of Nile tilapia under 1% and 2% *Aloe barbadensis* supplementation in the feed.

Materials and Methods

The current study was carried out to evaluate Variation in growth rate and hematology of Nile tilapia (*Oreochromis niloticus*) under 1% and 2% *Aloe barbadensis* supplementation in the feed. The experiment was done in the Fish Nutrition Laboratory, Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad. The time duration for this trial was two months from 5 July to 5 September.

Experimental system

From Fisheries Research Farm, the University of Agriculture Faisalabad, fingerlings of Nile tilapia were collected for the current study. Three glass aquaria (one control and two experimental) with two replicates were used. Each glass aquaria of 80-liter capacity was consisting of 10 *Oreochromis*

niloticus. All three aquaria were provided with aerators that dissolved the oxygen in the water. Before initiating the experiment, stocked Nile tilapia was kept in a glass aquarium and habituated to lab condition for one week. A commercial diet was provided to the fish during this period twice a day. To maintain water quality and physicochemical parameters, water was replaced twice a day in each aquarium. Try to relieve the fingerlings in aquaria, they were measure for body weight (g) and total length (cm).

Diet Formation

Locally available feed ingredients were collected from the market in raw form. Fish feed ingredients were comprised of fishmeal, wheat grain, yellow corn, rice bran, soybean meal, vitamin and minerals, and rice flour. All the ingredients were grounded in a pestle and mortar Experimental diet was prepared by adding 1% and 2% *Aloe barbadensis* in 100 (g) feed. All the

prepared diets will be separately packed and labeled. The feed will be given two times a day (morning and evening). All three jars were labeled as A (Control group *Aloe vera* =0), B (*Aloe vera* = 1%), and C (*Aloe vera* =2%).



Fig 1: Mixing of experimented feed

Table 1: Composition of experimental feed

Ingredients	<i>Aloe barbadensis</i> levels % in the diet		
	0.0% (control)	1 %	2 %
Fish meal	48	48	48
Soybean meal	38	38	38
Rice polish	5	5	5
Wheat flour	5	5	5
Vitamins and minerals	2	2	2
Sunflower oil	2	1.5	1
<i>Aloe vera</i>	0	0.1	2
Total	100	100	100

Growth performance

For evaluation of growth performance, fish was observed weekly. At the end of the trial, the survival rate, SGR, FCR, feed efficacy, and condition factor was calculated, and various

growth and hematology parameters including white blood cells count, hemoglobin, platelet count, and hematocrit were analyzed by employing their respective methods. Weekly monitored the important water quality parameters.

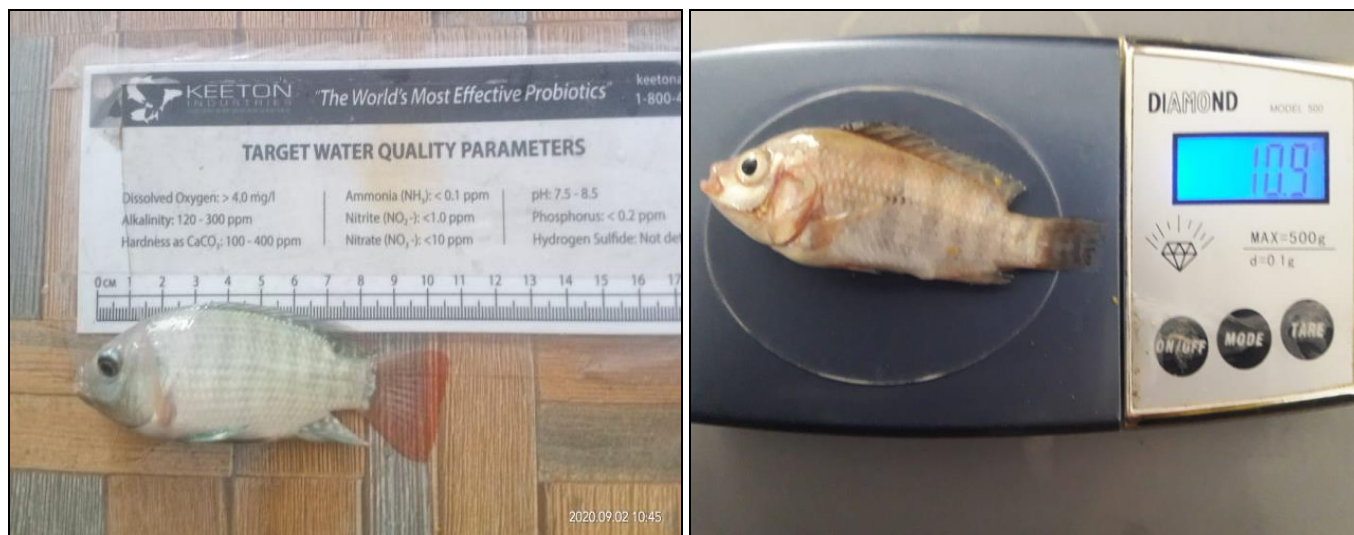


Fig: 2 Measurement of length and weight of *Oreochromis niloticus*.

Results

Table 2: Growth parameters

Growth parameters	T ₀ (<i>Aloe vera</i> =0)	T ₁ (<i>Aloe vera</i> =1%)	T ₂ (<i>Aloe vera</i> =2%)	P-value
Initial weight (g)	27.2	19.7	20.5	0.0835
Final weight (g)	37.4	41.7	40	
Weight gain	12.2	22	19.5	
Initial length (cm)	6.8	6.8	6.8	0.0001**
Final length (cm)	8.3	8.6	8.2	
Length gain (cm)	1.5	3	2.7	
SGR (%)	0.60	1.54	1.39	0.0001**
FCR	1.85	1.48	0.95	0.0061
Survival rate (%)				
CF	7.37	5.38	6.47	0.0012

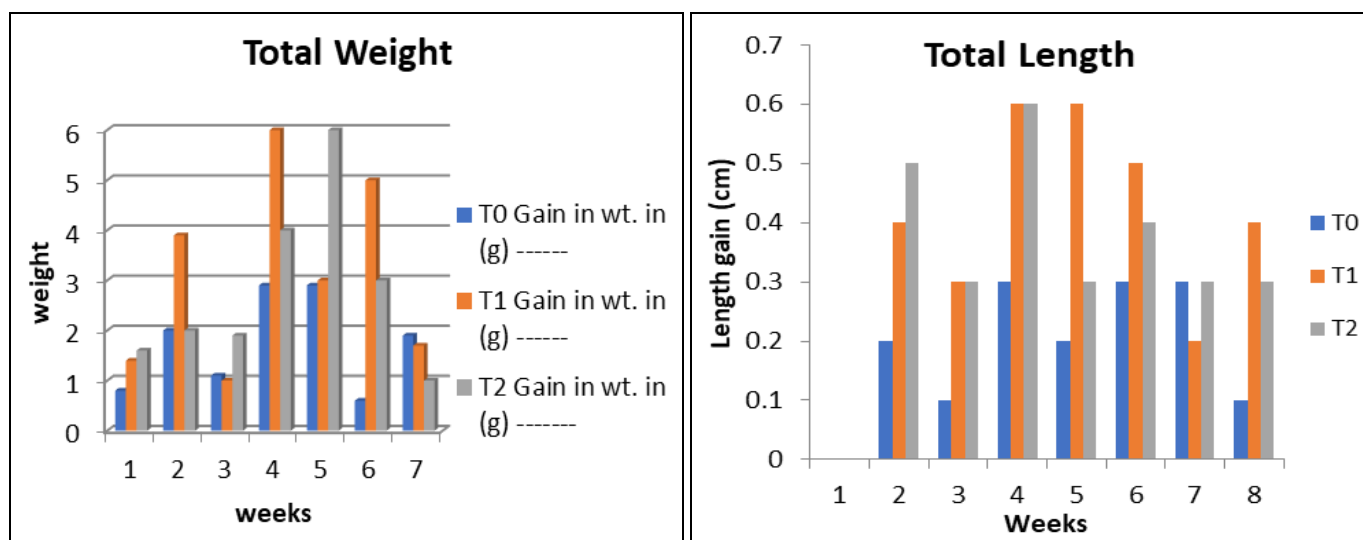


Fig 3: Graph showing an average gain in body weight (g) of *Oreochromis niloticus* in T₀, T₁

Table 3: Blood parameters

Hematological parameters	T ₀ (<i>Aloe vera</i> =0)	T ₁ (<i>Aloe vera</i> =1%)	T ₂ (<i>Aloe vera</i> =2%)	P-value
RBCs (10 ⁶ /μL)	1.15	1.26	1.18	0.0035**
WBCs (10 ³ /μL)	11.35	15.65	13.60	0.0266*
Hb (g/dl)	5.9	6.93	6.36	0.0043**
Hct (%)	29.10	34.35	32.60	0.0233*
Immunoglobulins	14.8	16.2	19.25	471**

Discussion

Results showed that T₁ group fishes' average weight was greater than T₀ and T₂ group fishes. The highest weight gain was observed in T₁ was 41.7g.

The overall increase in length was seen in the treatment T₁ which was given by feed with 1% *Aloe barbadensis*, which was higher than T₀ which was given by feed without *Aloe barbadensis*. An increase in average length was seen significantly in T₁ as compared to T₀. 8.6 cm was the highest increment in length for T₁.

On average specific growth rate was at a peak for T₁ 2.40 as compared to T₀ and T₂. On average feed conversion ratios observed for T₀, T₁ and T₂ were 1.27, 2.53, and 1.93. The survival rate was also 100% for T₁ while T₀ and T₂ were 80% and 90% respectively.

Means value for condition factor was 6.45, 5.23, and 5.47 for T₀, T₁, and T₂, respectively. T₂ group was found to show better condition factor than T₁.

Analysis of blood indicated the highest RBCs count for T₁ which was 1.61 (10⁶/μL). For T₀ it was 1.54 and for T₂ was 1.53 (10⁶/μL). WBCs value was also at peak for T₁ as compared to T₀ and T₂.

Hb content for three treatments T₀, T₁, and T₂ was 5.9, 6.93, and 6.36 (g/dl). Hct (%) was also high for T₂ as compared to T₀ and T₁ given as 29.92, 34.44 and 32.75. Premier values of MCV, MCH, and MCHC were also observed for T₂.

Statistical analysis showed that growth parameters and immunity parameters like gain in length gain in weight, white blood cells count, immunoglobulins protein, lysozyme activity, FCR, and SGR had significant values for T₁ as compared to the other two feeds.

Conclusion

The experimental results showed that the use of *Aloe barbadensis* also increased the many activities of fish. ANOVA showed a significant difference between T₁ and T₀ treatments. It was shown that the T₁ treatment group which was fed with 1% *Aloe barbadensis* had a higher effect as compared to feed without *Aloe barbadensis*.

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