



Effect of vitamin c on growth performance of the fish *Clarias batrachus* treated with dietary aflatoxin

Amjad Fatmi and Durreshahwar Ruby

Department of Zoology , Govt. College, Dholpur-328001. Rajasthan, India

Department of Zoology, B. S. College Danapur, Patna -800014, Bihar, India

E-mail: amjadfatmi@gmail.com

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ABSTRACT

Studies were conducted to determinate the effect of vitamin c on growth performance and survival rate of fish *Clarias batrachus* treated with dietary aflatoxin. There was a significant decrease in the adverse effects of aflatoxin on total length gain, total weight gain, average growth rate as well as survival rate of the fish fed with vitamin C containing feed

Keywords: Aflatoxin, Vitamin C, Survival Rate, Average length gain, Average weight gain, Specific growth rate.

INTRODUCTION

India is the largest producer of fresh water fish with an annual production of 9.06 metric tonnes. Fish flesh is considered as a rich source of protein and vitamins. About 12.8 percent of total protein consumed in India comes from fresh water fish. However, fish farming is also associated with risk of infectious diseases, contamination and decrease of food quality that can adversely effects the fish health (Nomoto, 2005). One of the risks associated aquaculture is contamination of aflatoxin in the feed (Santa Croce *et al.*, 2008) Aflatoxins are mainly produced by two molds *Aspergillus flavus* and *Aspergillus paraticus* (Oleviera 2013) which can grow in improperly stored food (Cheeke and Shull 1985, Ellis *et al.*, 2000). The toxic effects of aflatoxin depends upon the species, dose of the aflatoxin as well as the time of exposure (Columbe *et al.*, 1984, Ngethe *et al.*, 1993, Centoducati, 1993). Exposure to aflatoxin retards growth and survival due to immune supression, kidney and liver disfunctions (Caguan *et al.*, 2004, Sepahdari *et al.*, 2010, Zaki *et al.*, 2012, Selim *et al.*, 2013, Mehfoz *et al.*, 2015). Vitamine C is considered as an important component of the diet for growth and other biological functions. It improves the immunity and increases protein synthesis (Lovel 1972, Shehata *et al.*, 2009). Asian cat fish of genus *Clarias* popularly known as Mangur is found throughout Asia and Africa. It is considered as an important fish due to its taste and excellent nutritional profile (Rui *et al.*, 2007). In many parts of India, it is frequently prescribed to lactating pregnant, anaemic and malnutritional individuals

(Debnath *et al.*, 2017). However the fish is showing a drastic decline from their natural habitat in India during the last few years. The objective of the present investigation was to explore role of Vitamin C in reduction of adverse effects of aflatoxin on growth and survival of the fish *Clarias batrachus*.

MATERIAL AND METHODS

Experimental Design

A total of 60 apparently healthy *Clarias batrachus* were obtained from private fish farm at Dholpur. The length of fishes was about 10 to 20 cm and the weight was about 40 to 50 grams. The fishes were kept in twelve aquaria measuring 21X 1¹ X1¹. five fishes were kept in each aquarium. Three aquaria were kept as control and nine aquaria were divided into three sets. Each set consisted of three aquaria and kept as experimental sets.

Preparation of feed

Four types of feeds were prepared for the fishes on the basis of presence of aflatoxin or Vitamin C in the feed and they were distinguished as Feed I, Feed II, Feed III and Feed IV.

Feed I or good feed contained 100 percent good feed and no mouldy feed or Vitamin C. Feed I were given to control or fishes of first set of aquaria comprising IA IB and IC.

Feed II consisted of 100 percent mouldy feed without vitamin C. Feed II were given to fishes of second set of Aquaria comprising 2A 2B and 2C.

Feed III. consisted of 100 percent mouldy feed mixed with vitamin C. The concentration was 300mg vitamin C per Kg of feed. Feed III were given to fishes of third set of aquaria comprising 3A 3B and 3C.

Feed IV consisted of 100 percent mouldy feed mixed with vitamin C. The concentration was 600mg vitamin C per Kg of feed. Feed IV was given to fishes of fourth sets of aquaria comprising 4A 4B and 4C.

Mouldy feed was prepared in the laboratory. The commercial fish feed was procured from market was first sprinkled with small amount of water to make the feed moist and the mixed with cultured *Aspergillus flavus* procured from ICAR New Delhi. The inoculation

was made in a transfer chamber to avoid contamination. The mixed feed was then covered with a plastic sac. For the preparation of feed III and feed IV 300 mg and 600mg of Vitamin C per kg feed was added to feed III and feed IV respectively. The infected feed was kept in a condition which is favourable for growth of the mould. The feeding was started from the second day two times a day at a feeding rate of 4% of the body weight.

Growth rate were determined by using the method of Castle and Tiews (1980).

$Total\ weight\ gain\ (TWG) = Final\ body\ weight - Initial\ body\ weight$

$Average\ growth\ Rate = \frac{Final\ body\ weight - initial\ body\ weight}{Number\ of\ experimental\ feeding\ days}$

$Specific\ growth\ Rate = \frac{Final\ body\ weight - Initial\ body\ weight}{Initial\ body\ weight} \times 100$

$Total\ length\ gain = Final\ body\ length - Initial\ body\ length$

$Body\ length\ gain\ (\%) = \frac{Final\ body\ length - Initial\ body\ length}{Initial\ body\ length} \times 100$

$Survival\ Percent = \frac{Final\ population}{Initial\ population} \times 100$

Statistical analysis:

Statistical analysis was carried out by the method of analysis of variance (ANOVA)

RESULTS AND DISCUSSION

Survival percent

Survival percent was significantly ($p > 0.05$) decreased in fish fed with aflatoxin contaminated feed as compared to control (Table-1). The present finding was in agreement with those of Raghwan 2011 and Mahfouz *et al.*, 2015. Increased mortality in the fish may be due to liver and kidney disfunction since aflatoxin causes hepatocellular carcinoma and liver necrosis (Nunez *et al.*, 1991, Zaki 2011). Presence of vitamin C in the feed significantly decreased the adverse effects of aflatoxin and thereby survival rate was increased. Present finding agrees with those of Nayek *et al.*, 2007 and Shehata *et al.*, 2009. These results are probably due to improved immunity and general health due to vitamin C (Shehata *et al.*, 2009, Pal *et al.*, 2012).

Table -1. Showing effect of dietary aflatoxin and vitamin C on growth of the fish.

Feed	I	II	III	IV
Initial Body weight(g)	45.6 ± 3.96	46.0 ± 3.12	46.26 ± 2.33	45.54 ± 3.02
Final body weight(g)	115.7 ± 5.87	87.13 ± 4.80	95.53 ± 4.57	102.10 ± 3.97
Initial Body length(cm)	10.04 ± 0.72	11.07 ± 1.10	10.44 ± 0.76	10.71 ± 0.54
Final Body length(cm)	19.5 ± 1.03	14.87 ± 0.52	15.17 ± 0.53	18.0 ± 0.68

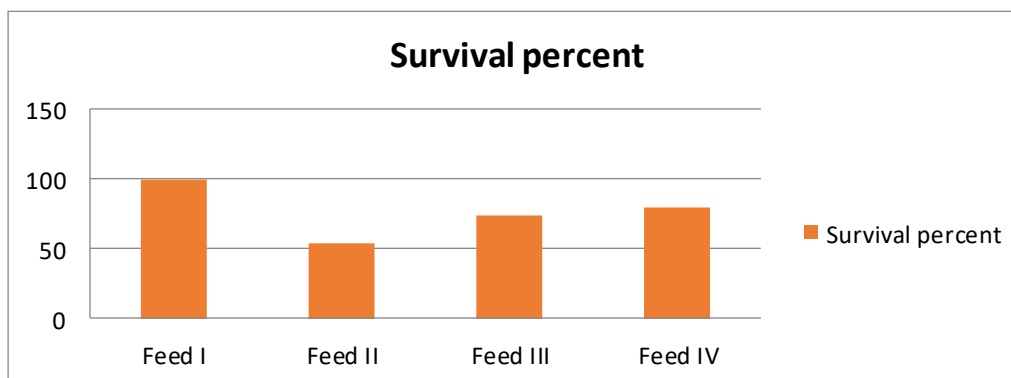


Fig 1. Showing effect of dietary aflatoxin and Vitamin C on survival percent of the fish.

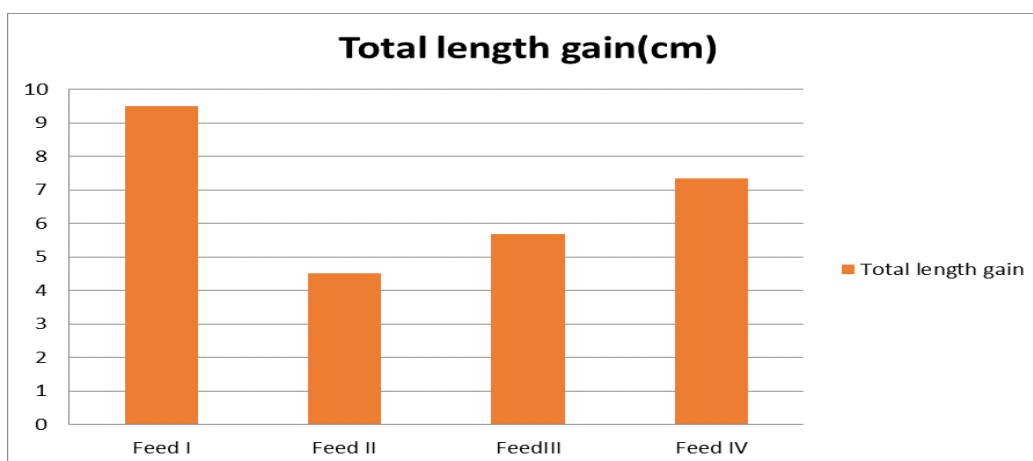


Fig 2. Showing effect of dietary aflatoxin and Vitamin C on total body length gain of the fish.

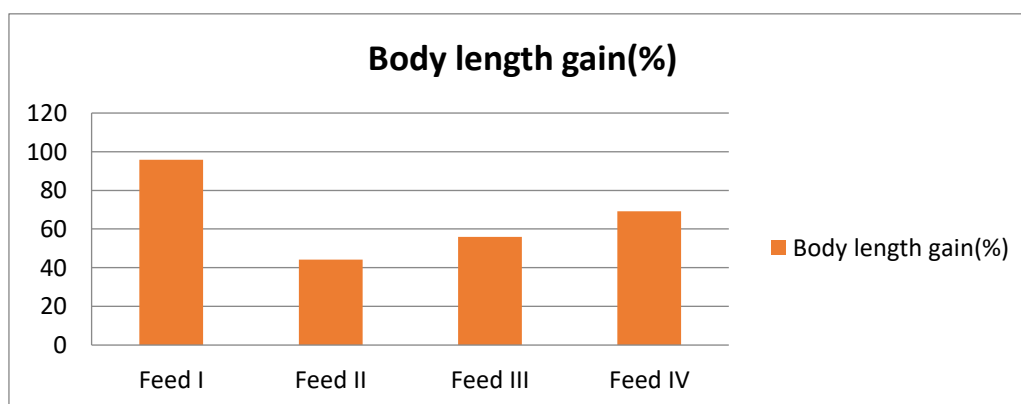


Fig 3. Showing effect of dietary aflatoxin and Vitamin C on percent length gain of the fish.

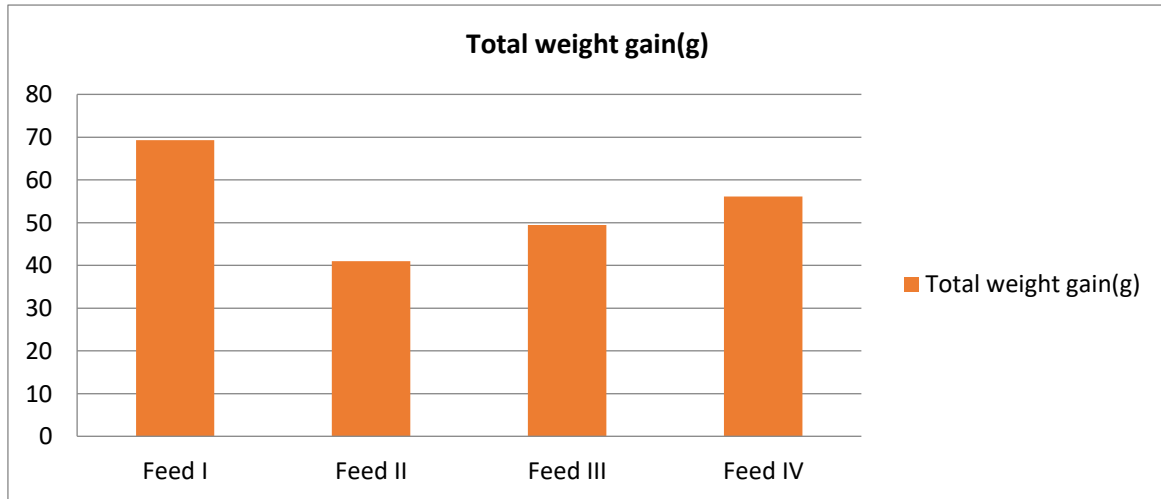


Fig 4. Showing effect of dietary aflatoxin and Vitamin C on total weight gain of the fish.

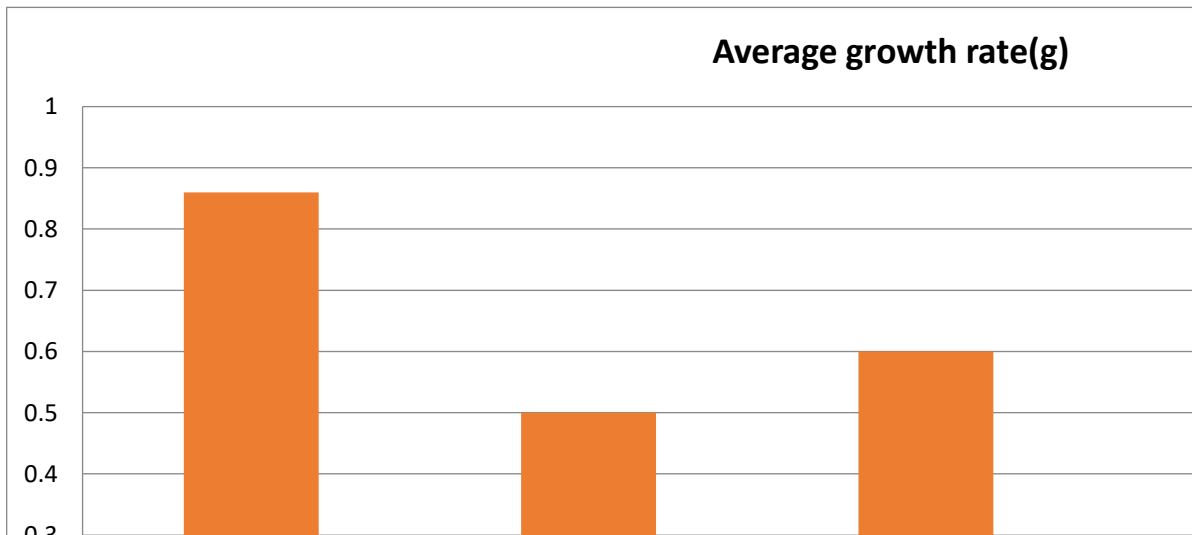


Fig 5. Showing effect of dietary aflatoxin and Vitamin C on survival percent of *Clarias batrachus*

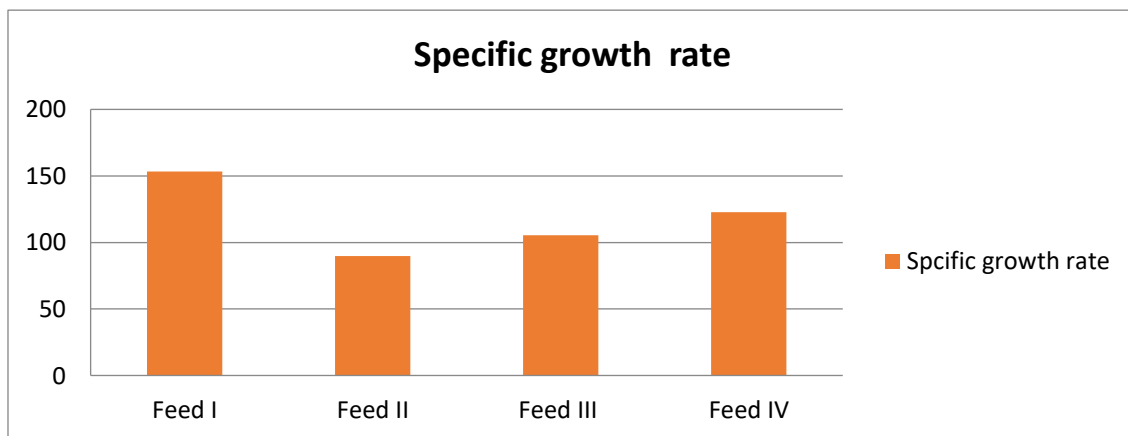


Fig 6. Showing effect of dietary aflatoxin and Vitamin C on specific growth rate of the fish.

Growth Performance

The results showed significant ($p > 0.05$) reduction in the negative effects of aflatoxin on growth indices of the fish by vitamin c. Body length gain was significantly decreased in the fish fed with aflatoxin contaminated feed but the effect was significantly ($p > 0.05$) reduced by the presence of vitamin c in the feed. The percent length gain was also significantly ($p > 0.05$) higher in fish containing vitamin c in the diet as compared to those which got only aflatoxin contaminated feed (Table-1, Fig 1,2). The result of body weight gain are depicted in table 1 and figure 3-5. The total weight gain, average growth rate and specific growth rate was significantly reduced in the fish fed with aflatoxin contaminated feed as compared to control. The present findings agree with those of Nguyen *et al.*, 2002, Selim *et al.*, 2014, Mehfoz and Sherif 2015. Poor growth may be due to decreased appetite, decrease in metabolic process of carbohydrate, lipid and protein and also due to decrease in transcription process of protein synthesis as a result of exposure to aflatoxin (Cheek and Shull 1985, Joner *et al.*, 2000 and Bbosa *et al.*, 2013). Addition of Vitamin C significantly ($p > 0.05$) improved the growth performance in the fish. These results agree with those of Shehata *et al.*, (2009). Sahoo and Mukherjee (2003) reported that vitamin C improved the immunity in *Labeo rohita* exposed to aflatoxin Nayek *et al.*, 2007 reported increased serum protein in vitamin c treated *Labeo rohita*. Maryam *et al.*, 2018 reported that vitamin c prevents *Aspergillus parasiticus* growth in the culture and negate the production of aflatoxin by inhibiting aflatoxin gene expression.

Thus reduction in adverse effects of aflatoxin on growth performance of the fish is due to suppression of growth of the mold and decrease in expression of gene responsible for aflatoxin production.

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Conflict of Interest

The author declares that there is no conflict of interest.

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