RESEARCH ARTICLE

Studies on effects of dietary aflatoxin on growth performance and survival rate of fish *Clarias batrachus*

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ABSTRACT

Studies were conducted to determinate the effect of different levels of aflatoxin contaminated feed on growth performance and survival rate of fish *Clarias batrachus*. There was a significant decrease in average length gain, total weight gain, average weight gain as well as survival rate with increase in contamination of aflatoxin in the feed of the fish.

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

INTRODUCTION

Aflatoxins are metabolic by products of moulds *Aspergillusflavus* and *Aspergillusparasiticus.*These are toxic compounds and the cause of high mortality in animals and in some cases human beings (Reed and Casali, 1987, Montesano et al, 1995).The moulds can grow on the improperly stored feed or on feeds of inferior quality resulting in production of aflatoxins in many parts of the world including India. These toxins are completely heat stable so neither heating nor freezing destroy them and thus remain on the food indefinitely. The moulds grow on grains and legumes mostly during storage which then enters into human directly through food of plant origin and indirectly through food of animal origin. Toxigenic *A. flavus* produces aflatoxin B_1 and aflatoxin B_2 whereas *A. parasiticus* produces aflatoxin G_1 and aflatoxinG_2. AflatoxinB_1(AFB_1) is the most potent among all the types of aflatoxin identified till now and is classified as group 1 carcinogen by International agency for research on cancer. Effects of aflatoxin B_1 in fishes have been reported by several workers. Nunez *et al.*(1991) reported hepatocellular adenoma and hepatocellular carcinoma in Rainbow trout when exposed to aflatoxin B_1. Caguan*et al.*(2004) reported loss of appetite, decreased mean total biomass and low survival percentage in tilapia when fed with aflatoxin contaminated feed . There are reports of elevated liver function enzymes SGPT and SGOT in *Tilapia zilli* and *Clariaslazera* when these fishes were exposed to aflatoxinB_1 (Zaki*etal.*, 2010; 2011). Mahfouz and Sharif (2015)

reported decrease growth indices and elevated ALT, AST and alkaline phosphatise in *Oreochromisniloticus* when exposed to various doses of AFB_1.

Asian cat fish *Clariasbatrachus* commonly known as Magur is an important commercial fish for its high quality flesh and for its medicinal value. In many parts of India it is consumed by anaemic, malnourished individuals, elderly persons and children due to its high nutrition value. Growth and survival are indicators of effects of a toxic compound in various animals including fish .The objective of the present study was to explore the effects of aflatoxin contaminated feeds on growth and survival of *Clariasbatrachus*.

MATERIALS AND METHODS

A total 72 apparently healthy *Clariasbatrachus* were obtained from private fish farm at Dholpur district of Rajasthan. The length of the fish was about 10 to 20 cm and the weight was about 35 to 55 grams. The fishes were kept in twelve aquaria measuring 2^1 X 1^1 X 1^1 . Six fishes were kept in each aquarium. Three aquaria were kept as control and nine aquaria were divided into three sets of three aquaria each and kept as experimental sets.

Preparation of Feed

Four types of feeds were prepared for the fishes depend upon the percentage of contaminated 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. Feed I were given to control or fishes of first set of aquaria comprising IA, IB and IC.

Feed II consisted of 90 percent good feed and 10 percent mouldy feed. Feed II were given to second set of aquaria comprising 2A, 2B and 2C.

Feed III contained 50 percent mouldy feed and 50 percent good feed. Feed III were given to fishes of third set of aquaria comprising of 3A, 3B and 3C.

Feed IV contained 100 percent mouldy feed. Feed IV was given to fishes of fourth set of aquaria comprising 4A, 4B and 4C.

Mouldy feed was prepared in laboratory. The commercial fish feed procured from market was first sprinkled with small amount of tap water to make the feed moist and then mixed with cultured *Aspergillusflavus* 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. The infected feed was kept in a condition which is favourable for the growth of mould. Required amount of mouldy feed and good feed were weighed carefully for each treatment and then mixed thoroughly. 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).

RESULTS AND DISCUSSION

Body Weight and body length

The result showed significant effects of aflatoxin on growth indices of the fish.

Body length gain was significantly ($p>0.05$) decreased in the fish fed with aflatoxin contaminated feed as compared to control. The total length gain in fishes fed

Table -1 Showingthe effects of aflatoxincontaminated feed on body weight , body length and survival rate in various groups of the fishes.

Treatment	I	II	III	IV
Initial Body length (cm)	11.36 ±1.15	11.67 ±2.21	10.95 ±1.12	11.60 ±1.12
Final body length	21.6 ±2.06	21.7 ±2.05	17.1 ±0.92	15.4 ±0.81
Initial body weight (g)	50.9 ±2.91	50.7 ±2.33	51.4 ±2.13	52.8 ±1.86
Final body weight (g)	125.7 ±3.34	124.0 ±3.37	109.3 ±2.31	98.7 ±3.26
Survival %	100	83	61	38

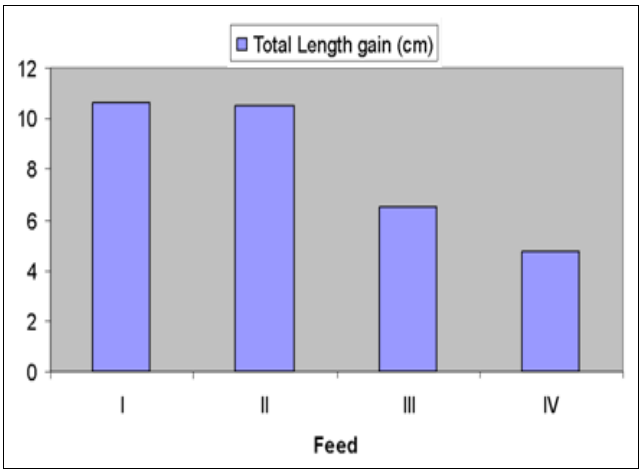

Fig. 1: Showing effects of aflatoxin on total length gain of the fish.

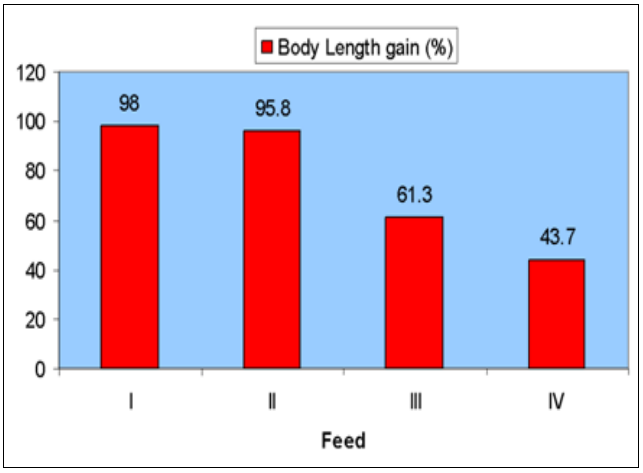

Fig. 2: Showing effect of aflatoxin on body length gain percent in the fish.

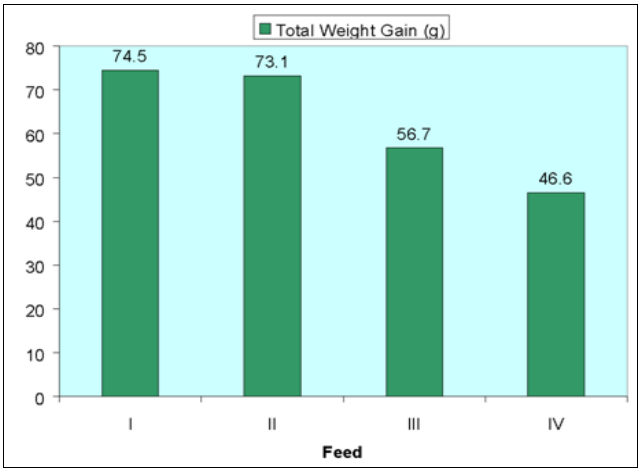

Fig.3:Shows effect of aflatoxin on total weight gain of the fish

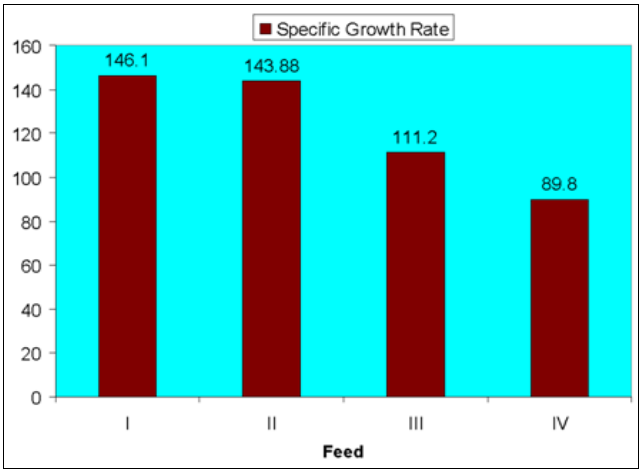

Fig. 4: Showing effect of aflatoxin on specific growth rate of the fish

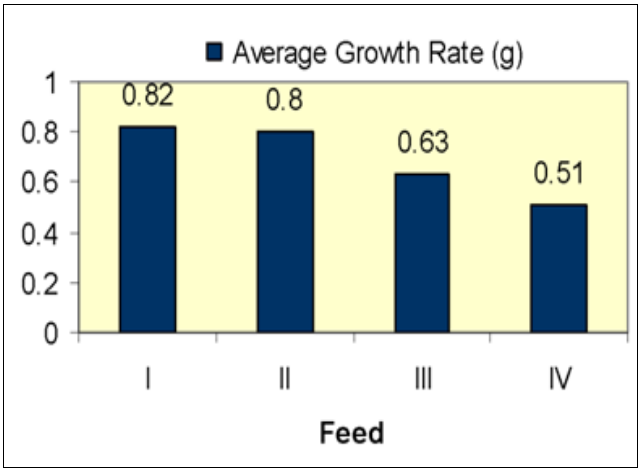

Fig. 5: Showing effect of aflatoxin on average growth rate of the fish

with feed I was 10.61 ±2.03 as compared to 4.7 ± 0.8 in fishes treated with feed IV. The percent length gain was also significantly higher in control or fishes fed with mould free feed as compared to fishes fed with feed IV hundred percent mouldy feed (fig 1 and 2).

The results of body weight gain are presented in table I and fig 3 - 5. The total weight gain (TWG) was 74. 5 ± 5.18 in fishes fed with feed I which gradually decreased with increase in the percentage of mouldy feed reaching its minimum 46.6 ± 3.75 in fishes fed with feed IV. The average growth rate (AGR) in fishes treated with feed I was significantly higher (p>0.05) than those of fishes which were fed with feed II, III and feed IV. The average growth rate in control was 0.82 ± 0.05 followed by 0.80 ± 0.03 in fishes treated with feed II and the minimum 0.51 ± 0.03 was found in fed with feed IV or hundred percent mouldy feed. The Specific growth rate (SGR) also showed a significant (p> 0.05) and gradual decline with the increase in the aflatoxin

contamination in the feed reaching its minimum in those fishes which were given feed IV or hundred percent mouldy feed. These results agree with the findings of Royes*et al.* (2002), Caguan*et al.* (2004), Mahfouz and Sharif (2015) in *O. niloticus*, Ogunjobi*et al*.(2012), Agbebi*et al*. (2012) in *C. gariepinus*.

Aflatoxin causes decreased appetite in in fishes (cheek and Shull, 1985) and also suppresses activities of different cell proteins which leads to inhibition of protein synthesis as well as lipid and carbohydrate metabolism (Joner 2000). Thus negative effects of aflatoxin on growth in the present studies may be due to suppression of metabolic process of carbohydrate, lipid and protein and also due to loss of appetite as a result of aflatoxin.

Aflatoxin may also create a condition of stress increasing utilization of glutathione for detoxification process in fishes (Devegowda, 1998). Methionine is one of the components glutathione. Hence this process of detoxification may decrease availability of methionine resulting in poor growth.

Survival Rate

Survival rate decreased with increase in aflatoxin contamination in feeds. The fishes which were fed with feed I or aflatoxin free diet showed maximum or 100% survival whereas minimum survival i.e., 38% was observed in those fishes which were given feed IV (Table 1). The present findings are in agreement with those found in *O. Niloticus*(Caguan*et al*., 2004; Mahfouz *et al*., 2015).

Aflatoxin causes hepatic abnormality in fishes (Nunez *et. al*., 1991; Zaki*et al*., 2011; 2012). Thus the lowered survival rate in aflatoxin treated fish was probably due to impaired liver function and loss of appetite.

Zaki*et al*. (2012) reported decreased immunity in *Clariaslazera* when exposed to aflatoxin. Thus the decreased in survival rate may also be due to loss of immunity in the aflatoxin treated fishes.

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