

AN OVER REVIEW ON EFFECT OF AFLATOXIN IN ANIMAL HUSBANDRY

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ABSTRACT

Aflatoxins are toxic metabolites produced by a variety of molds such as *Aspergillus flavus* and *Aspergillus parasiticus*. They are carcinogenic and can be present in grains, nuts, cottonseeds and other commodities associated with human food or animal feeds. Aflatoxins have been implicated in human health disorders including hepatocellular carcinoma, aflatoxicosis, Reye's syndrome and chronic hepatitis. Symptoms of toxicity in animals range from death to chronic diseases, reproductive interference, immune suppression, decreased milk and egg production.

INTRODUCTION

Aflatoxins are defined as difuranocyclopentanocumarines/difuranopentanolidocumarines this contains a dihydrofuran or a tetrahydrofuran ring. One of the most important effects of post harvest decays of fruits, vegetables and especially of seed and feed deterioration by fungi is the produce of mycotoxins. This is a disease of animals and humans following consumption of feeds and foods invaded by fungi that produce toxic substances called mycotoxins (Agrios, 1978; Moss, 1989). Aflatoxins are a family of closely related secondary metabolites produced by fungi viz., *Aspergillus flavus* and *A. parasiticus* which are not indispensable to the fungi's life but show toxic effects on human beings, animals, plants and microorganisms.

Aflatoxin problems have historically developed during years with severe high-temperature stress, particularly when coupled with water deficiency, insect ear and grain damage. The occurrence of aflatoxins is influenced by certain environmental factors; hence the extent of contamination will vary with geographic location, agricultural and agronomic practices, and the susceptibility of commodities to fungal invasion during pre-harvest, storage, and/or processing periods.

Its name derives from the fact that it was originally found to be produced by *Aspergillus flavus* (Agrios, 1978), but is now known to be produced by other species of *Aspergillus*. The studies exhibited that there are four major aflatoxins namely B₁, B₂, G₁, G₂ plus two additional metabolic products, M₁ and M₂, that are significant as direct contaminants of foods and feeds. The aflatoxins M₁ and M₂ were first isolated from milk of lactating animals fed aflatoxin preparations; hence, the M designation. Whereas the B designation of aflatoxins B₁ and

B₂ resulted from the exhibition of blue fluorescence under UV-light, while the G designation refers to the yellow-green fluorescence of the relevant structures under UV-light. Out of about 20 known aflatoxins, the moulds *Aspergillus flavus* and *A. parasiticus* produce exclusively aflatoxin B₁ (C₁₇ H₁₂ O₆), B₂ (C₁₇ H₁₄ O₆), G₁ (C₁₇ H₁₂ O₇) and G₂ (C₁₇ H₁₄ O₇), and all the other aflatoxins are derivatives of these four. Aflatoxins have received greater attention than any other mycotoxins because of their demonstrated potent carcinogenic effect in susceptible laboratory animals and their acute toxicological effects in humans. The positive correlation between the consumption of aflatoxin-contaminated foods and the increase of the occurrence of liver cancer in several populations in South East Asia and Africa suggests the threat posed to human health by aflatoxin (Peers and Linsell, 1973). The absolute safety is never achieved; many countries have attempted to limit exposure to aflatoxins by imposing regulatory limits on commodities intended for use as food and feed.

Aflatoxicosis and animal health

The injuries presented by mycotoxins may be divided into two classes. The first is related to the economic loss to producers of agricultural products. The second hazard is that to human health. This may result from direct ingestion of mycotoxins from the food such as groundnuts and cereals contaminated with fungi and also from secondary contamination from eating meat of animals with residues of mycotoxins or their metabolites in the tissues. Most laboratory animals, with the exception of the mouse, are readily killed by the aflatoxins. Following the administration of aflatoxin B₁ to the rat, the species most extensively studied, the main lesions are seen in the liver, while kidney and adrenals show damage.

The animal health impression depend on the dose- and time of used aflatoxin, and two distinct forms of aflatoxicosis, namely acute and chronic, can be distinguished depending on the dose and length of time of exposure (Leeson *et al.*, 1995). Aflatoxicosis is primarily a hepatic disease. The susceptibility of individual animals to aflatoxins varies considerably depending on species, age, sex and nutrition. In fact, aflatoxins cause liver damage, decreased milk and egg production, recurrent infection as a result of immunity suppression, in addition to embryo toxicity in animals consuming low dietary concentrations. The young's of the species are most susceptible although all ages are affected in different degrees for different species. Clinical signs of aflatoxicosis in animals include gastrointestinal dysfunction, reduced reproductivity, reduced feed utilization and efficiency, anemia and jaundice. Nursing animals may be affected as a result of the conversion of aflatoxin B₁ to the metabolite aflatoxin M₁ excreted in milk of dairy cattle. Aflatoxin B₁, M₁, and G₁ have been shown to cause various types of cancer in different animal species (Liener, 1969; Goldbatt, 1969; Heathcote and Hibbert, 1978; Finley *et al.*, 1992; Eaton and Groopman, 1994; Line and Brackett, 1995).

Determination of aflatoxin

The aflatoxin content in food and fodder can be determined by analytical techniques such as: thin layer, gas or liquid chromatography, spectrofluorometry, spectrophotometry and ELISA (Chu and Ueno, 1977; Biermann and Terplan, 1980; Ueno *et al.*, 1983; Morgan *et al.*, 1986; Park *et al.*, 1989; Fukal, 1990; Barbieri *et al.*, 1994; Bradburn *et al.*, 1995; Pei-Yin *et al.*, 1995; Sabino *et al.*, 1995; Espinosa *et al.*, 1996).

Degradation of aflatoxin

Approximately 25% of the world crops are affected by mycotoxins annually. This causes significant economic losses due to loss of crops and animals. Experimental data gathered during the last 3 decades on the loss of productivity in farm animals consuming contaminated feeds. The carcinogenicity in experimental animals provide sufficient evidence regarding the hazardous nature of aflatoxins (Palmgren and Hayes, 1987). Aflatoxins are unique in being resistant to degradation under normal food processing conditions (Ciegler and Vesonder, 1983). It is a continuous challenge to select proper degradation methods that will effectively decompose aflatoxins, while retaining the nutritive quality and palatability of the treated food.

Preventing the contamination of food by the toxigenic fungi, *Aspergillus flavus* and *Aspergillus parasiticus*, is the most rational and economic approach to avoid the potential hazards. However, prevention is not always possible under certain agronomic and storage practices. Therefore, decontamination has gained importance in salvaging food already contaminated with toxic fungal metabolites. Detoxification of food containing aflatoxins is a problem of current concern that has to be accomplished by a variety of methods. Segregation of contaminated and non-contaminated products is sometimes carried out by hand sorting (Brackett, 1987). Physical approaches to aflatoxins destruction generally involve treating with heat, UV, light or ionizing radiation (Aziz and Refai, 1989; Aziz *et al.*, 1990; Refai *et al.*, 1995 and 2003). Chemical degradation of aflatoxins is usually carried out by

chlorination, oxidizing or hydrolytic agents while ammoniation is the most widely accepted, however, effective ammoniation can require expensive equipment and may result in loss in nutritional quality of the treated feed (Samarajeewa *et al.*, 1990; Refai *et al.*, 1995). Many microorganisms including bacteria, yeasts, moulds, actinomycetes and algae are able to remove or degrade aflatoxins in foods and feeds (Line and Brackett, 1995). As well as, the conjugated linoleic acid present in poultry meats, eggs and other animal products is considered to have an antioxidative and anticarcinogenic property (Chin *et al.*, 1992; Chen *et al.*, 1997).

Some key advice to minimizing the aflatoxin in food

Aflatoxin develops in the field when grains are exposed to severe environmental conditions known to stress kernel development and promote fungal infection within the animal's ear. Management practices that improve plant health strongly discourage aflatoxin development while timely planting, adequate fertility, good weed and insect control, supplemental irrigation, suitable plant population, and hybrid selection help reduce aflatoxins potential.

Farmers may reduce the likelihood of aflatoxin buildup in the field by harvesting grains before it reaches the industry standard of 15.5 per cent moisture.

Do not store grain in trucks, combines, bins, or any non aerated site for more than 4 to 6 h. Fungi readily invade kernels with cracked or damaged seed coats. Increasing fan speed, opening sieves, and reducing ground speed help enhance grain quality collected by a combine. Daily clean out of corn and debris left in combines, trucks, pits, grain carts, and augers; helps to prevent potential contamination sources.

Elevators or grain markets should use chemical analyses to determine aflatoxin content and improve sampling by increasing the sample size and using proper sampling techniques (Erick Larson).

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