MYCOTOXINS, NATURAL CONTAMINANTS IN THE FOOD CHAIN

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Summary

Food safety is of paramount importance worldwide and mycotoxins, toxic metabolites produced by filamentous fungi in food and animal feed, can be viewed with concern to human and animal health. The main mycotoxigenic fungi are from 3 genera, *Aspergillus*, *Penicillium* and *Fusarium*. These can develop in foods at any stage in the food chain

from the field to the plate. There are over 400 mycotoxins known and about 30 have received much attention. The toxins have been found in a wide range of food commodities such cereals, root crops, nuts and seed, dairy products and meat products as well as in animal feeds and ingredients used to produce them. The main factors that affect occurrence of mycotoxins in food and feeds are biological, environmental, post-harvest storage and preservation and processing. Control of these would eliminate or reduce occurrence of the toxins in the food chain. Developing economies in warmer regions of the world are at particular risk from these contaminants as the climates favor mould growth, while effective control and good storage may be difficult to achieve. The health consequences of mycotoxin ingestion have been recorded in humans for many years. The mycotoxicosis known as ergotism caused massive suffering in Europe in the Middle Ages; mycotoxicosis continue to cause adve human rse health effects in both humans and animals. Rapid and reliable methods are now available for detection of mycotoxins and international regulatory bodies regularly assess the risks associated with mycotoxins and set regulatory limits. Various strategies have been developed to reduce or eliminate the occurrence of mycotoxins in the food chain. Effective control measures require a combination of good agricultural practice, carefully controlled storage and surveillance at every stage from field to plate and production of feeding stuff.

1. Introduction

Mycotoxins are natural toxic compounds produced by certain filamentous fungi on many agricultural commodities. They are known to cause toxic response, a mycotoxicosis, when introduced in low concentrations to higher vertebrates and other animals (Smith, *et al.* 1994). . Mycotoxins have a long history in human disease and ergotism is probably the oldest recognized mycotoxicosis. Rye became infected with the ergot fungus, *Claviceps purpurea* which formed a solid biomass (sclerotia) in the developing seed and when harvested and ground into rye flour, a cocktail of deadly poisons was released. The poisons caused convulsion and spontaneous abortion. In the Middle Ages, rye was a staple diet of the peasantry in Europe and records show that there was huge human suffering which restricted population expansion; this may have caused reduction in dependency on rye as staple diet. In 1960, many turkeys died of a disease syndrome called the "turkey X disease" in England, UK. The diet for the birds had been contaminated mould toxin, later identified as aflatoxins. Aflatoxins are very toxic secondary metabolites produced by mould, *Aspergillus flavus.*

More than 400 mycotoxins are produced by about 350 species of filamentous fungi however only about 30 can be viewed with concern in crops and animal products used for human foods. More than 2,000 secondary metabolites from filamentous fungi have been catalogued. Contamination of forage, cereals and other crops is the main entry of many mycotoxins into food and animal feed. Now contamination of food and feeds with mycotoxins is a world-wide problem and the FAO estimated that 25% of the world's food crops are contaminated with mycotoxins and the levels can have substantial economic consequences for farmers, livestock producers, grain handlers, food processors and indeed national economies.

Mycotoxins are, in general, low molecular weight, non-antigenic fungal secondary metabolites formed by way of several metabolic pathways, e.g. the polyketide route

(aflatoxins), a linear carbon backbone of polyketide origin (fumonisins), the terpene route (trichothecenes), the amino acid route (aflatoxin), and the tricarboxylic acid route (rubratoxin). Some mycotoxins, such as cyclopiazonic acid are formed from a combination of two or more of the principal pathways. Mycotoxins normally enter the human and animal dietary system by indirect or direct contamination. Direct contamination occurs when the food or feed becomes infected with a toxigenic fungus with subsequent toxin formation. Indirect contamination occurs when an ingredient of a process has previously become contaminated with toxin-producing fungi and, while the fungus may be killed or removed during processing, the mycotoxins will mostly remain in the final product. Most of the important mycotoxins are, in general, quite resistant to most forms of food and feed processing.

Direct economic losses resulting from mycotoxin-contaminated agricultural crops can be measured in reduced crop yields and lower quality, reduced animal performance and reproductive capabilities, and increased disease incidence. Such losses have been greatly underestimated in the past. Crop producers with mycotoxin-contaminated products will incur downgrading of crops, reduced markets, increased handling and processing, and increased costs for detoxification or dilution where these are legally permitted options. In the European Union (EU) it is illegal to blend food containing mycotoxins above the statutory maxima with material free of the toxins in order to reduce the concentration to a legal level. Also, it is illegal to treat foods containing aflatoxins by any chemical method in order to reduce the concentration of the toxin(s). Feed and food processors may experience increased costs for further processing needs, especially for analyses and monitoring for presence of mycotoxins. Also animal producers may experience increased production costs related to veterinary requirements, reduced outputs and possibly seeking new mycotoxin-free supplies.

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Biographical Sketch

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