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Effects of Mycotoxins on the Health Status of Dairy Cattle

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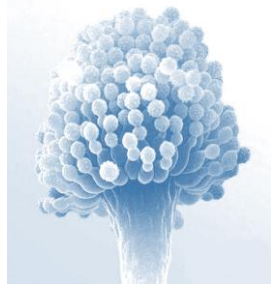
Abstract

The purpose of this study is to highlight some aspects regarding the effects of mycotoxins on the health status of dairy cattle. Fungi producing mycotoxins are very common and can grow on many nutrient substrates and of course in very varied climatic conditions. It is estimated that a quarter of the crops present worldwide are to a large extent contaminated with mycotoxins and the economic consequences are quite serious. Because of large amounts of mycotoxins, crops are destroyed or used as animal feed, leading to poor animal development or death. It is known that if the crops used for feed are contaminated then products like milk and meat will contain mycotoxins or biotransformation products, unfortunately. Regarding the effects of mycotoxins on ruminants, the complexity of developing specific animal studies should be investigated, as there is a multitude of effects that cause confusion.



Aflatoxins

Aflatoxins are a group of mycotoxins mainly synthesized by the molds *Aspergillus flavus* and *A. parasiticus* which are present in many raw materials used for animal feed. Increased attention has been paid to aflatoxin B1 because, after being metabolized in the rumen, it passes into milk in the form of **aflatoxin M₁**. There is strict regulation to control this toxin due to its harmful effect on both humans and animals. This toxin is classified as a human carcinogen. In addition to losses in milk quality and production, fertility can also be compromised. The liver is the target organ for mycotoxins, therefore liver damage is observed, with congestion and hemorrhages. Fat deposits are also observed on the liver, kidneys, heart, producing encephalopathies and edema in the limbs, flatulence, abdominal pain and ruminal stasis.



Zearalenone

Due to their estrogenic activity, **zearalenone** and its metabolites are responsible for reproductive problems, such as abnormal estrus cycles, which can disrupt fertility and mammary glands.

When the intoxication is chronic, long cycles of anestrus will appear in addition to chronic endometritis with hypertrophy of the uterine muscle.



Ochratoxin

They are produced by several types of mold, so they are present in temperate and tropical areas. **Ochratoxin A** is more widespread and has nephrotoxic activity. May affect ruminants; however, it is rapidly broken down in a healthy rumen so that it is not considered a major risk to dairy cattle.

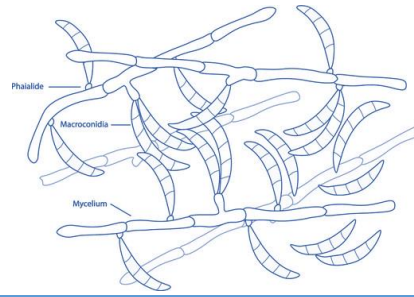
Introduction

Mycotoxins are secondary metabolites of fungi that contaminate food and feed and have a significant negative impact on human and animal health, including animal productivity. *Aspergillus*, *Fusarium* and *Penicillium* are the main mycotoxin-producing fungi. These toxigenic mushrooms are classified into two groups; field fungi that contaminate crops and produce toxins while still in the field, such as *Fusarium* species, and storage fungi, such as *Aspergillus* and *Penicillium* species, that mainly produce post-harvest toxins during storage. Mycotoxin production is related to environmental conditions, plant stress and grain damage by rodents and pests, and abiotic factors such as forage pH and moisture content. Aflatoxins (AF) produced by *Aspergillus* species, fumonisins (FUM), zearalenone (ZEN), T-2 toxin (T-2) and deoxynivalenol (DON) produced by *Fusarium* species and ochratoxin A (OTA) produced by *Aspergillus* and *Penicillium* species are well-known mycotoxins of major agricultural importance and have been found concurrently in feed, with FA, which is a class 1 human carcinogen, the most widespread and also the most studied. Consumption of feed contaminated with these toxins can cause mycotoxicosis in animals, characterized by a range of clinical signs depending on the toxin, and can cause losses in the animal industry.



Trichothecenes

The most relevant trichothecenes due to their clinical significance are **DON** (deoxynivalenol, also called vomitoxin) and **T-2**. Detoxification can be reduced by a low rumen pH. Clinical signs derived from trichothecenes include fertility problems, diarrhea, gastroenteritis, and intestinal bleeding. **DON** affects the liver and its ability to detoxify. It also produces a significant decrease in milk production, fat in the milk and an increase in the number of somatic cells. **T-2** and its hydroxy and acetyl metabolites produce cytotoxic immunosuppressive effects, therefore posing a risk to animal health. In dairy cows, the presence of **T-2** can be linked to anorexia, low milk production, gastroenteritis, intestinal bleeding and death. **T-2** has been associated with a marked reduction in the immune response in fresh (periparturient) calves and cows.

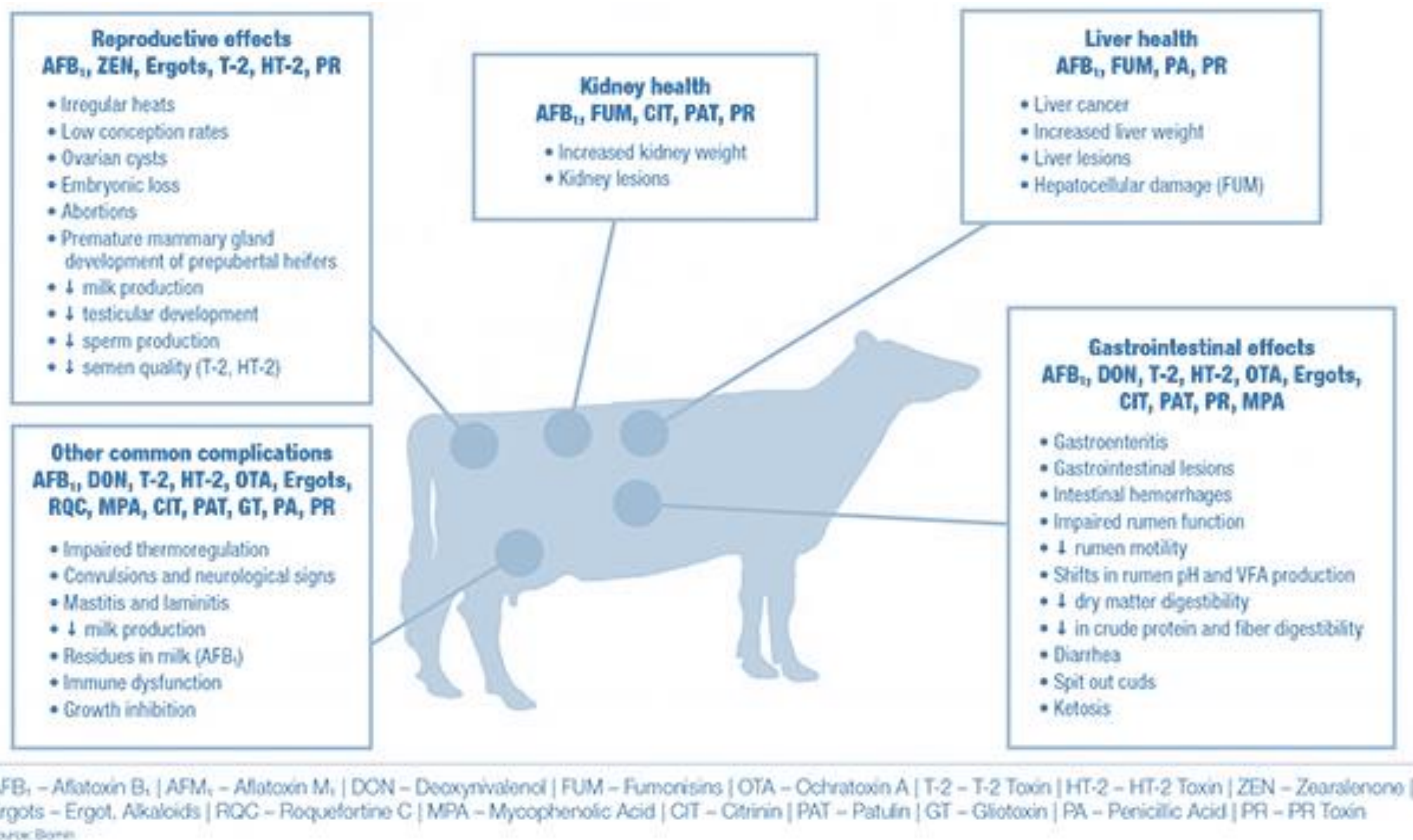


Fumonisin

Fumisin B1 and **B2** are the most important and are metabolized relatively slowly and inefficiently in the rumen. Organs damaged in ruminants include the liver and kidney, leading to neurotoxic and nephrotic syndromes, cerebral and pulmonary edema, hepatotoxicity, and cardiac damage.



Mycotoxins	Effects on animals
Aflatoxins	Reduced milk production in dairy cows. Decreased milk quality and safety due to toxin transfer from contaminated feed. Decreased feed efficiency and rate of gain in beef cows. Compromised immune and ruminal functions. Liver dysfunctions.
T-2	Immunosuppression in cattle due to reduced antibody production, neutrophil function and lymphocyte blastogenesis. Bovine infertility and late gestation abortion. The extent of transfer to the milk of ruminants is negligible.
Deoxinivalenol	Gastrointestinal problems and reduced performance probably due to food refusal. There is no evidence of transfer to the milk of ruminants.
Zearalenone	Infertility, reduced milk production and hyperestrogenism in cattle. The extent of transfer to the milk of ruminants is negligible.
Fumonisin	Reduced performance probably due to food refusal. Mild liver disease. The transfer of the toxin into the milk of ruminants is negligible.
Ochratoxin	No significant toxicity to cattle when fed alone at natural doses. Transfer of the toxin into milk is minimal.



Conclusions

Susceptibility of dairy cows (and ruminants in general) to mycotoxins is largely dependent on the presystemic clearance of ingested mycotoxins by the rumen microflora. A number of mycotoxins resist microbial degradation, and typical poisonings caused by fungal alkaloids and other mycotoxins with high rumen stability have been described in cattle. Some of the mycotoxins occurring in silage or other stored feed materials exert significant antimicrobial activity and alter the rumen.