

Mycotoxigenesis in Horses: A Worldwide Concern!!!

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Mycotoxins are toxic chemical compounds produced by some fungi as a defence system when they are threatened. Horses are highly exposed to mycotoxins due to the variety of feedstuffs included in their ration. Mycotoxicosis severity depends on duration of exposure, number of mycotoxins in presence, housing conditions and health status of the horses. Mycotoxicosis may lead to immunosuppression, reduction of the athletic performances, cancers, and sudden death. Horse stalls contain high quantity of forages, concentrates or bedding materials from cereals, they are the ideal place for fungal growth and so mycotoxins presence. Unfortunately, diagnosis is difficult because clinical signs may be associated with bacterial disease or unexplained behavioural changes. However, preventive solutions do exist to avoid mycotoxicosis; using modified clay is one of these solutions.

I- Mould growth, mycotoxin formation

When moulds are threatened, they can produce mycotoxins as a defence system. Therefore, the formation of mycotoxins is not only favoured by the amount of moulds, but also by the measurements taken to reduce them. Changes in temperature and humidity, use of fungicides generate a stress on the moulds and can increase the amount of mycotoxins. The presence of mycotoxins is not easy to demonstrate; they are not evenly spread and therefore a negative test may not be reliable. As the mycotoxins remain, even after the moulds have gone, the use of a mould inhibitor in storage maybe much too late to prevent mycotoxin formation and will not neutralize those that are already there.

II- Mycotoxicosis in the equine world

Horses are selective grazers and normally graze some areas like a golf green while leaving other areas (roughs) long and defecating in them. In most cases, poisonous plants can be present in horse pastures and the horses will not touch them unless there is nothing else to eat ⁽⁵⁾. This intensive grazing on specific grasses involves a symbiosis between the intensive grazed grasses and a fungus in order to grow and to survive. The fungi are called endotoxins and they induce a lack of palatability and toxicity for the horses at every physiological stage. Those endotoxins are part of the mycotoxins family which are not only restricted to grains. Table 1 describes which mycotoxins may be found according to the feedstuff. Pasture grasses, hay, straw and stubble can all support the growth of various fungi ⁽⁴⁾. Moulds tend to develop in isolated pockets ("hot spots") in the stored commodities. After having been consumed by animals, there is no more evidence of their existence. Consequently, accurate concentration of mycotoxins in the feed is difficult to determine due to this heterogeneous concentration. From their bedding material to the ryegrass they graze, horses are daily exposed to mycotoxins. Moreover, equines are simple stomach herbivores and they are considered as more sensitive than the ruminants to mycotoxicosis because nutrient absorption occurs prior to fermentative digestion ⁽³⁾.

Mycotoxins family	Feedstuffs	Recommendation levels* (in ppb) (3 et 4)
Aflatoxin	Corn and by-products, rye, cottonseed, peanuts, oat	20
T-2 toxin	Corn and by-products, oat, rye, wheat, bran, barley, straw	50
DON	Corn and by-products, oat, rye, wheat, bran, barley, straw	400
Zearalenone	Corn and by-products, oat, rye, wheat, bran, barley, straw	100
Fumonisin	Corn and by-products, oat, rye, wheat, bran, barley, straw	1000
Endotoxines (lolitrem, néotyphodium, alkaloids...)	Grass, hay, oat, rye, ryegrass, clover	3000

Table 1: Relation between mycotoxins family and plants with recommendations on tolerance levels in the final ration.

* Some of the recommendations are based on field observations and require scientific studies to be validated.

Mycotoxins problem requires a different approach in equines if compared to other farm animals. These other species are bred for meat and/or milk yield and have a relatively short lifetime while in most cases, the horse is bred for athletic performance, conformation, temperament, beauty and/or durability ⁽¹⁾.

Although the effects of mycotoxins on horses are not well documented in scientific literature, in field situations, apparent mycotoxin problems appear to be significant ⁽³⁾ all over the world (USA, Argentina, Brazil, South Africa, Egypt, Europe, China, New-Zealand...). Indeed, mycotoxins have been implicated in a variety of health problems described in figure 1. Many effects of high concentrations of mycotoxins are well known: like leukoencephalomalacia (ELEM) and colic for instance. At very low contamination levels however, mycotoxins already affect the immunologic and digestive systems, as well as the reproductive tract.

ELEM is a disease known since 1850 in the USA and characterised by a sudden apparition of multifocal nervous troubles leading rapidly to death within 10 to 24 hours ⁽²⁾. In every case, symptoms (successive excitation and torpor) are linked to the distribution of a mouldy feed (mainly corn and its by-products) at winter time during which ration is complemented with grains and concentrates. This pathology is due to the presence of fumonisins which is an endophyte fungi colonizing the plants without any visual sign, but intoxication may be detected by an initial phase of unpalatable ration and depression. While late-gestation mares are known to be very sensitive to the ergot alkaloids ⁽⁵⁾, leukoencephalomalacia has no predisposition on age, sex or breed ⁽²⁾.

Ergot alkaloids that are mostly present in grass, hay and even clover, induce reproductive troubles; clinical signs are various (extended gestation, dystocia, oedematous placentas and weak or dead foal). Trichothecenes generate gastro-intestinal disturbances and a decrease in feed consumption and reduced growth. Claviceps toxicity mainly affects the embryo development (embryo mortality or dead foal). The main effect of aflatoxicosis is Immunosuppression and liver lesion.

As we can see, each family of mycotoxin induces specific symptoms but in the daily life, diagnosis is not easy. Mycotoxins are 'silent, inodorous and invisible killers'.

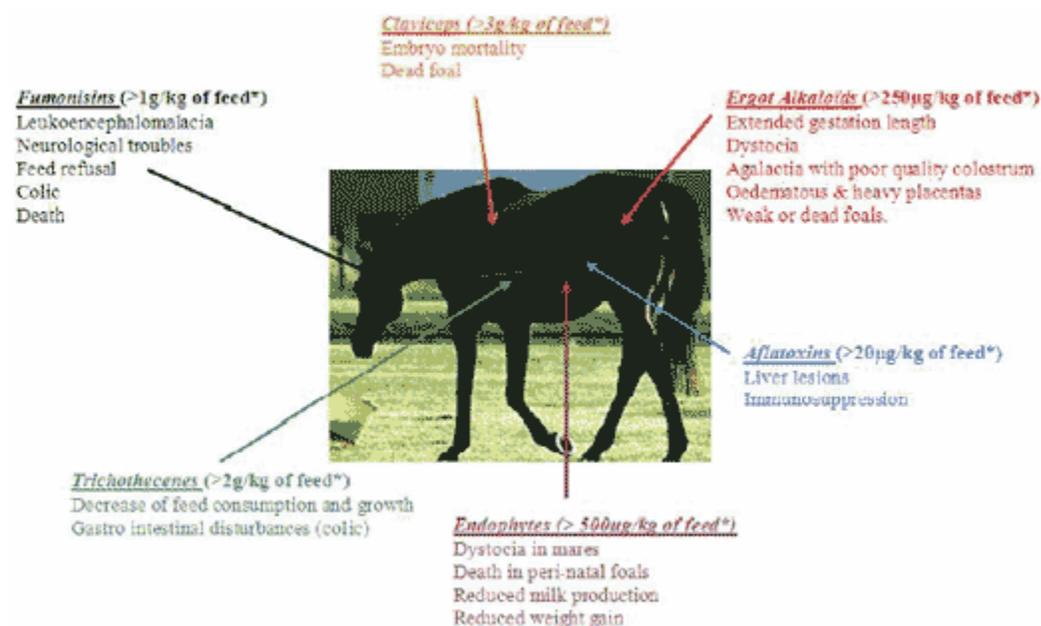


Figure 1: Mycotoxins and their effect on horses.

What we mainly see in the field are the effects of chronic exposure to low levels of mycotoxins: reduced feed intake, weight loss, reproduction troubles, recurrent pathology, and vet costs increasing; symptoms that are usually not directly linked to mycotoxicosis.

Indeed, clinical signs may be associated to an infectious pathogen instead of the presence of mycotoxin. A problem with mycotoxicosis is that they start at very low contamination levels. Also, combination of several toxins at low toxicity levels may be as harmful as one mycotoxin at a high toxicity level.

Horses are highly exposed to a long-term exposition to mycotoxins. Moreover, due to the diversity of feed compounds in their final ration, a polycontamination is very likely to occur. Polycontamination induces synergistic effect between mycotoxins; this synergy increases the toxicity of each mycotoxin in presence of the other ones.

So horses face a long-term exposition to multi-contamination, which is the worst case.

III- Classical preventive measures against mycotoxicosis

Until now, no treatment does exist for this mycotoxicosis. Therefore prevention stays the best solution by:

- Adopt good cultural practises.
- Use a mould inhibitor.
- Remove the contaminated raw material, or incorporate it in low dose in the final ration.
- Remove the horse from the infected pasture.
- Incorporate a mycotoxin inactivator with a large scale of efficiency either in preventive or in curative situation with demonstrated reliability even at low dosage.
- As prevention is the best way to beat mycotoxins, a daily incorporation of the mycotoxin deactivator is recommended to guarantee the prevention of detrimental effects of mycotoxins.

IV- MT.X+: nanotechnology for efficient mycotoxin adsorption

By modifying the clay with the intercalation of seaweed pillars, OLMIX created a new 100% natural material. This newly developed nanostructure named "Amadéite" has the exceptional potential to prevent the absorption of mycotoxins in animal feed. MT.X+ (combination of the nanoclay Amadéite with other active ingredients such as genuine Montmorillonite, diatomaceous earth and yeast cell walls) is produced to get a large spectrum of adsorption to be more efficient in case of multicontaminated rations. To test the efficacy of the nanoclay, OLMIX cooperated with TNO in the Netherlands. The Amadéite was tested in a computer controlled artificial tube, which confirmed the efficacy of the clay as a wide spectrum mycotoxin inactivator. The results showed that Amadéite inhibits the bioaccessibility of fumonisin by 60% and it also reduces the bioaccessibility of DON by 40%. The adsorbance capacity of Amadéite® did not inhibit the digestibility of proteins, carbohydrates, and vitamins ⁽⁶⁾.

Conclusion

Raw materials contamination is unavoidable under certain environmental conditions and, due to its housing conditions and its feeding behaviour; horses must face to a long-term exposition to multicontaminated feed. Acute mycotoxicosis is easily to diagnose but often lethal; the main problem of mycotoxins is that their toxicity synergism and their detrimental impacts start at very low levels. Prevention is the solution to avoid horses' death! To reduce the detrimental impact of mycotoxicosis, solutions do exist and the inclusion of a mycotoxin inactivator with a large spectrum of efficacy as MT.X+ appears to be the best and the most reliable protection for animal health and productivity

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<<http://en.engormix.com/MA-equines/health/forums/article-mycotoxicosis-horses-worldwide-t4026/165-p0.htm>>.