



Risks of mycotoxin intoxication in pigs

Mycotoxins constitute a diverse group of toxic secondary metabolites of filamentous micromycetes. These low-molecular-weight substances are produced during the pre-harvest period, during harvest and during subsequent storage of raw materials and feed. They are very resistant to any technological treatment and elimination. Due to their strong toxicity, the diversity of toxic effects and the synergistic interactions of the individual mycotoxins, they are considered to be dangerous substances to consumers of contaminated feed and food.

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Climate change will have a major impact on crop production in the coming decades. Rising global temperatures, increased CO₂ concentrations and the distribution of rainfall will have both direct impacts on production, such as changes in yields and parameters of individual crops, and indirect impacts, such as on diseases, pests and weeds. There will also certainly be changes in the geographical distribution of mycotoxin-producing fungal species. The most common fungi in our country with typical mild climate are *Fusarium graminearum*, *F. poae*, *F. avenaceum* and *F. culmorum* found in cereals and *F. verticillioides* in maize. However, with climatic changes we can expect the incidence of other fungal species and their metabolites.

Effect of mycotoxins on pig health and performance

Mycotoxins are capable of causing acute and chronic intoxication in animals and humans. The specific effects are due to several factors. These include:

- the type of mycotoxin,
- duration of exposure,
- the concentration of ingested mycotoxin,
- synergistic effects of multiple mycotoxins,
- the species and age of the animal,
- the health and nutritional status of the organism.

The symptoms of acute toxicity are specific depending on the effect of each group of mycotoxins. Intake of high doses of fusarium mycotoxins may lead to acute problems such as abdominal discomfort, diarrhea, gastrointestinal bleeding, shock and it may result in death of the animal. Exposure of pigs to high doses of fumonisins can lead to pulmonary edema due to cardiac insufficiency. Acute intoxication with zearalenone (ZEA) does not occur; rather, the chronic effect is due to the estrogenic action of the ZEA molecule, and vulvovaginitis, udder edema and vaginal prolapse are observed.

Chronic signs of intoxication are more frequent and are caused by prolonged intake of low concentrations of mycotoxins. They are usually without visible symptoms on the animal organism, but they always lead to immunosuppression with consequent effects on the health and ultimately on the performance of the animals.

Effects of mycotoxins on the intestinal health of pigs

A number of mycotoxins, in particular deoxynivalenol (DON), T-2 toxin and fumonisin B1, have been shown to have adverse effects on the gut. Not only absorbed mycotoxins but also mycotoxins that are present in the intestinal lumen have an adverse effect. The mechanisms of intestinal damage are varied and include, especially, a negative effect on the immune system of the intestine and the immune system of the organism as a whole, an increase in intestinal permeability, lowering of the protective mucus layer of the intestinal mucosa, impaired absorption of vitamins and other essential substances, induction of a pro-inflammatory state and intestinal dysbiosis. This results in reduced resistance to infectious diseases such as salmonellosis and colibacillosis, increased medication costs and particularly reduced performance.

Therefore, it is necessary to actively address this issue and come up with new comprehensive strategies to eliminate or deactivate mycotoxins.

Prevention options

There are various techniques to eliminate the negative effects of mycotoxins directly in the digestive tract or liver of the animal, such as adsorption, detoxification or biotransformation.

Commercially available formulations are usually clay-based or use a combination of clay with specific microorganisms and/or enzymes that convert toxic compounds into non-toxic or less toxic ones, and very often contain immunomodulators. Important parameters to ensure the efficacy of the product are their stability in the digestive tract of animals, resistance to administered drugs, and from a technological point of view, resistance to elevated temperature during granulation. The binding to the mycotoxin molecule that takes place in the digestive tract of the animals must be irreversible and without risk of formation of new metabolites that may be more toxic than the original mycotoxin. The best response to the claimed efficacy of a product against the negative effects of mycotoxins on animal health and performance is the response after feeding/intake. This means exact verification on the target animal category in the field.

ADDICOO's strategy for the prevention of mycotoxicosis

Based on the results of analyses of raw materials and complete feeds, ADDICOO GROUP s.r.o. proposes measures to reduce the negative impact of mycotoxins on animal health and performance.



In case of elevated concentrations of mycotoxins, it recommends the inclusion of Fortisorb® Phyto. Fortisorb® Phyto contains purified and activated clay as a basic substance to prevent the negative effects of mycotoxins, which has been proven effective scientifically and also by long-term use in field conditions. The product can prevent the toxic effects of mycotoxins especially zearalenone, T-2 toxin, fumonisin and deoxynivalenol. Another component of the product are yeast cell wall derivatives, which act as natural immunostimulants.

Most toxic substances are detoxified in the liver, so their protection is essential for animal health. For this reason, Fortisorb® Phyto is supplemented with phytogenic substances with hepatoprotective, anti-inflammatory and antibacterial effects.

Efficacy of Fortisorb® Phyto – in vivo trials

In 2020, in vivo efficacy testing of Fortisorb® Phyto (part of project no. TJ02000062) took place at the PNRC research station of Delacon Biotechnik. The length of the experimental period was 35 days and the trial was conducted on Danbred pigs with an average initial weight of 32 kg. The testing was divided into two phases. The aim of the first phase (Phase A) was to determine the impact of high doses of mycotoxins on animal health and performance and the benefit of using the product at higher levels of mycotoxins in the feed. It is known that some types of clays can bind nutrients, leading to a deterioration in performance and health parameters. For this reason, Phase B was included in the trial to eliminate the risk of nutrient adsorption in the digestive tract. In this phase, a mycotoxin-free compound feed was fed. In each phase, a total of 48 pigs were divided into two groups (Phase A: 1st control group + mycotoxins, 2nd control group + Fortisorb® Phyto at 2 kg/t + mycotoxins, Phase B: 1st control group, 2nd control group + Fortisorb® Premium at 1.5 kg/t).

In Phase A, a feed mixture with wheat that was naturally contaminated mainly with the fusarium toxin DON was used. The total mycotoxin concentration was around 5000 ppb. In Phase B, pigs were fed a mycotoxin-free mixture.

For both phases, performance parameters (feed intake, daily gain and feed conversion) were continuously monitored and on day 35 of testing, biological material (blood, intestinal and liver tissue) was collected to assess the health status of six pigs from each group.

Elimination of negative effects of mycotoxins – results of Phase A testing

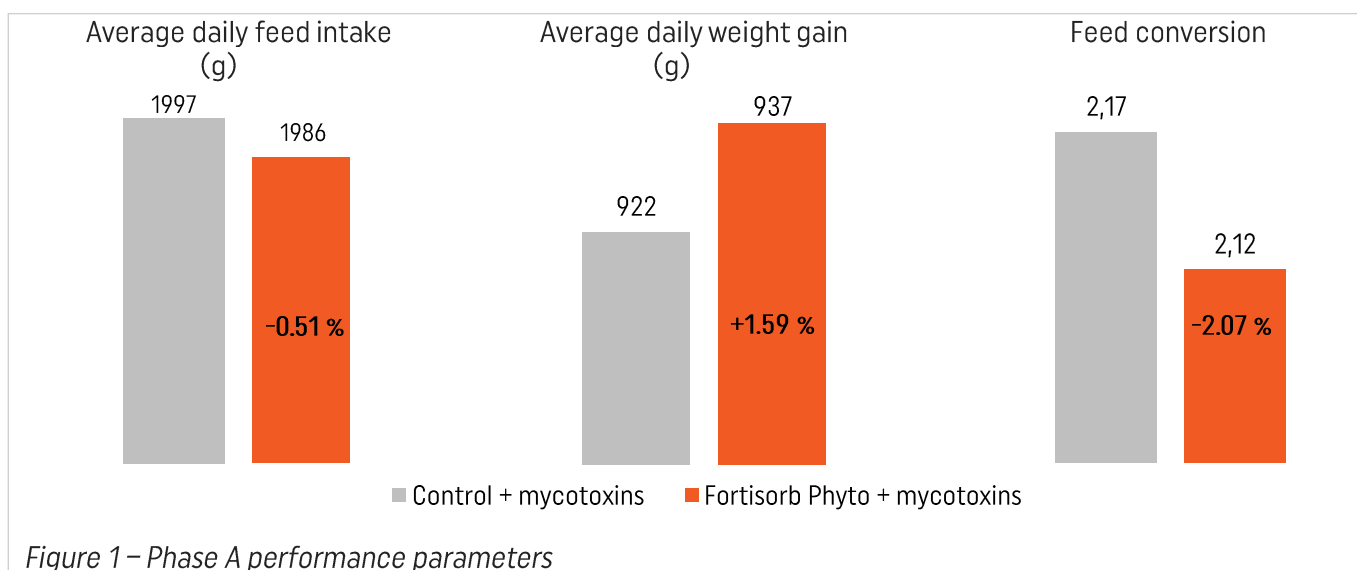


Figure 1 – Phase A performance parameters

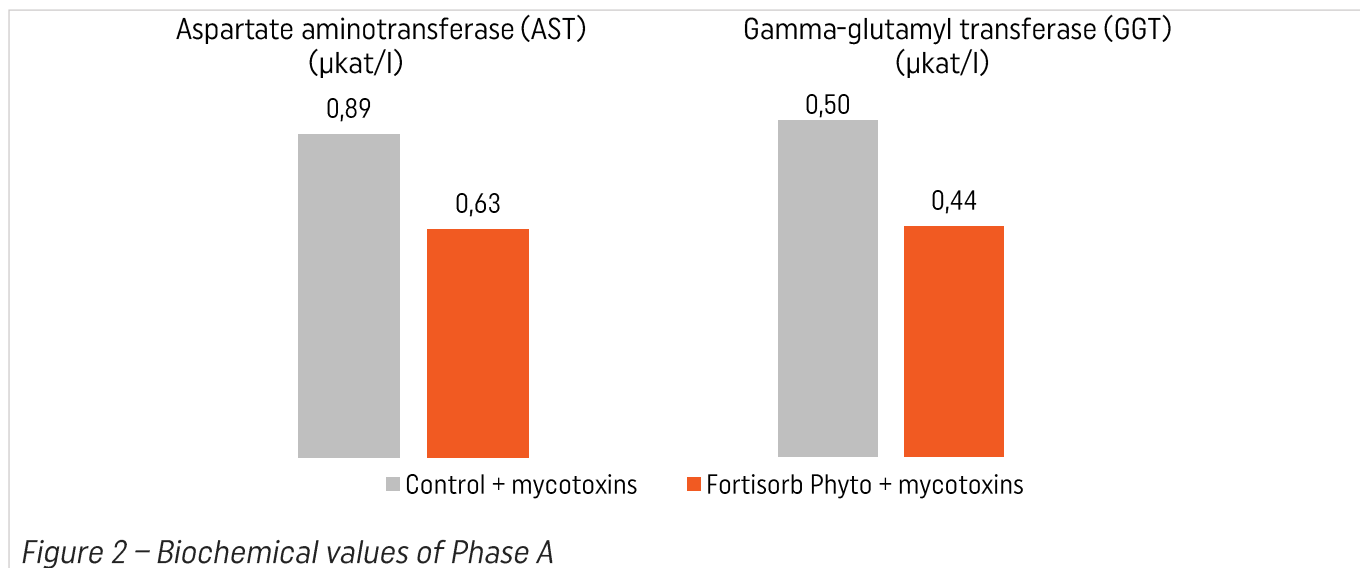


Figure 2 – Biochemical values of Phase A

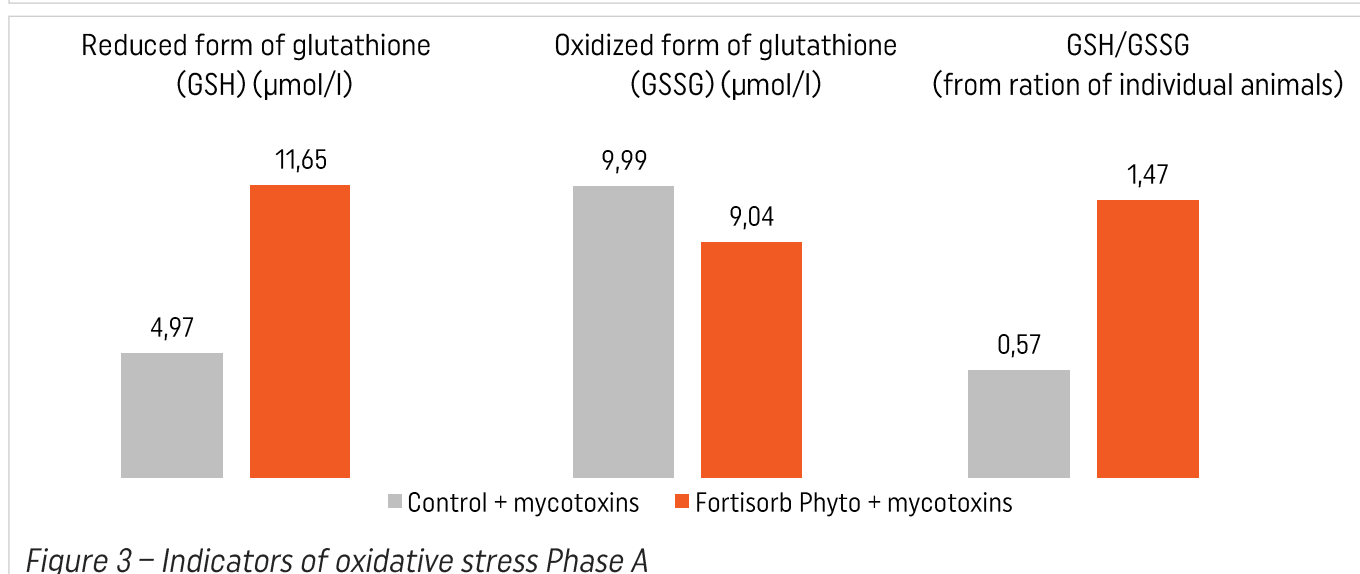


Figure 3 – Indicators of oxidative stress Phase A

Supplementation with **Fortisorb® Phyto** increased average daily weight gain and reduced feed conversion in comparison with control group, feed intake was comparable to the control (Figure 1). **It is clear from the results that Fortisorb® Phyto is able to compensate for the negative effects of high doses of deoxynivalenol without loss of performance, especially at gut level.**

The results of the biochemical blood tests clearly showed a beneficial effect on the liver parenchyma. The activity of liver enzymes (AST, GGT) of the control group was elevated, indicating liver cell damage. In contrast, the liver enzyme activity in the Fortisorb Phyto group corresponded to physiological values (Figure 2).

This beneficial effect was confirmed by the histopathological examination. In the liver tissue of the control group, a marked inflammatory infiltrate and focal necrosis of hepatocytes were observed, whereas in the Fortisorb Phyto group the liver tissue was free of inflammation and necrotic changes. **This clearly shows that the phytogetic substances contained in Fortisorb® Phyto have been shown to protect and regenerate liver tissue, acting as a preventive measure in the event of inflammatory changes in the liver parenchyma.**

The last part of the trial dealt with the evaluation of oxidative stress levels from blood and intestinal tissue samples. Mycotoxins have the effect of increasing the production of free oxygen radicals, which

cause damage to the cell membrane, impairs protein synthesis and, as a consequence, deteriorate health and performance parameters. Glutathione is one of the most important antioxidants that combats the pathological effects of free radicals. The ratio of reduced (GSH) to oxidized (GSSG) forms of glutathione is an important indicator of oxidative damage. The ratio tells us information about the level of oxidative stress in the body, the higher the value, the lower the oxidative damage to the cells.

Another parameter assessed was serum malondialdehyde (MDA). This highly toxic substance and marker of oxidative damage is known to increase after mycotoxin intake.

Fortisorb Phyto has been shown to increase the level of the antioxidant GSH and increase the GSH/GSSG ratio (Figure 3), while serum MDA decreased. **This change in individual parameters indicates the ability of the clay component of Fortisorb® Phyto to eliminate the negative effects of mycotoxins. Together with the influence of phytogenic substances, they contribute to increase GSH synthesis and reduce the risk of oxidative tissue damage and keep free radicals under control.**



Exclusion of nutrient binding risk - results of Phase B testing

The objective of Phase B was to eliminate any potential risk of nutrient binding to the clay component of the product. Some clays of tectonic origin, which are extensible structures, may experience undesirable absorption of microelements and nutrients and thus animal health and performance may be affected. The result of this testing showed an improvement in all performance parameters studied (Figure 4). Hematological and biochemical testing showed no values outside of the physiological range. Oxidative damage did not occur in either group due to the absence of mycotoxins.

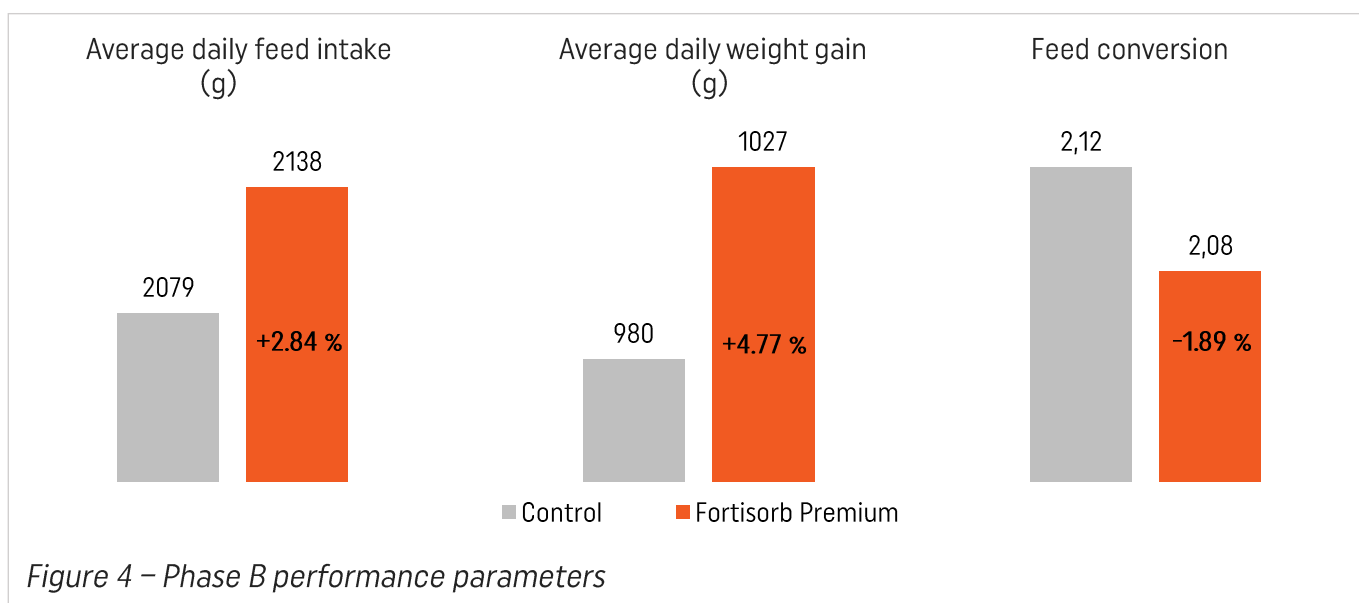


Figure 4 – Phase B performance parameters

The results confirm that the purified and activated bentonite contained in Fortisorb® Phyto does not pose a risk of nutrient absorption. In addition, the clay component changes the consistency of the digestive tract, reducing the rate of passage through the intestine, which helps to increase nutrient digestibility.

The result showed that the ingredients contained in Fortisorb® Phyto improve performance indicators and its preventive use has a positive effect.

Conclusion

Fortisorb Phyto stands out for its ability to eliminate the negative impact of mycotoxins. An additional benefit is its hepatoprotective effect, which is important in ensuring the breakdown of foreign substances and for promoting digestion.

The use of a complex product, which is ADDICOO's Fortisorb® Phyto, is an effective solution in the combat against mycotoxins.