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Preventing mycotoxicosis in poultry

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Introduction

Mycotoxicosis is a significant issue in the chicken business. Mycotoxin production will be stimulated by improper handling and storing grains in tropical conditions. Aflatoxicosis sensitivity is higher in young birds than in adults. Ducks are also ten times more subtle than chickens. Ochratoxicosis less common and more dangerous in poultry than aflatoxicosis. Mycotoxins are very common in grains causing poor performance, feed efficiency, increased mortality in both layers and broilers. This necessitates strategies to mitigate their deleterious effects in poultry.

Mycotoxin adulteration is more found in grains grown or processed in tropical countries such as India. Mycotoxins are poisons produced by roughly 50 fungus species that are ket alnown to be detrimental to poultry. These mycotoxins are metabolites that fungi make during the nutrient's metabolism found in feeds and feed components. Mould growth is aided by the high moisture content of fresh maize and grain. Many mycotoxins remain stable during mill grinding and crushing, as well as feed storage. Temperature, moisture, and grain all have an impact on creation of toxin and its quantities (Ajmal *et al*., 2022).

Aflatoxin production and fungus development are common in poultry feed and components. Even though the aflatoxin content in feed is very less, the adverse consequence is considerably exacerbated by the ochratoxin, which might be present at a low level. The most prevalent mycotoxicosis in poultry are aflatoxicosis and orchatoxicosis mycotoxicosis. Other types of mycotoxicosis are not very common. Mycotoxicosis is common in hot and

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humid environments of Indian states having areas with inadequate storage amenities. Aflatoxin levels in maize, sorghum, rice, cottonseed, groundnut cake, millet, like feed grains range from 20-100 ppb and can reach 500 ppb.

Aflatoxicosis

The fungus "*Aspergillus flavus"* produces the most prevalent and important mycotoxin, aflatoxin and is also responsible for name of the toxin. These aflatoxins are a family of extremely poisonous, mutagenic, and oncogenic chemicals. It is an extremely poisonous mycotoxin produced by numerous *Aspergillus* species. However, *Penicillium puberulum* and *Aspergillus parasiticus* also create aflatoxin. Both these moulds are common in the rainy seasons and produce aflatoxin in high humidity and warm (30-35°C) conditions. The mould growth is accelerated where the moisture level exceeds 10% and the temperature is between 28° and 30°C. Aflatoxin is highly heat stable and can resist harsh environmental conditions (Klich, 2007).

Mycotoxin concentrations in broken grain may be 30-50 times higher than in intact grain. Natural aflatoxin contains amino acids B-1, 2, G-1,2. The designations B and G are based on their colour reaction to fluorescent light, which is either blue (B) or green (G). Aflatoxin B1 is the most dangerous of all and is usually found in the highest quantity. It primarily harms the liver. Once generated in grains, aflatoxin is stable and is not eliminated by typical mill grinding and crushing or storage.

Necropsy findings

Metabolic alterations in affected birds cause expansion of the kidney, spleen, liver and decrease of bursa of fabricus, thymus, testes. Fat accumulates inside liver cells as clear vacuoles after a high dose exposure. As a result, the liver becomes significantly yellow, enlarged, and easily breakable. Minor haemorrhages, fragility of small blood vessels and diminished clotting factor synthesis occurs resulting in "bloody thigh syndrome". Aflatoxin is eliminated promptly through urine and bile and does not accumulate in human tissues explaining quick recovery of egg making and hatchability after cessation of toxin administration.

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Detrimental properties of aflatoxin

Aflatoxicosis results in loss in egg production, decreased feed efficiency, liver damage, paralysis, haemorrhages, lameness, anaemia, poor performance, increased mortality from heat stress and vulnerability to infectious disease. Aflatoxin reduces the fusion and transportation of yolk precursors in the liver, which lowers egg production. Size of egg, weight of yolk, number of total eggs are all reduced. Aflatoxicosis disturbs male and female weight gain, feed conversion efficiency, feed intake, pigmentation, reproductive success and egg production. Levels as low as 110 ppb in broilers might result in meagre feed conversion and weight increase, possibly due to liver injury and decreased nutrient absorption. Birds may not entirely recover once the damage has been done (Banerjee *et al*., 2022).

Immuno suppression

Aflatoxicosis impairs the immune system. Aflatoxicosis increases the risk or severity of Marek's disease, caecal coccidiosis, inclusion body hepatitis, *E. coli* infection, gumboro disease and salmonellosis in chicken. Thus, aflatoxicosis has been linked to an increase in vulnerability to infectious disease. As a result of aflatoxicosis in chicken, vaccine failure is emerging. Aflatoxicosis causes immunological suppression by reducing the spleen, bursa of fabricus, and thymus. Since it lowers passive maternal immunity, immune suppression can be dangerous in breeders.

Ochratoxicosis

Ochratoxicosis is caused by the fungus Aspergillus ochraceous due to release of mycotoxin called ochratoxin. Even though aflatoxin B1 is the most potent mycotoxin ochratoxin is still more dangerous than it. As a result, ochratoxin is one of the most dangerous mycotoxins for poultry. They primarily harm the kidneys. It is produced by five more Aspergillus species in addition to Aspergillus ochraceous. Ochratoxin is generated on a variety of grains, fodder, feed stuffs and is classified into four types: A, B, C, and D. Of them, Orchatoxin A is the most poisonous, common, abundant and stable.

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Figure 1 Sources of mycotoxins

Ochratoxin can be found in maize, rice, most minor grains, and animal feed (Figure 1). It commonly occurs in poultry diets under high temperature and high moisture conditions. Younger birds are especially vulnerable to ochratoxin consumption. Acute ochratoxicosis results in mortality from kidney failure (Tahir *et al*., 2022).

Injurious effect of Ochratoxin

Ochratoxins in poultry cause death and weight loss causing decreased feed conversion, growth rate, and coloration. Ochratoxicosis in growers postpones sexual maturation. Ochratoxin can diminish egg size and quality. The immunosuppression caused by ochratoxin-A is mostly through thymus shrinkage and other affected lymphoid organs. In broilers, cell-mediated immunity is severely compromised. Depletion of antibody-containing cells in lymphoid organs impairs antibody-mediated immunity. The vaccine response is substantially compromised, and the concomitant coccidiosis and salmonellosis are aggravated.

Symptoms

The birds affected with aflatoxin are sad, thirsty, frequently pee, and eventually die due to kidney failure. The survived birds are underdeveloped, with poor feathering, anaemia,

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and immunological suppression (when ochratoxin levels more than 0.7 ppm). A loss of weight or wet droppings and an increased number of discoloured eggs can be seen. At ochratoxin levels greater than 2.0 ppm, decline in egg production, hatchability, as well as poor performance in progeny produced from affected hens is seen.

Treatment

Mycotoxin binders

Activated charcoal, synthetic Zeolites, yeast cell wall components and mineral clays like aluminosilicates and sodium bentonite are examples of mycotoxin binding agents. The effectiveness of these compounds is determined by their adsorptive activity, structure, purity, and the properties of the targeted mycotoxin. By adsorption and excretion in the faeces, feed supplementation with activated carbon decreases harmful effects of other insecticides, pesticides, and pollutants too (Ibrahim *et al*., 2023).

Precautions

i) Contaminated feed should be substituted with uncontaminated feed. Most mycotoxicosis in poultry is frequently reversible as soon as an uncontaminated diet is provided.

ii) Increase protein intake in the diet. Mycotoxins have an impact on protein and amino acid metabolism. Increasing protein intake can help to mitigate the negative effects, especially if the food is free of aflatoxin. Increase your vitamin supplementation as well.

iii) An excess of methionine and other sulphur-containing amino acids might protect chicks from deleterious effects of aflatoxin.

iv) Handling of parasitic or bacterial infections.

v) Inadequate supervision is especially dangerous to mycotoxin-stressed chickens. It should be addressed properly.

vi) Liver tonics might be given. An extra dose of a lipotropic drug, such as choline can reduce damage to liver.

vii) Taking vitamin D3 supplements might lessen harmful effects of aflatoxin like poorer egg shell quality and leg weakness.

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viii) Because mycotoxins generate free radicals, they affect poultry's antioxidant defences. As a result, vitamin E, vitamin C, and selenium intake should be increased to compensate it (Basiouni *et al*., 2023).

Prevention and Control

Mycotoxins are particularly frequent in grains, necessitating a programme to reduce their negative effects in poultry.

i) Get a cleaner feed material.

ii) Throw away any grains with any suspension of supposed of mouldy contamination like caked feed.

iii) Maintain grain moisture levels of lesser than 14%.

iv) Sun drying is the most effective means of preventing mouldy growth. However, it does not eliminate the fungal toxin.

v) Keep the feed and fodder components in a dry, finely ventilated area that is also free of insects and rodents.

vi) Proper poultry household ventilation to decrease humidity (eliminates moisture needed for fungal development and mycotoxin synthesis in feed producing units).

vii) Do not store feed intended for livestock consumption for longer than a week. Mycotoxin can develop in decaying, crusted feed in feed mills, feeders, and storage containers. As a result, constant checking of feed vessels is critical.

ix) Remove toxin-contaminated feed as soon as possible.

x) Pelletizing feed kills fungal spores and reduces fungal load. Pelleting and antifungal medication are more effective in combination.

xi) Despite all these efforts, mycotoxins do enter the feed. As a result, the most practical solution to this challenging situation is to utilise effective verified broad spectrum mould inhibitors.

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xii) Neutralisation of mycotoxins already in feed can be done by linking them to an inert substance, preventing them from being absorbed from the intestines.

Conclusions

The best practises control of mycotoxin are:

i) Preventing growing of fungus on crops during harvest, feed storage, and feed processing.

ii) Use of an appropriate mycotoxin binder to increase output and reduce costs.

iii) Prevention is more cost effective than therapy mostly in poultry diseases.

References

Ajmal, M., Bedale, W., Akram, A., & Yu, J. H. (2022). Comprehensive review of aflatoxin contamination, impact on health and food security, and management strategies in Pakistan. *Toxins*, *14*(12), 845.

Banerjee, S., Behera, R., Panda, S., Jena, G. R., Kumar, D., Naik, P. K., ... & Beura, C. K. (2022). Aflatoxins in duck production-a review. *Indian Journal of Animal Nutrition*, *39*(3), 221-234.

Basiouni, S., Tellez-Isaias, G., Latorre, J. D., Graham, B. D., Petrone-Garcia, V. M., El-Seedi, H. R., ... & Shehata, A. A. (2023). Anti-inflammatory and antioxidative phytogenic substances against secret killers in poultry: Current status and prospects. *Veterinary sciences*, *10*(1), 55.

Ibrahim, I., Natsir, M. H., Sjofjan, O., & Nuningtyas, Y. F. (2023). The combination of nano zeolite and natural feed additives as mycotoxin binders in corn feed materials. *Developing Modern Livestock Production in Tropical Countries*, 212.

Klich, M. A. (2007). Aspergillus flavus: the major producer of aflatoxin. *Molecular plant pathology*, *8*(6), 713-722.

Tahir, M. A., Abbas, A., Muneeb, M., Bilal, R. M., Hussain, K., Abdel-Moneim, A. M. E., ... & Alagawany, M. (2022). Ochratoxicosis in poultry: Occurrence, environmental factors, pathological alterations and amelioration strategies. *World's Poultry Science Journal*, *78*(3), 727-749.