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Aflatoxin B1 Hampers Bone Mineralization in Broiler Chickens

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Introduction

Broiler chicken production is a significant aspect of the global poultry industry, providing a major protein source for human consumption. However, the quality of broiler chicken meat is heavily influenced by various factors, one of which is the presence of mycotoxins in their feed. Among these mycotoxins, Aflatoxin B1 (AFB1) stands out as a potent carcinogen and detrimental substance for animal health. Beyond its well-known hepatotoxic effects, recent studies have shed light on its impact on bone health in broiler chickens. This article delves into the mechanisms by which AFB1 hampers bone mineralization in broiler chickens, highlighting the significance of addressing this issue for both animal welfare and food safety. Aflatoxins are naturally occurring mycotoxins produced by certain species of fungi, particularly *Aspergillus flavus* and *A. parasiticus*, which commonly contaminate agricultural commodities such as corn, peanuts and feed grains. Among the aflatoxins, AFB1 is the most prevalent and toxic compound. Its ingestion poses significant health risks to animals and humans alike. Once ingested, AFB1 is metabolized by the liver into several metabolites, some of which are highly reactive and capable of forming DNA adducts, leading to mutagenesis and carcinogenesis [1].

Broiler chickens are particularly susceptible to AFB1 contamination due to their high feed intake relative to body weight. Chronic exposure to even low levels of AFB1 can result in reduced growth rates, impaired immune function and increased susceptibility to various diseases. Moreover, recent research has highlighted the adverse effects of AFB1 on bone health in broiler chickens. Bone mineralization is a complex process involving the deposition of minerals, primarily calcium and phosphorus, onto a collagen matrix, resulting in the formation of strong and resilient bones. Any disruption to this process can compromise skeletal integrity and overall health. Studies have shown that AFB1 exposure in broiler chickens leads to decreased bone mineral density, altered bone microarchitecture and increased bone fragility [2].

Description

The mechanisms by which AFB1 impairs bone mineralization in broiler chickens are multifaceted. One primary mechanism involves the interference with calcium metabolism. AFB1 disrupts the balance of calcium-regulating hormones such as Parathyroid Hormone (PTH) and calcitonin, leading to dysregulation of calcium homeostasis. As a result, there is reduced calcium availability for bone mineralization, impairing the formation of hydroxyapatite crystals, which are essential for bone strength. Furthermore, AFB1 induces oxidative stress and inflammation, both of which contribute to bone resorption and impaired bone formation. Oxidative stress leads to the generation of Reactive Oxygen Species (ROS), which can directly damage bone cells and inhibit osteoblast function, thereby impairing bone formation. Additionally, inflammation triggers the release of pro-inflammatory cytokines such as Interleukin-6 (IL-6) and Tumor Necrosis Factor-Alpha (TNF-α), which promote bone resorption by activating osteoclasts and inhibiting osteoblast activity [3].

Moreover, AFB1 has been shown to disrupt the endocrine system, including the hypothalamic-pituitary-gonadal axis, which plays a crucial role in bone development and maintenance. Dysregulation of sex hormones such as estrogen and testosterone can have profound effects on bone metabolism, leading to decreased bone mineralization and increased bone turnover [4]. The impairment of bone mineralization in broiler chickens due to AFB1 contamination not only affects their overall health and welfare but also raises concerns regarding food safety. Broiler chickens with weakened skeletal structures are more prone to skeletal deformities and fractures, leading to pain and suffering. Furthermore, the presence of AFB1 residues in chicken meat and eggs poses risks to consumers, as AFB1 is a known carcinogen with the potential to cause liver cancer and other adverse health effects. Ultimately, addressing the issue of AFB1 contamination requires a multifaceted approach involving collaboration between various stakeholders, including poultry producers, feed manufacturers, regulatory agencies and research institutions. By prioritizing efforts to mitigate AFB1 contamination and its impact on bone mineralization in broiler chickens, the poultry industry can uphold animal welfare standards, ensure food safety and maintain consumer confidence in the quality of poultry products [5].

Conclusion

Aflatoxin B1 contamination poses significant challenges to the poultry industry, affecting both animal welfare and food safety. Its detrimental effects on bone mineralization in broiler chickens highlight the importance of implementing effective mitigation strategies to minimize exposure and mitigate its impact. By addressing the underlying mechanisms by which AFB1 impairs bone health, stakeholders can work towards ensuring the production of safe and high-quality broiler chicken meat for consumers worldwide. In conclusion, addressing the detrimental effects of AFB1 on bone mineralization in broiler chickens requires a multifaceted approach encompassing genetics, nutrition, management practices, regulatory measures and on-going research efforts. By implementing targeted interventions and fostering collaboration across the poultry industry and scientific community, we can mitigate the impact of AFB1 contamination and uphold the health and welfare of broiler chickens while ensuring the safety and quality of poultry products for consumers worldwide.

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Conflict of Interest

There are no conflicts of interest by author.

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