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Smith J W & Hamilton P B. Aflatoxicosis in the broiler chicken. *Poultry Sci.* 49:207-15, 1970. [Department of Poultry Science, North Carolina State University, Raleigh, NC]

For the first time, a field outbreak of suspected moldy feed toxicosis was documented as aflatoxicosis by fulfilling Koch's postulates. Symptoms useful in diagnosis and procedures for the relief and prevention of aflatoxicosis were described. Evidence was presented that mycotoxins cause serious economic loss by reducing growth rate and efficiency of conversion of feed to body mass in farm animals. [The *SCI*® indicates that this paper has been cited in more than 185 publications.]

Justification for Mycotoxin Research

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I was hired in 1967 to study moldy feed problems, thought to have killed more than 250,000 turkeys in North Carolina between 1965 and 1967. Lacking experience with poultry as experimental animals, I read, listened, observed, and did a great many profitless experiments until an opportunity arrived in the winter of 1968. This took the form of a field outbreak in broiler chickens that persisted for several months. Another fortunate occurrence was the arrival of Jeffrey W. Smith for graduate study. Jeff was a rare student; he had "eyes in his head," never did an experiment that didn't work the first time, and was deeply involved in every experiment.

Here, the progress of science was being thwarted in moldy feed problems. Aflatoxin had been discovered as the result of turkey "X" disease in England in 1960; it also affected chickens, ducks, pheasants, swine, and cattle. However, nobody had fed aflatoxin to farm animals to see if it caused "X" disease. In the North Carolina outbreak, we performed experiments using the suspect feed and experimental diets to which aflatoxin had been added, proving "X" disease and our outbreak to be aflatoxicosis.

This report was also the first convincing evidence that mycotoxicoses could be economically important in farm animals, in the absence of overwhelming mortality. Our paper provided easily detected symptoms helpful in diagnosing field outbreaks of aflatoxicosis. Poor growth rates and inefficient utilization of feed that we associated with aflatoxin can occur throughout the year in the poultry industry, and the effects can be so minor that they escape the eyes of diagnosticians. In reality, accountants and animal health scientists can make diagnoses of mycotoxicoses.[1] These facts led to the definition of safety with mycotoxins as the absence of economic loss.[2] Our finding of a regressed bursa of Fabricius, determinant of antibody formation in chickens, prefigured the profound effects of mycotoxins on the total immune system.[3]

Our demonstration that aflatoxin occurred in arriving corn and other feed ingredients, that amplification occurred during feed manufacture and storage, and that aflatoxicosis outbreaks could be ended or prevented by simple cleanup programs and informed purchasing practices led to the widespread adoption of programs for the control of molds and mycotoxins by the industry. Essential to these adoptions was our observation that birds recovered when aflatoxin was removed from their diets.

Surprisingly to me, a widely copied aspect of our study was the expression of organ size as a percentage of body weight, which could change with aflatoxin concentration. Instead of relying on subjective statements, such as "the liver was enlarged," the parameter became a continuous variable, easily handled by common statistical procedures and dose-response relationships.[4] This approach elicited much interest from animal pathologists who, at the time, were not accustomed to quantitative approaches.

I was enthusiastic from the start that our simple paper had both theoretical and practical importance, but that did not stop some of my colleagues from referring, somewhat derogatorily, to my two students and me as alpha, beta, and gamma toxins. On the other hand, friends and acquaintances told me that it provided justification for hundreds of scientists and for the loosening of purse strings by research funding agencies. We have received more than 2,100 requests for reprints, including eight in 1991—21 years after publication. I attended a symposium in which five of six speakers showed data attributed to this paper. On a more formal level, this paper was mentioned in my being awarded an honorary degree from the "Marsilio Ficino" Free University of Science, Bologna, Italy, and my receiving the Corn Products Council International Research Award. It is sobering to reflect that mycotoxins are not just laboratory curiosities but are real-world problems causing annual losses of perhaps a billion dollars.

1. **Jones F T, Hagler W M & Hamilton P B.** Association of low levels of aflatoxin in feed with productivity losses in commercial broiler operations. *Poultry Sci.* 61:861-8, 1982.
2. **Schaeffer J L & Hamilton P B.** Interactions of mycotoxins with feed ingredients. Do safe levels exist? (Smith J E & Henderson R. eds.) *Mycotoxins and animal feeds.* Boca Raton. FL: CRC Press. 1991, p. 827-43.
3. **Boonchuvit B & Hamilton P B.** Interaction of aflatoxin and paratyphoid infections in broiler chickens. *Poultry Sci.* 54:1567-73, 1975.
4. **Dixon R C, Nelson L A & Hamilton P B.** Dose-response relationships during aflatoxicosis in young chickens. *Toxicol. Appl. Pharmacol.* 64:1-9, 1982.

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