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A survey of mycotoxins in livestock feeds in Ethiopia

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Abstract

Mycotoxins in feeds are a risk factor in the production of livestock due to potential adverse health effects in exposed livestock and human exposure through animal-derived foods, particularly aflatoxin exposure via milk. A survey of commodities commonly used in livestock feeds in Ethiopia was conducted to provide information on the risk-potential associated with feed commodities. Mycotoxins included in the survey were aflatoxin, fumonisin, ochratoxin, and vomitoxin. Levels of concern (LOC) were defined as 20 ppb for aflatoxin, 5 ppm for fumonisin, 100 ppb for ochratoxin, and 5 ppm for vomitoxin. A total of 933 samples were analyzed from 22 feed distribution locations situated in major livestock-producing regions in the states of Amhara, Oromia, SNNPR, and Tigray. LOCs were reached or exceeded in 31.9 % of samples for aflatoxin, 0.1 % for fumonisin, 2.3 % for ochratoxin, and 0.0 % for vomitoxin. Samples testing at or above LOCs were not associated with specific regions, but there was an association between problematic levels and oil seed cakes. Following manufacture, oil seed cakes are distributed widely in Ethiopia, explaining the lack of regional bias in aflatoxin contamination. Future studies should investigate the production chain of oil seed cakes in Ethiopia to identify mycotoxin-production risk factors and potential risk mitigation opportunities.

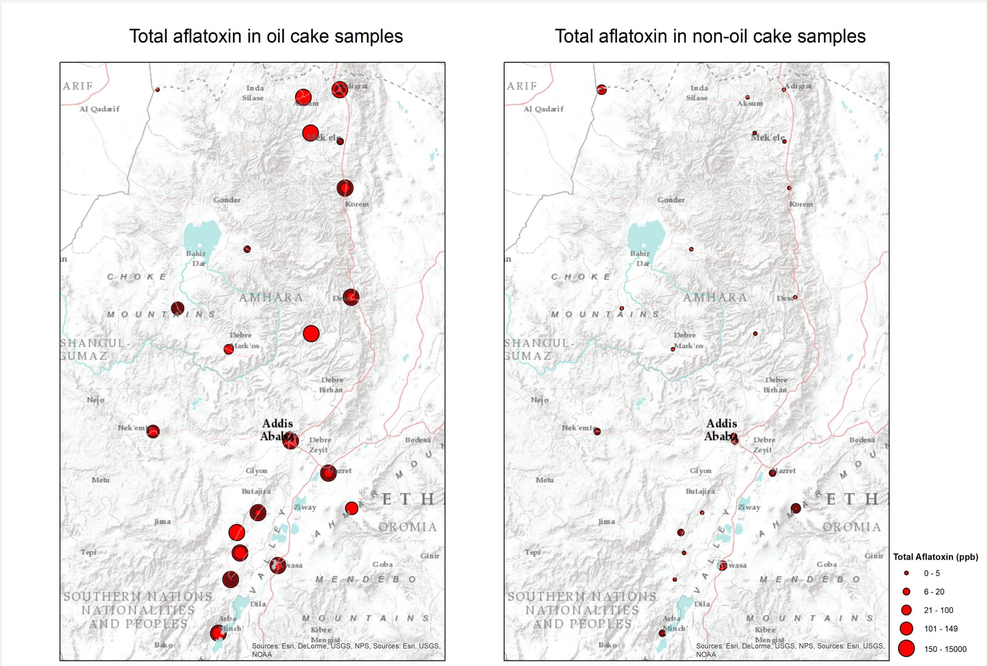

Figure 1: Aflatoxin concentrations in sampled Ethiopian livestock feeds showing results for oil seed cake samples (left), and non-oil seed cake samples (right).

Results

Aflatoxin was the most problematic mycotoxin in livestock feed ingredients, with concentrations at or above the LOC found in 31.9% of samples. Proportions of samples testing at or above LOC levels were much lower for the other toxins, with 0.1 % for fumonisin, 2.3 % for ochratoxin, and 0.0 % for vomitoxin.

Mycotoxin concentrations at or above the LOCs were strongly associated with oil seed cake samples, including oil seed cakes prepared from noug (Niger) seed, sesame seed, cottonseed, linseed, and soybeans. Non-oil seed cake samples, including maize, rice, wheat, sorghum, and raw soybean, were generally associated with low or non-detectable mycotoxin concentrations. There was no regional bias in the distribution of feed ingredient samples with mycotoxin concentrations (Figure 1).

Figure 2: Bagged livestock feeds being loaded for transport.

Figure 3: Examples of sub-optimal feed storage conditions and insect damage observed during sample collection.

Introduction

In 2015, aflatoxin concentrations were reported in Ethiopian milk samples at concentrations above those considered safe for human consumption under most international standards. Livestock feeds are the likely sources of aflatoxins in milk. Key questions that followed the aflatoxin concentration reports included:

1. How widespread were mycotoxin contamination in Ethiopian livestock feeds?
2. What mycotoxins (in addition to aflatoxins) were important contaminants of Ethiopian livestock feeds?
3. Is mycotoxin contamination in Ethiopian livestock feeds associated with particular feed ingredients?

To address these questions, Ethiopian livestock feed ingredients, collected at local points of feed distribution, were surveyed for the presence of aflatoxins, fumonisin, vomitoxin, and ochratoxin.

Methods

933 representative feed ingredient samples were collected from 22 feed distribution locations spread through the major livestock-producing regions of Ethiopia (Figure 1). The samples were ground, and analyzed in Ethiopia using lateral mycotoxin strip test kits and associated readers (Charm Sciences Inc.). Test validation was done using duplicates of 108 samples which were shipped to the Veterinary Medical Diagnostic Laboratory at the University of Missouri for analysis using HPLC methods.

Toxin concentrations were characterized relative to levels of concern (LOC), defined as 20 ppb for aflatoxin, 5 ppm for fumonisin, 100 ppb for ochratoxin, and 5 ppm for vomitoxin. The distribution of mycotoxins were mapped, separated into two feed ingredient groups: oil seed cakes and non-oil seed cakes.

Discussion

Ethiopian livestock feeds are typically sold in bagged form, from distribution facilities located in livestock-producing regions (Figure 2). Bagged feeds were therefore key sampling points to represent this type of feed. Although storage conditions at feed distribution facilities were generally good, problems that could be considered risk factors for mycotoxin production were observed during the sampling campaign (Figure 3). Poor storage conditions at feed distribution facilities were, however, not generally correlated with mycotoxin concentrations at or above LOCs. Factors that determine the risk of mycotoxin contamination of oil seed cakes are therefore more likely to be associated with earlier stages of the production and distribution chain. Future studies should investigate the production and distribution chain of oil seed cakes in Ethiopia to identify mycotoxin-production risk factors, the points in the production and distribution chain where risk factors are prevalent, and potential risk mitigation opportunities.

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