AFLATOXINS: FINDING SOLUTIONS FOR IMPROVED FOOD SAFETY

Aflatoxicosis: Evidence from Kenya

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This brief examines the impact of acute aflatoxicosis on human health in Kenya. Ingestion of large amounts of aflatoxins causes acute toxicity, and, as described below, Kenya is the country with the highest incidence of acute toxicity possibly ever documented. Outbreaks have occurred since the 1980s, with certain areas and age groups being most at risk. Apart from outbreaks, a population survey in Kenya also revealed a high exposure to aflatoxins. This essay demonstrates the cost-effectiveness of better control of aflatoxins and presents promising approaches to surveillance.

Aflatoxicosis outbreaks in Kenya

People in Kenya, especially those in the country's eastern region, have the highest known exposure to aflatoxins as evidenced by the country's history of outbreaks.

Exposure to aflatoxins occurs primarily through ingestion of contaminated food. Ingestion of aflatoxins at very high levels (>6000mg) results in hepatic (liver) failure and death within 1–2 weeks of exposure—a condition known as acute aflatoxicosis (Groopman 1988). Chronic or prolonged low-level aflatoxin consumption increases the risk for liver cancer and is associated with stunting and immunosuppression (brief 4). Aflatoxins have also been implicated in the etiology and pathogenesis of malnutrition diseases as well as in increased neonatal susceptibility to infections and jaundice (Hendrickse 1997).

In 1981, Kenya experienced its first recorded outbreak of aflatoxicosis. At that time, investigators found that after about seven days of consumption of maize grain containing 3.2–12mg/kg of aflatoxin B1, symptoms of abdominal discomfort, anorexia, general malaise, and low-grade fever were exhibited in 20 cases, with patients ranging between 2.5 and 45 years of age. Hepatic failure developed in 12 of the 20 patients, all of whom eventually died between 1 and 12 days following hospital admission.

The most severe aflatoxicosis outbreak ever reported in Kenya occurred in Eastern Province in 2004. This outbreak resulted in 317 cases and claimed 125 lives, a case fatality rate (CFR) of 39 percent. Of the 308 patients for whom age data were available, 68 (22 percent) were <5 years, 90 (29 percent) were 5–14 years, and 150 (49 percent) were >15 years. Children younger than 14 years, representing 51 percent of the child population, were thus presumed to have had a greater predisposition to aflatoxicosis risk. CFR was significantly higher in Makueni district than in Kitui district (CDC 2004). Since 2004, outbreaks among subsistence farmers have recurred annually in Eastern Province.

During the outbreak that occurred in 2010, the levels of aflatoxin-B1 serum found in Kenya were among the highest ever recorded in the world.

Assessment of aflatoxin exposure in populations

Population studies have also assessed aflatoxin prevalence in Kenya outside of outbreaks. In 2011, the US Centers for Disease Control and Prevention (CDC) conducted data analysis on aflatoxin-B1-lysine results from a subset of stored serum samples from the population survey Kenya Aids Indicator Survey (KAIS). The objectives were (1) to characterize aflatoxin exposure across Kenya; (2) to identify populations in Kenya with the highest aflatoxin exposure in order to target future public health interventions; and (3) to compare aflatoxin exposure in Kenya to other countries.

Extensive aflatoxin exposure was found throughout Kenya, with approximately 80 percent of KAIS participants having detectable levels. With the limit of detection (LOD) at 0.02 ng/mL, exposure ranged from <LOD–211 pg/mg albumin, with a median of 1.78 pg/mg albumin. The extent of exposure persisted across the spectrum of age, gender, and socioeconomic status. The exposure varied regionally and was highest among KAIS participants from Eastern Province and lowest in Rift Valley and Nyanza Provinces. These findings are consistent with the geographical distribution of acute outbreaks. Aflatoxin exposure was associated with self-reported adverse health events, and participants who reported recent illness or who recently sought healthcare had higher serum aflatoxin levels than did participants who had not recently reported illness or sought healthcare (CDC 2012).

Current interventions in Kenya

RAPID SCREENING OF GRAINS

Since these outbreaks occurred, the CDC and the Kenya Ministry of Public Health and Sanitation have focused on prevention efforts to reduce aflatoxin contamination in homegrown maize. During the 2006 outbreak investigation, a portable screening tool was adapted for rapid assessment of aflatoxin contamination in maize in the rural village setting. This tool was used to identify households with contaminated maize, a key step in the maize-replacement effort.

A Cost Effectiveness Analysis (CEA) study was carried out in 2006 to compare the benefits of replacing the current system, an aflatoxicosis intervention strategy designed to urgently identify contaminated maize and guide replacement efforts for the aflatoxicosis affected focal area of the Eastern Province. The study determined that society would save US$913.71 per aflatoxicosis case prevented by adopting the proposed new strategy—that of field testing homegrown maize for aflatoxin contamination using the portable rapid screening technology followed by laboratory confirmation (Saha 2009).

SURVEILLANCE

In May–June 2010, a surveillance system that involved the use of moisture meters coupled with rapid test kits and a laboratory confirmation system detected extensive contamination in both Eastern Province and Coastal Province. Visual inspection was most frequently used (95.0 percent), followed by laboratory testing (84.2 percent) and then moisture meter testing (84.2 percent). At the time of the assessment, only 5.3 percent of millers employed

rapid test kits. MoPHS tested aflatoxin levels at large, commercial maize millers throughout Kenya, with the majority indicating that they employ various methods to prevent aflatoxin contamination. The sensitivity of the test strip (Agri-Strip) technology in comparison with the laboratory confirmatory tests was 92 percent (Saha 2009). This meant that 8 percent of the maize tested falsely negative, posing a risk of aflatoxicosis for the population in the affected area. (Saha 2009).

Conclusions, policy choices, and recommendations

The findings from the population survey suggest that there is a large population at risk of aflatoxicosis in Kenya, particularly in Eastern, Coastal, Central, and Nairobi Provinces, with children below 15 years of age being most at risk. An innovative evidence-based strategy is urgently needed in Kenya to decrease aflatoxin exposure. Resources are also needed to quantify the burden of disease and associated health effects as well as to decrease aflatoxin exposure. We propose the following policy recommendations:

As suggested by the CEA data, a substantial potential reduction in aflatoxicosis cases and savings to society can be brought about by adopting the proposed aflatoxicosis intervention program (Saha 2009).

One practical and innovative approach to preventing morbidity from aflatoxin exposure during outbreak times is dietary interventions, such as the use of refined calcium dioctahedral smectite clay, branded under the name NovaSil. NovaSil binds aflatoxins with high affinity and high capacity in the gastrointestinal tract, preventing its bio-availability.

Due to widespread food movement across the region, a regional approach to containing aflatoxin exposure, such as the Partnership for Aflatoxin Control in Africa (PACA), should be the focus.

FOR FURTHER READING

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