

The Dangers of Aflatoxin Contamination to the Growth and Survival of Nigeria's Sesame Industry.

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ABSTRACT

The significant growth in Nigeria's sesame industry, in terms of production, export, and generation of foreign exchange to the country, may be maintained and sustained if the stakeholders understand the dangers posed to the industry by aflatoxin contamination in sesame seed. The objective of this paper is to create awareness of aflatoxin contamination in sesame seed and its possible negative effects to the industry if allowed to happen. Already aflatoxin contamination in sesame seed has been reported by some researchers. It is anticipated that the growth witnessed by the Nigerian sesame seed industry over the past decade can be eroded if stakeholders fail to take adequate measures to prevent aflatoxin contamination in sesame seed. This study suggests improvement in methods of harvesting, drying, and storage of sesame seeds as well as enforcement of strict quality testing of sesame seed consignments before shipment to other countries.

(Keywords: aflatoxin, contamination, sesame seed, agricultural commodities, fungi metabolites)

INTRODUCTION

Nigeria's sesame production saw a tremendous increase over the last ten years, from a mere 80,000 metric tonnes in 2003 to about 158,000 metric tonnes in 2012. This increase was driven by the export of sesame seed which rose from 35,000 metric tonnes in 2003 to about 140,800 metric tonnes in 2010. As a result, Nigeria's foreign exchange earnings rose from 19,000,000 US dollars in 2003 to about 139,000,000 US dollars in 2010, making sesame seed the third largest export commodity after oil and cocoa both in terms of quantity and value (FAO, 2012).

Many agricultural commodities were found to be vulnerable to attack by a group of fungi that are able to produce toxic metabolites called mycotoxins. Among various mycotoxins, aflatoxins have assumed significance role due to their deleterious effects on human beings, poultry, and livestock. Aflatoxins are potent toxic, carcinogenic, mutagenic, and immunosuppressive agents, produced as secondary metabolites by the fungus *Aspergillus flavus* and *A. parasiticus* on variety of food products (Howard, *et al.*, 1990). Among 18 different types of aflatoxins identified, major members are aflatoxin B1, B2, G1 and G2. Aflatoxin B1 (AFB1) is normally predominant in amount in cultures as well as in food products (Eaton, 1997).

The aflatoxin problem was first recognized in 1960, when there was severe outbreak of a disease referred as "Turkey 'X' Disease" in the United Kingdom, in which over 100,000 turkeys died. The cause of the disease was attributed to toxins in peanut meal infected with *Aspergillus flavus* and the toxin was named aflatoxin (Reddy and Farid, 2000). Food products contaminated with aflatoxin include cereal (maize, sorghum, pearl millet, rice, and wheat), oilseeds (groundnut, soybean, sunflower, sesame, and cotton seeds), spices (chillies, black pepper, coriander, turmeric, and ginger), tree nuts (almonds, pistachio, walnuts, and coconut) and milk (Reed and Kasali, 1987).

Aflatoxicosis is poisoning that results from the ingestion of aflatoxins in contaminated food or feed. Aflatoxin poisoning is reported from all parts of the world in almost all domestic and non-domestic animals like cattle, horses, rabbits, and other non-human primates. Aflatoxicosis is also reported in humans in many parts of the world (Gong, *et al.*, 2002).

Diet is the major pathway through which humans as well as animals are exposed to aflatoxins. Apart from this, exposure to aflatoxin can be through ingestion of contaminated milk containing Aflatoxin M1 (metabolite of AFB1) and occupational exposures to aflatoxins in agricultural workers, people working in oil mills, and granaries have been reported (Sorenson, *et al.*, 1984).

The objective of this study is to draw the attention of stakeholders in Nigeria's sesame industry to the dangers of aflatoxin contamination, considering that sesame seed is also vulnerable to attack by the same fungus that produces aflatoxin.

AFLATOXIN CONTAMINATION IN SESAME SEED

Studies were conducted on two species of seeds of sesame (a.k.a. Bennisseed) (*Sesamum indicum* L, and *Sesamum radiatum* S) inoculated with a storage fungus (*Aspergillus flavus*) previously isolated from seeds of sesame. Results showed that *S. indicum* inoculated with the test fungus *A. flavus* and incubated for a period of 20 days showed the presence of aflatoxin B₁ estimated to be 25 ppb. While seeds of *S. radiatum* inoculated with the same test fungus and inculcated for the same length of time did not show any presence of aflatoxin.

All the seeds of the two species of *Sesamum* inoculated with the test fungus and incubated for 10 and 15 day intervals showed no presence of aflatoxin. The results portray the danger of consuming infested seeds of sesame which usually appear uninfected to a casual observer and the inherent danger of using such seeds for livestock feed (Mbah and Akueshi 2009).

In another study, Diedhiou *et al.* (2009), reported an aspergillus colonization and contamination of maize and sesame kernels in two agro ecological zones in Senegal. A study of the occurrence of aflatoxins in sesame seeds was conducted in the Khorasan province of Iran between September 2009 and August 2010. One hundred and eighty-two samples were analyzed by liquid chromatography. AFB1 was detected in 33 samples (18.1%), at a mean level of 1.62 ± 1.32 ng/g, and a maximum level of 5.54 ng/g. AFB1 levels exceeded the European Union (EU) maximum tolerated level (MTL, 2 ng/g) in 9

samples, and the Iran MTL (5 ng/g) in 1 sample. Regarding total aflatoxins (AFT), the mean level was 0.92 ± 1.36 ng/g, and the maximum level was 5.54 ng/g. (Mohammad, *et al.*, 2009).

EFFECT OF AFLATOXIN TO LIVESTOCK

Animal species respond differently in their susceptibility to the chronic and acute toxicity of aflatoxins. Environmental factors, exposure level, and duration of exposure beside age, health, and nutritional status of diet can influence the toxicity (FAO, 2000). Epidemiological, clinical, and experimental studies reveal that exposure to large doses (>6,000mg) of aflatoxin may cause acute toxicity with lethal effect whereas exposure to small doses for prolonged periods is carcinogenic (Groopmann and Kensler, 1999).

The most severe case of acute poisoning of aflatoxin was reported in north-west India in 1974 where 25% of the exposed population died after ingestion of the molded maize with aflatoxin levels ranging from 6250 to 15600 mg/kg (Robens and Richard, 1992). Chronic toxicity is due to long term exposure of moderate to low aflatoxin concentration. The symptoms include decrease in growth rate, lowered milk or egg production, and immunosuppression. There is some observed carcinogenicity, mainly related to aflatoxin B1. (McClean and Dutton, 1995).

EFFECTS AFLATOXIN TO HUMAN

Aflatoxin contamination in human has been reported in several countries like India, China, Thailand, and several African countries where environmental conditions favor aflatoxin development and the threat to human health is quite high. Groopman and Kensler (1999) reported a high incidence of liver cancer in China and several West African countries. Similarly many studies conducted showed a high incidence of hepatitis B virus, where dietary exposure to aflatoxin was prevalent (Aspen Cancer Conference, 2001). Further research revealed that both aflatoxin and hepatitis B virus act synergistically in the etiology of liver cancer (Montesano, *et al.*, 1997).

EFFECTS OF AFLATOXIN TO THE SURVIVAL NIGERIA'S SESAME INDUSTRY

The most anticipated and immediate effect of aflatoxin contamination to Nigeria's sesame industry is the fall in demand of sesame seed originated from Nigeria. This will be followed by drastic fall in prices of the crop and subsequent loss of huge foreign exchange generated from its export. The greatest negative impact will be felt by the small holder sesame crop farmers who will incur huge losses of revenue due to a fall in demand and prices that will impact negatively on their living conditions. Productions of sesame seed will likely fall in the subsequent years, because most farmers will shift to cultivation of other crops that will give them maximum benefit.

WAYS TO PREVENT AFLATOXIN CONTAMINATION IN SESAME SEED

- Improve methods of harvesting and drying by ensuring that farmers harvest their crops at the end of the rainy season and allow them to be fully dried before threshing.
- Similarly improve methods of storage both from the farmers, merchants and exporters may as well help to prevent the development of aflatoxin.
- Stores should be properly ventilated to prevent the mold/fungi from growing.
- There is the need to create awareness to all stakeholders from farmers, middlemen, merchants and exporters on dangers of aflatoxin contamination to the growth and survival of the sesame industry.
- The government and all stakeholders need to impose strict quality testing for all sesame seed consignment before export. This will prevent shipment of contaminated product to foreign buyers and ensure steady and sustainable market of sesame seed from Nigeria.

REFERENCES

1. Ananth, S.B and W. Farid. 2000. "Importance of Aflatoxin in Human and Livestock Health". AFLATOXIN. *Aspergillus and Aflatoxin in Groundnut*. International Crop Research Institute

for Semi Tropics (ICRISAT). Aspen Cancer Conference: Aspen, CO. *Molecular Epidemiology. AFLATOXIN. Liver and Mutation as Paradigm*. 53. <http://www.aspencancerconference.amc.org/3g2001groopmann.htm>

2. Diedhiou, P.M., R. Bandyopadhyay, D. Atehnkeng, and P.S. Ojionbo. 2011. *Aspergillus liginization and Aflatoxin Contamination of Maize and Sesame Kernels in Two Agro Ecological Zones of Senegal*. *Journal Phytophytol*. (159):268-275.
3. Eaton, L.D. 1997. "Chapter 9.26 Comprehensive Toxicology". *Aflatoxin Toxicology*. Pergamon Publications: London, UK.
4. FAO. 2000. FAO Library. Food and Agricultural Organization of the United Nations. <http://www.fao.org/impho/hilibrary/x0036e/x0036E.htm>.
5. FAO. 2012. Food and Agricultural Organization of the United Nation. FAOstat database available at: <http://faostat.fao.org/site/567/default.aspx>.
6. Gong, Y.Y., K. Cardwell, A. Hounsa, S. Egal, P.C. Turner, A.J. Hall, and C.P. Wild. 2002. "Dietary Aflatoxin Exposure and Impaired Growth in Young Children from Benin and Togo: Cross Sectional Study". *BMJ*. 325:20-21.
7. Groopmann, J.D. and W.K. Thomas. 1999. *CRC Critical Review in Toxicology 1999*. Chapter 19, 113-124
8. Mbah, M.C. and C.O. Akueshi. 2009. "Aflatoxin In Mould Infested Sesame Seeds". *African Journal of Biotechnology*. 8(3):391-394. ISSN 1684-5315 2009 Academic Journals.
9. Mclean, M. and M.F. Dutton. 1995. "Cellular Interactions and Metabolism of Aflatoxin: An Update". *Pharmacol Ther* 1995. 65(2):163-92.
10. Mohammad, A., R.B. Hamed, and F. Javad. 2009. "A Survey of Aflatoxins in Sesame in Iran". *Mycotoxin Research*. 11/2011; 27(4):259-63. DOI:10.1007/s12550-011-0102-y.
11. Montesano, R., P. Hainaut, and C.P. Wild. 1997. "Hepatocellular Carcinoma: From Gene to Public Health". *Review, Journal of National Cancer Institute*. 89:1844-51.
12. Ramdell, H.S. and D.L. Eaton. 1990. "Species Susceptibility to Aflatoxin B1 Carcinogenesis". *Cancer Research*. (50):615-620.
13. Reed, J.D. and O.B. Kasali. 1987. "Hazards to Live Stock of Consuming Aflatoxin Contaminated Meal in Africa". *ICRISAT*

Proceedings of International Workshop on Aflatoxin Contamination in Ground Nuts. 6-9 Oct 1987.

14. Reddy, S.B. and W. Farid. 2000. "Importance of Aflatoxin in Human and Livestock Health". *Aflatoxin. Aspergillus and Aflatoxin in Groundnut*. International Crop Research Institute for Semi Tropics.
15. Robens, J.F. and J.L. Richard. 1992. "Aflatoxins in Animal and Human Health". *Rev Environ Contam Toxicol*. 127 :69-94.
16. Sorenson, W.G., W. Jones, J. Simpson, and J.I. Davidson. 1984. "Aflatoxin in Respireable Airborne Peanut Dust". *Journal of Toxicology and Environmental Health*.14:525-533

SUGGESTED CITATION

Umar, U.A., A.M. Falaki, I.U. Abubakar, and H. Mani. 2015. "The Dangers of Aflatoxin Contamination to the Growth and Survival of Nigeria's Sesame Industry". *Pacific Journal of Science and Technology*. 16(1):270-273.

 [Pacific Journal of Science and Technology](http://www.akamaiuniversity.us/PJST.htm)