



Aflatoxins in Nigerian Groundnut: Continuous Threat to Health, Agriculture and Foreign Trade

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Summary

Groundnut is the most common host of aflatoxin world wide. In Nigeria, this crop is largely grown by resource-limited farmers under rainfed conditions. Most of the groundnut and groundnut-based products grown and/or sold in Nigeria contain varying quantities of aflatoxins. At least 30% of groundnut grains and seeds sold on local markets are contaminated by aflatoxins, with 25-83% of them exceeding permissible levels for many countries, including Nigeria. Aflatoxin contaminations are higher in local groundnut varieties than in improved ones. Similarly, 87-100% of *kuli kuli* consumed in Nigeria is contaminated by aflatoxins; the situation of many other groundnut-based products are not very different from that of *kuli kuli*. This Policy Brief is an integral component of proactive measures being taken to create awareness and sustain on going measures to effectively manage aflatoxin contamination in groundnut and other crops prone to aflatoxin contamination. Other measures include regular use of good agricultural practices, consistent enforcement of pertinent existing, and constant re-assessment and revision of policies, regulations and evolving biological control methods.

1. What are aflatoxins?

Aflatoxins (*Aspergillus flavus* toxins) are poisonous substances produced by some fungi (molds) on crops, foods and feeds. They have worldwide occurrence, usually in tropical and sub-tropical areas (latitudes 35° North and 35° South). Fungi of the *Aspergillus* group are responsible for secreting these toxins, [mainly *Aspergillus flavus* and *A. parasiticus*]. They live in soils and decayed materials. When their spores are released, they infect crops on farms, produce in stores and processed products.

Aflatoxin: A dangerous mycotoxin

Aflatoxins belong to a larger family of diverse and highly toxic mycotoxins produced by some pathogenic fungi. There are six major forms of Aflatoxins - Aflatoxin B₁, B₂, G₁, and G₂ (found in plant-based foods and feeds) and Aflatoxin M₁ and M₂ (found in milk and milk products).

Aflatoxin B₁ (AFB₁) is the most dangerous form due to its direct link with the human liver cancer, immune system suppression and stunted growth in children.

2. Crops prone to Aflatoxins contamination

Aflatoxins contaminate a wide range of crops and their products. The crops mostly affected are groundnut, maize, sorghum, millet, rice, sesame, wheat, cowpea, spices and cassava.

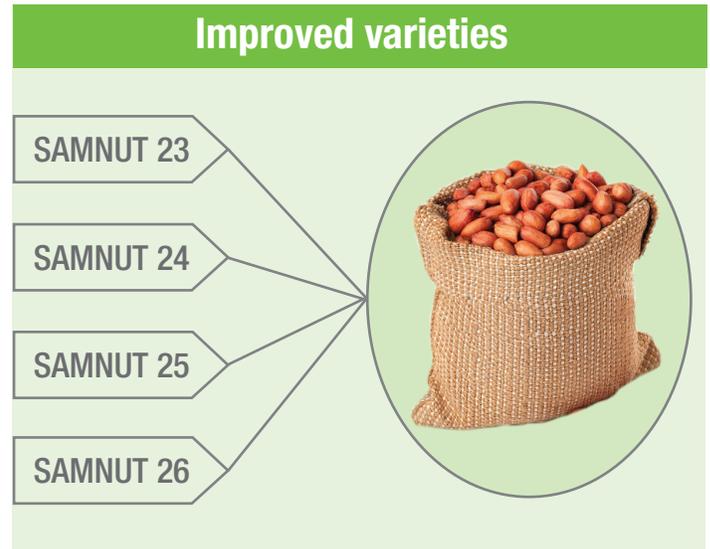
Groundnut is reported to be the most common host of aflatoxin worldwide. This crop is largely grown by resource-limited farmers under rainfed conditions. It is a core component of farming systems, source of employment and cash incomes in the major producing states of the Northwest, Northeast and North-central regions of Nigeria. It can be consumed raw, boiled, roasted, processed and/or incorporated into other foodstuffs. Groundnut cake (*Kuli kuli*) is commonly consumed as a snack, while both the cake and haulms are used as feed to livestock.



AFB₁ contaminations are also higher in all local groundnut varieties (10.15 µg/kg-13.74 µg/kg) compared to the **improved varieties (SAMNUT 23, SAMNUT 24, SAMNUT 25 and SAMNUT 26)** released by the Institute for Agricultural Research (6.04 µg/kg-10.49 µg/kg). These varieties are being promoted by development partners of the Nigerian Government. Likewise, groundnut shelled by hand are reported to have lower levels of AFB₁ (39 µg/kg) compared to seeds shelled mechanically (338 µg/kg).

3. Outcomes of research on Aflatoxin in groundnut and groundnut products in Nigeria

Over the years, researchers have demonstrated that most of the groundnut and groundnut-based products in Nigeria contain varying quantities of Aflatoxins. At least 30% of the groundnut grains and seeds sold on local markets are contaminated by aflatoxins, with 25-83% of them exceeding permissible levels for countries of the European Union, while 14-25 % are beyond US and Nigerian permissible limits. Average Aflatoxin concentration in fresh local varieties of groundnut was recently found to be 19.6 µg/kg, which is below the Nigerian and US limits (Table 1). Within the framework of a country-led strategy mission, Aflatoxin concentrations in groundnuts meant for consumption have been reported from 9.50 to 534.50 µg/kg.



AFB₁ concentrations in *kuli kuli*, a groundnut product widely consumed in different forms by a vast majority of Nigerians, range between 4.10-268.00 µg/kg, which is above the 2 µg/kg limit for Nigeria and 20 µg/kg limit for groundnut. Indeed, 87-100% of *kuli kuli* consumed in Nigeria is contaminated by aflatoxin. The situation of several other groundnut-based products are not very different from that of *kuli kuli*. For example, between 91-96% of roasted groundnut sold at different locations across Nigeria are contaminated by AFB₁ with concentrations ranging between 1-65 µg/kg.

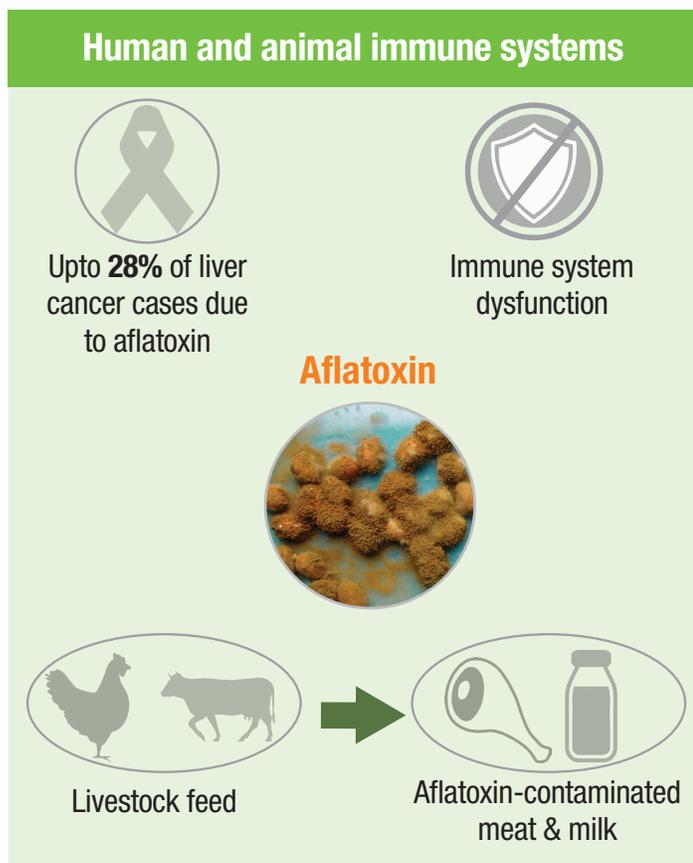
Table 1. Aflatoxin limits for commodities for direct consumption.

Countries	Aflatoxin Limits	Additional information
Nigeria	4 µg/kg	Maize
	20 µg/kg	Groundnut
	4 µg/kg	<i>Kuli kuli</i>
	10 µg/kg	Sorghum
European Union	4 µg/kg	Total aflatoxins (B ₁ , B ₂ , G ₁ and G ₂)
	0.05 µg/kg	Aflatoxin M ₁ in milk and milk products
	0.025 µg/kg	M ₁ for infant foods
United States of America	20 µg/kg	Total aflatoxins in all foods except milk
	0.5 µg/kg	M ₁ in milk
Australia and Canada	15 µg/kg	Total aflatoxins in all nuts

4. Impacts of Aflatoxin contamination on human health, agriculture and trade

Continuous exposure to food and feed contaminated by aflatoxins can lead to suppression of human and animal immune systems, increased viral load in those living with HIV and AIDS, infertility in men, liver cancer, and even death. Since its identification, evidence shows that aflatoxins cause liver cancer in humans and are implicated in up to 28% of cases of liver cancer worldwide. Aflatoxin-related cancers are the fifth- and seventh-most common cancers in men and women respectively. In poultry and cattle, egg and milk production can drop with a corresponding decrease in weight gain leading to increased mortalities. Africa loses about 1.5 billion Naira (about US\$500 million) annually in export trade due to systematic rejections of export crops and animal products with unacceptable levels of aflatoxins. The EU rejected 24 agricultural commodities from Nigeria, due to contamination with aflatoxins and pesticide residues including groundnuts, which was specifically rejected due to aflatoxins. Also, the EU ban on import of five (5) commodities from Nigeria led to a decline of ₦671.1 billion in import revenue. Consequently, attempts to export crop contaminated by aflatoxins has led to serious loss of trade revenue and diplomatic humiliation to Nigeria.

Aflatoxin contamination was the core reason for export sanctions and notifications by the European Union (EU)



to Nigeria in 2016. This ban motivated nation-wide high level advocacy campaigns on agricultural quality control and standardization across all the six geo-political zones of Nigeria. These campaigns recognize the pivotal role of food safety across agricultural sector value chains from production, processing, transportation, consumption to export.

5. Managing Aflatoxin contamination in groundnut and groundnut-based products

Good agricultural practices (GAP) – using the most appropriate seeds, timely planting, ensuring adequate farm sanitation (weeding when required), harvesting when crops are matured, adequate drying of crops after harvest, respecting basic hygienic condition during processing can keep away Aflatoxin contamination. Similarly, emerging bio-control methods could be applied, where feasible, to manage Aflatoxin contamination. While a majority of Nigerian resource-limited farmers are willing and able to implement farm-level measures, an inclusive approach to food safety and quality regulations remains supreme.

6. Conclusions and Policy Implications for Nigeria

Good agricultural practices and consistent enforcement of food safety regulations is a motivation for placing Aflatoxin-free groundnut on both domestic and foreign markets. Nigeria has already engaged on an aggressive export promotion drive on food safety and quality control. Complementary measures should include:

- recurrent awareness creation about the harmful effects of aflatoxins on human health and nutrition;
- development and facilitation of access to aflatoxin-free groundnut varieties and other crops liable to contamination;
- identification and promotion of alternative non-food uses of aflatoxin-contaminated groundnut, such as biofuels in industries;
- resolute enforcement of existing policies and regulations of crops liable to aflatoxin contamination meant for domestic and exports markets;
- acquisition of Aflatoxin testing facilities and the systematic detection of Aflatoxins loads in groundnuts;
- development/implementation of an inclusive Aflatoxin national strategy that goes beyond departmental and institutional mandates;
- enhancement of national capacities on Aflatoxin detection and quantification.

7. Key documents consulted and further reading

Ezekiel CN, Sulyok M, Warth B, Odebode AC and Krska R. (2012) Natural occurrence of mycotoxins in peanut cake from Nigeria. *Food Control* 27(2):338-342. DOI: 10.1016/j.foodcont.2012.04.010

Oluwabamiwo BF, Nden E and Abdullahi M. (2017). Food safety challenges of *Kulikuli* sold in Kaduna metropolis. Presented at the 12th Annual conference of the Mycotoxicology society of Nigeria held 1-3rd November 2017 at the Federal. Institute of Industrial Reserch, Oshodi, Lagos.

Ifeji EI, Makun HA, Mohammed Adeyemi RYH, Mailafiya SC and Olurunmowaju YB. (2014). Natural occurrence of Aflatoxin and Ochratoxin A in raw and roasted groundnut from Niger State. *Mycotoxicology* 1:35-48

Afolabi CG, Ezekiel CN, Kehinde IA, Olaolu AW and Ogunsanya OM. (2015) Contamination of Groundnut in South-Western Nigeria by Aflatoxigenic Fungi and Aflatoxins in Relation to Processing. *Journal of Phytopathology*. 163(4)279–286.

Oyedele OA, Ezekiel CN, Sulyok M, Adetunji MC, Warth B, Atanda OO and Krska R. (2015) Mycotoxin risk assessment for consumers of groundnut in domestic markets in Nigeria. *International Journal of Food Microbiology*. 251: 24-32

Ogara IM, Oluwabamiwo BF, Adedayo VO, Adgizi EA, Idahor KO and Ari MM. (2017) Aflatoxin B1 of Freshly harvested, hand and Machine shelled groundnuts and Groundnut cake. *Production Agriculture and Technology*. 13 (1): 26-29.

Ezekiel CN, Sulyok M, Babalola DA, Warth B, Ezekiel VC and Krska R. (2013) Incidence and consumer awareness of toxigenic *Aspergillus* section *Flavi* and Aflatoxin B1 in peanut cake from Nigeria. *Food Control* 30(2):596-601 DOI: 10.1016/j.foodcont.2012.07.048

Kayode OF, Sulyok M, Fapohunda SO, Ezekiel CN, Krska R and Oguntona CR. (2013) Mycotoxins and fungal metabolites in groundnut- and maize-based snacks from

Nigeria Food Additives Contaminants, Part B: Surveillance 6(4):294-300. doi: 10.1080/19393210.2013.823626.

Ezekiel CN, Kayode FO, Fapohunda SO, Olurunfemi MF and Kponi BT. (2012) Aflatoxigenic molds and Aflatoxins in street-vended snacks in Lagos, Nigeria. *Internet Journal of Food Safety*, 14: 88–92.

Felagha I, Ayalogu OE and Ifeanacho MO. (2016) Total Aflatoxin Contamination of Wheat, Groundnut and Their Products Sold in Three Markets within Port-Harcourt Metropolis, Nigeria *Journal of Environment and Earth Science*. 6(8): 45-49.

Jolly PE, Inusah S, Lu B, Ellis WO, Nyarko A, Philips TD and Williams JH. (2013) Association between high Aflatoxin B₁ and high viral load in HIV Positive people. *World Mycotoxin Journal* 6: (3) 255-261

Dhanasekaran D, Shanmugapriya S, Thajuddin N and Pannerselvam A. (2011) Aflatoxins and Aflatoxicosis in humans and animals In: Guevara-Gonzalez, R. G. (Ed.) *Aflatoxins-Biochemistry and Molecular Biology*. 221-253. DOI: 10.5772/896

Fashube B. (2017) Why EU Rejected 24 Nigerian Food Product – NAFDAC. [http://globalvillageextra.com/en/index.php/2017/06/05/why-eu-rejected-24 Nigerian food-product-NAFDAC/](http://globalvillageextra.com/en/index.php/2017/06/05/why-eu-rejected-24-Nigerian-food-product-NAFDAC/). Accessed 21.06.2017

Makun HA. (2017) Improving public health and international trade through mycotoxin control. Keynote address presented at the 12th Conference of the Mycotoxicology Society of Nigeria, held at the Federal Institute of Industrial Research, Oshodi, Lagos.

PACA (2017). Review and Update of the Nigerian Aflatoxin Assessment and Mitigation Strategy. Final Report, 139 pp.

Liu Y and Wu F (2010). Global burden of Aflatoxin-induced hepatocellular carcinoma: A risk assessment. *Environ Health Perspect* 118: 818–824.

International Agency for Research on Cancer (2010). Agents Classified by the IARC Monographs, Volumes 1-100. 2010.