

Acute aflatoxin exposure & Impacts: The Kenyan example and response towards outbreaks

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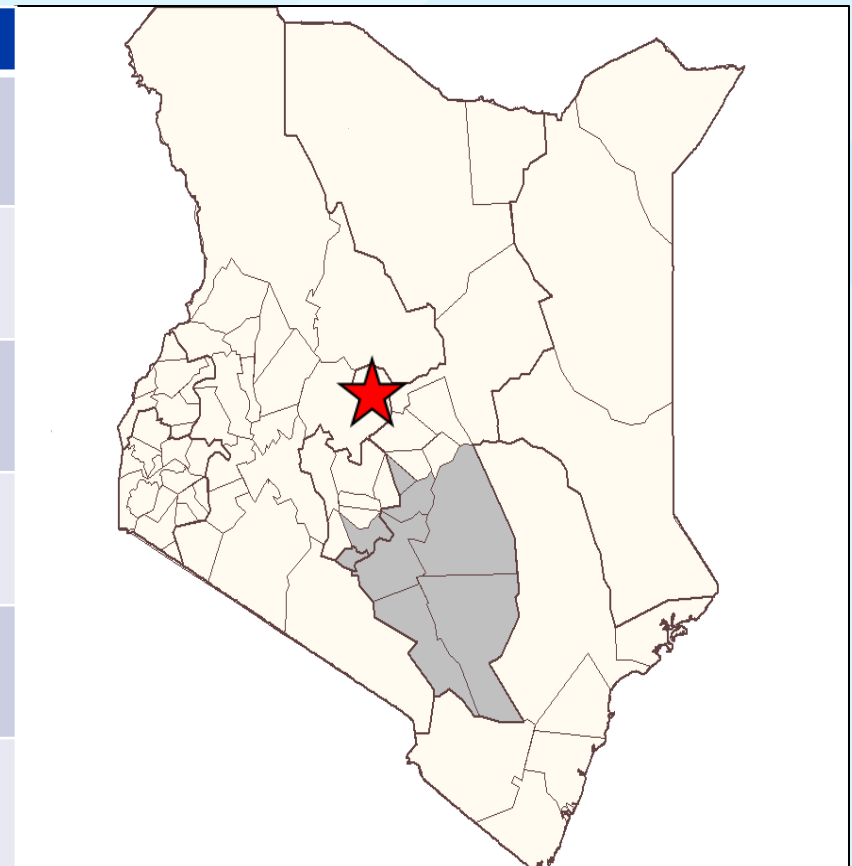
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Aflatoxicosis in Kenya

Makueni and Kitui Counties, Kenya

Year	Region	Cases	Deaths	CFR
1981	Makueni/Kitui	20	12	60
2004	Makueni/Kitui	317	125	39
2005	Makueni/Kitui	75	35	49
2006	Makueni/Kitui	51	21	41
2007	Makueni/Kitui	34	16	47
2014	Oloitoktok, Kajiado	27	10	40



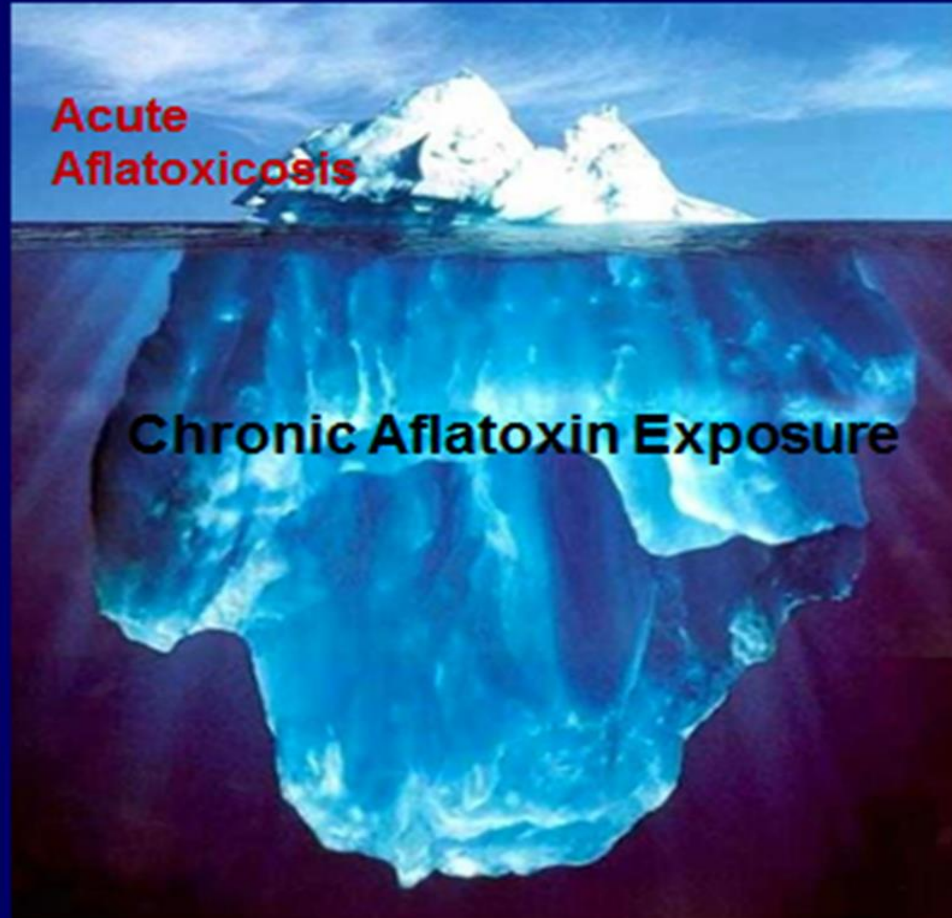
Aflatoxicosis in Kenya

□ Aflatoxin exposure

- Chronic exposure is endemic
- Acute exposure (i.e., aflatoxicosis) occurs almost yearly



Aflatoxicosis



Aflatoxin

- ❑ Most important for toxicity & widespread
- ❑ Unavoidable contaminant: cereals, rice, cassava, nuts, chillies, spices, juices, butter, eggs, milk, bread, meat
- ❑ Lipophilic therefore crosses placental barrier
- ❑ 4 main aflatoxins: B1, B2, G1, G2 and milk toxin M1
- ❑ B1: most toxic, abundant & potent carcinogen

Aflatoxin

- Health effect; immunomodulation
growth retardation/stunting
hepatocellular carcinoma
Death

CHILDREN ARE NOT LITTLE ADULTS



Giotto, National Gallery, Washington DC



Raphael, National Gallery of Art, Washington, DC



CHILDREN ARE NOT LITTLE ADULTS



1. Different and unique exposures
2. Dynamic developmental physiology
3. Longer life expectancy
4. Politically powerless



How Children are Different

Short Stature-
closer to ground



Hand to mouth
activity



Increased food
intake and
metabolic rate



Increased air intake



Altered excretion



Increased skin
surface area



Long "shelf life"



Ongoing organ
development



Aflatoxicosis

- Aflatoxicosis = acute poisoning caused by aflatoxins
 - Jaundice, vomiting, abdominal pain, fever, oedema



MYCOTOXINS



FAO, 1991

IMMUNOSUPPRESSION

- **Dietary exposure**
 - Chronic ingestion of aflatoxin B₁ and Tricothecenes have potent immunosuppressive effect and are carcinogenic

Immunotoxicity in humans

- ❑ Threshold dose unknown
- ❑ 2 main studies in West Africa (Turner PC 2003; Jiang 2005)
- ❑ “limited, inconsistent and uncertain”

Aflatoxin & immunomodulation

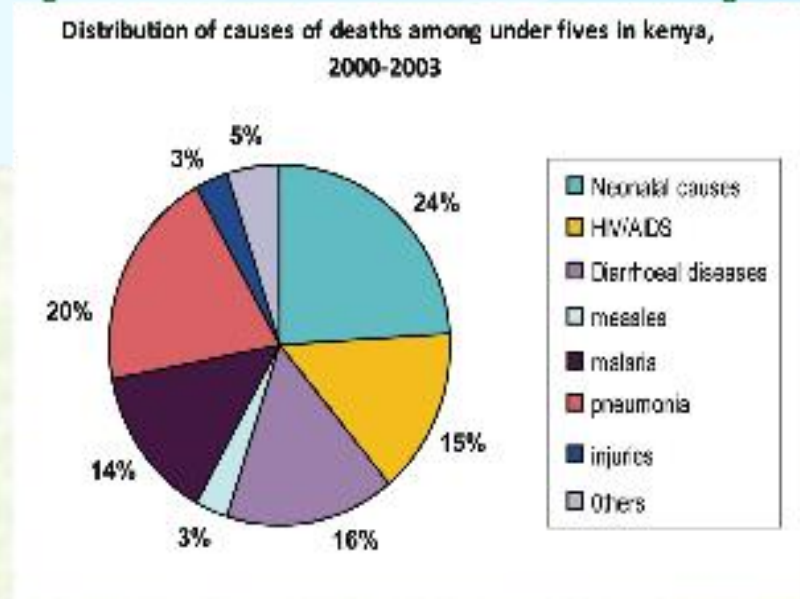
- ❑ In vivo & in vitro studies of animals & human cells (Gallikeev 1968, Pier, 1970)
- ❑ Modulate cytokine production (Oswald 2005, Bondy 2000)
- ❑ Decrease T or B lymphocyte activity
- ❑ Impair macrophage/neutrophil functions,
- ❑ Suppress NK cells-mediated cytotoxicity
- ❑ Depress immunity to vaccinations (Yi Jiang 2008)

❑ Aflatoxin-albumin adduct biomarker have been associated with a decreased potential for antibody responses, decreased immune cytotoxic activity, and decreased numbers of regulatory T cells, which may result in hyperactivation of the immune system (Jiang Y et al. Clin Dev Immunol 2008;

Statement of problem

- ❑ High morbidity and mortality in the paediatric population due to vaccine-preventable illnesses continues despite varied and exerted national efforts to address this.

Figure 3: Distribution of Causes of Death among Under Fives in Kenya



Source: WHO, Kenya Mortality Country Fact Sheet 2006

Doing nothing



Justification of an outbreak response

- The Disease Surveillance and Response Unit in the Ministry of Health receives reports of suspected cases
- Cases reported during the high risk season (April – June) based on previous outbreaks in Kenya.
- Emergency meeting is convened at the DSRU with partners and FELTP residents
- Protocol is reviewed

Objectives of response

- To determine the extent of aflatoxicosis outbreak
- To confirm the existence of an outbreak of aflatoxicosis
- To characterize the aflatoxicosis cases
- To establish factors associated with aflatoxicosis poisoning.
- To determine levels of aflatoxin in case household food samples
- To provide health education on ways of reducing aflatoxin exposure

Methods- Data Collection

1. *Records Review*

- Review of the line list of suspected cases reported through the hospital-based surveillance
- Review of inpatient and outpatient registers in selected health facilities to establish the number of acute jaundice cases using a data abstraction form

2. *Case Patient/Proxy Interviews*

- Hospitalized cases using a structured questionnaire.
- Collect a serum sample from the suspected case patient
- For fatal cases, a proxy is interviewed

Data collection (cont)

3. *Active Case Search*

- Visit suspected case patients' villages and households and conduct interviews with each family member.
- Administer the household maize questionnaire to the consenting head of household and collect a maize/flour sample for aflatoxin testing.
- Team conducts health education on ways to prevent aflatoxin exposure.

Diagnosis and analysis

- ❑ Diagnosis is made on the basis of clinical presentation, specifically clinical suspicion.

- ❑ Steps taken to assist with diagnosis:
 - 1) Testing food being consumed by the case-patient for aflatoxin.
 - 2) Ruling out and testing for other causes of acute hepatitis.
 - 3) Serum levels of aflatoxin

- ❑ Analytical method:-
high performance liquid chromatography–electrospray tandem mass spectrometry (HPLC-ESI-MS/MS)

Aflatoxin Exposure Put into Perspective

	Levels (pg/mg) albumin	% Detectable
Aflatoxicosis outbreak in Kenya	120-1200	
Kenya Aflatoxin Sero-Survey (2007)	<LOD – 211 (HPLC-ESI-MS/MS)	78
Uganda Aflatoxin Sero-Survey(2010)	<LOD- 173.8 (HPLC-ESI-MS/MS)	72
United States National Health and Nutrition Examination Survey (NHANES) 1999-2000 survey (Schleicher et al., 2013)	<LOD – 4.43 (Isotope dilution- ID-LC–MS/MS)	1

Challenges

- ❑ No local lab capacity to test for aflatoxin in serum
- ❑ Threshold of aflatoxin levels where you would start to see health effects are unknown
- ❑ Coordination - cross-cutting/ Multi-sectoral
- ❑ Replacement - withdrawal of contaminated food
- ❑ Lack of affordable Rapid diagnostic kits at village/sub-county level for early detection of aflatoxin contamination and for surveillance.

Recommendations – Outbreak response

- Regional reference lab should be established
- Develop/strengthening a monitoring system (in foods and of jaundice - Early Warning System)
- Enhance multi-sectoral collaboration - through the Outbreak Control Team / Emergency Operating Center
- Public Private Partnerships
- Resources are needed to quantify the burden of disease and associated health effects

Thank You!

Asanteni sana

