Human health effects of aflatoxins

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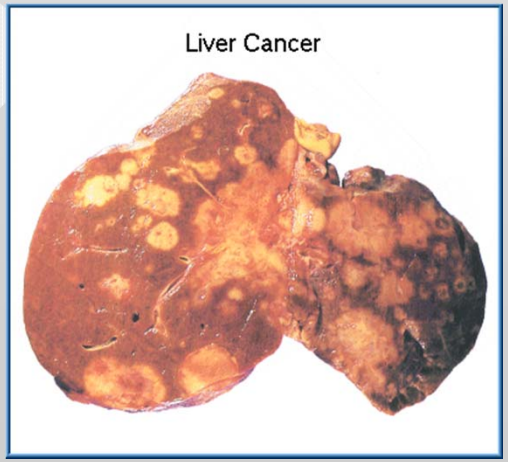
Toxicity of aflatoxins

- Acutely toxic
- Immunosuppressive
  - Increase HIV viral load in infected individuals (in Ghana - Jolly et al. 2013)
- Mutagenic
- Carcinogenic
- Impair growth in young children
- Aflatoxins are classified as compounds carcinogenic to humans

Health effects

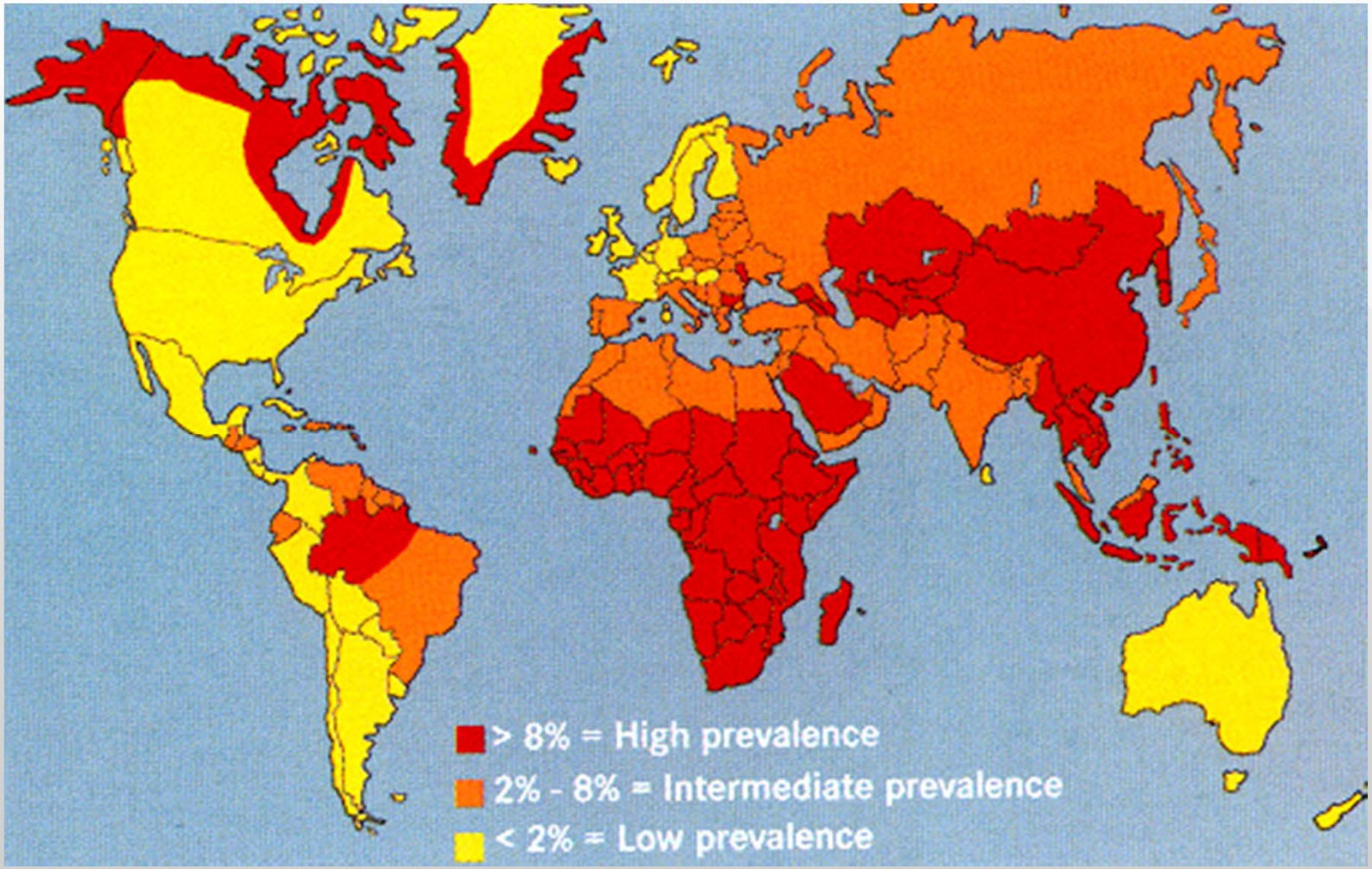
- High (acute) levels of contamination (above 200 ppb)
  - Direct outbreak of human disease e.g. Aflatoxicosis in Kenya, 265 people died
  - Acute illness and death, usually through liver cirrhosis
- Low (chronic) levels of contamination
  - Child stunting and underweight (Togo, Benin – Gong et al, 2004 and Tanzania
  - Immune suppression (The Gambia-Turner et al. 2003)
- Acute and chronic contamination
  - Liver cancer



Liver cancers cases attributable to aflatoxins *(Liu and Wu 2010)*

- 25,200 – 155,000 cases of liver cancer are attributable to aflatoxins
  - This is up to 28.2% of all global liver cancers
- Most cases occur in sub Sahara Africa, Southeast Asia and China
- These regions suffer from high Hepatitis B virus (HBV) infection and uncontrolled aflatoxins in foods

Global prevalence of chronic Hepatitis B virus infection 1997



HBV infection contributes to liver damage that is potentiated by chronic aflatoxin exposure

- The virus may interfere with aflatoxin detoxification process
- HBV-infected hepatocytes are prone to aflatoxin induced DNA damage
- Replication of the virus may contribute to the mutation potentiated by aflatoxins

Risk for primary liver cancer attributable to aflatoxins:

Exceeds 1case per year per 100,000 people

Country	HBV positive (Cases/year/100,000 people)	HBV negative (Cases/year/100,000 people)
Mozambique	54	1.8
Nigeria	68.1	2.27
Kenya	39.9	1.33
Tanzania	15.0	0.5
USA	0.008	0.003

The risk for HBV positive is up to 30 times higher than for HBV negative (Liu and Wu 2010)

Risk of liver cancer is very high in Africa and is related to high aflatoxin exposure *(Shephard 2008)*

Country(food item)	**Food intake** *(g/person/day)*	**Exposure** *(ng /kg body weight /day)*	**Risk** *(Cases/year/100, 000 people)*	**MoE**
Kenya (Maize)	400	353	29.2	0.5
Ghana (Kenkey)	1000	850	70.1	0.2
Tanzania (Local brew)	1048	402	33.1	0.4
Gambia (Groundnuts)	65	16	1.3	10.6

- Risk exceeds 1 case per year per 100,000
- Margin of Exposure (MoE) is lower than 10,000

Options to minimize exposure

- Reduce contamination in food
  - Setting maximum tolerable limits (MTL)
  - Applying GAP, sorting, dehulling etc
- Reduce consumption of susceptible food
- Reduce both contamination and consumption

Challenges for exposure reduction

- Reliance on one or two crops for food
- High occurrence of aflatoxins in the foods (staples)
- Low level of awareness on the problem of aflatoxins contamination and potential mitigation measures
- Low capacity for risk assessment and management for aflatoxins

Population liver cancer risk (cancers per 100,000 population) for different food intakes at different aflatoxin B1 contents *(Shaphard 2008)*

Aflatoxin B1 (ng/g)	Food Intake (g person^{-1} (60 kg) per day)					
	10	50	100	150	200	400
1	0.014	0.069	0.14	0.21	0.28	0.55
2	0.028	0.14	0.28	0.41	0.55	1.1
5	0.069	0.34	0.69	**1**	1.4	2.8
10	0.14	0.69	1.4	2.1	2.8	5.5
20	0.28	1.4	2.8	4.1	5.5	11

The blue colour values represents risk of concern (above 1 per 100,000)

Conclusions

- Risk of aflatoxins exposure in Africa is very high (MoE < 10 in most countries)
- Risk of liver cancer attributable to aflatoxins in Africa is unacceptably high (More than 1case per year per 100,000 people)
- Take urgent preventive measures:
  - Incorporate HBV vaccination in national vaccination programs
  - Diversify our diets to include foods that are less susceptible to aflatoxins
- Initiate aflatoxins control programs:
  - Raise awareness on aflatoxins
  - Build capacity for aflatoxins risk assessment, management and communication
  - Include aflatoxin exposure in national food borne surveillance systems

Thank you