Aflatoxin and Child Health

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OUTLINE

- Current Issues on Malnutrition.
- What are aflatoxin?
- Linking aflatoxin to child growth/heath. What are the evidence?
- Mitigation of aflatoxin and possible solutions
- Conclusion

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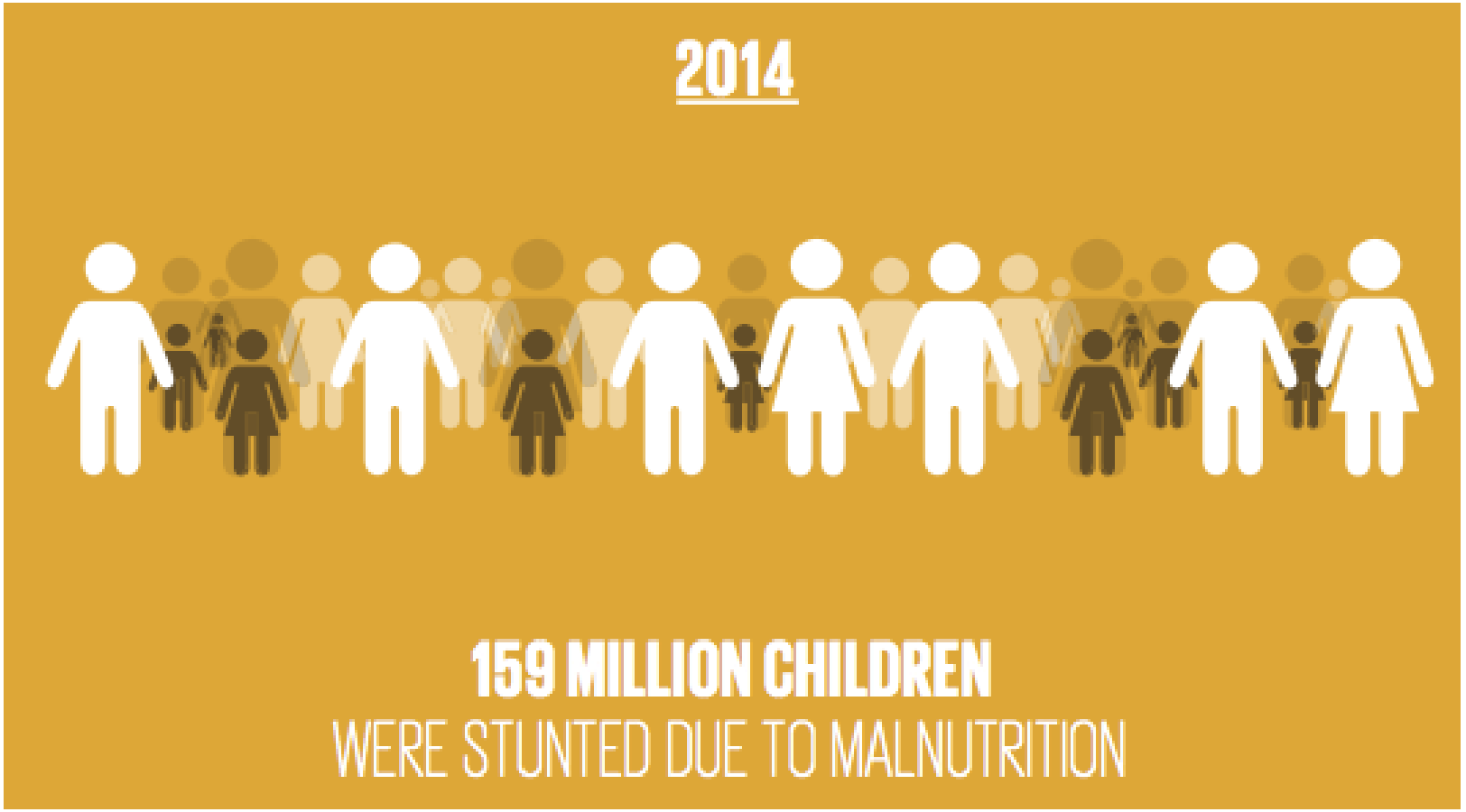
KEY FACTS



Chronic Malnutrition

Growth retardation in young children associated with:

- delays in cognitive development,
- lower school achievement,
- lower earnings and a higher probability of non-communicable chronic
  - diseases at adulthood.

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THE CALL TO ACTION

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

BY 2030
STUNTING NO LONGER IMPACTS CHILD DEVELOPMENT.

Current evidence on most effective way to reduce stunting:

Several Research efforts are focusing on identifying presently unknown causes of growth retardation!!!!

Mycotoxins (e.g. Aflatoxin is one of those UNKs)

- Scaling up of 10 proved nutrition-specific interventions to cover 90% of stunted will reduce stunting by 20% ONLY?? (Lancet 2013)

What are Aflatoxins

- Aflatoxins (B_1, B_2, G_1, G_2) are natural toxins produced by *Aspergillus* fungi which infect maize, groundnuts, wheat, and many other staple foods.

- They are class 1 carcinogen (IARC), mutagenic and also passed to human consumers via meat and milk (including breast milk) as Aflatoxin M_1

- Drought stresses crops, pest infestation, poor GAP and GMP increase infection rates

- These toxins are developed through the food value chain with increase in toxin development at storage

What do we know about Aflatoxins toxicity?

- Acute Exposure
  - If large doses are eaten, it will cause rapid death (e.g. Aflatoxicosis; Kenya 2004, 317 cases of reported death)

- Chronic exposure
  - Chronic exposure to low doses cause of liver cancer
  - May cause child stunting and low birth weights in animals and humans!!!!

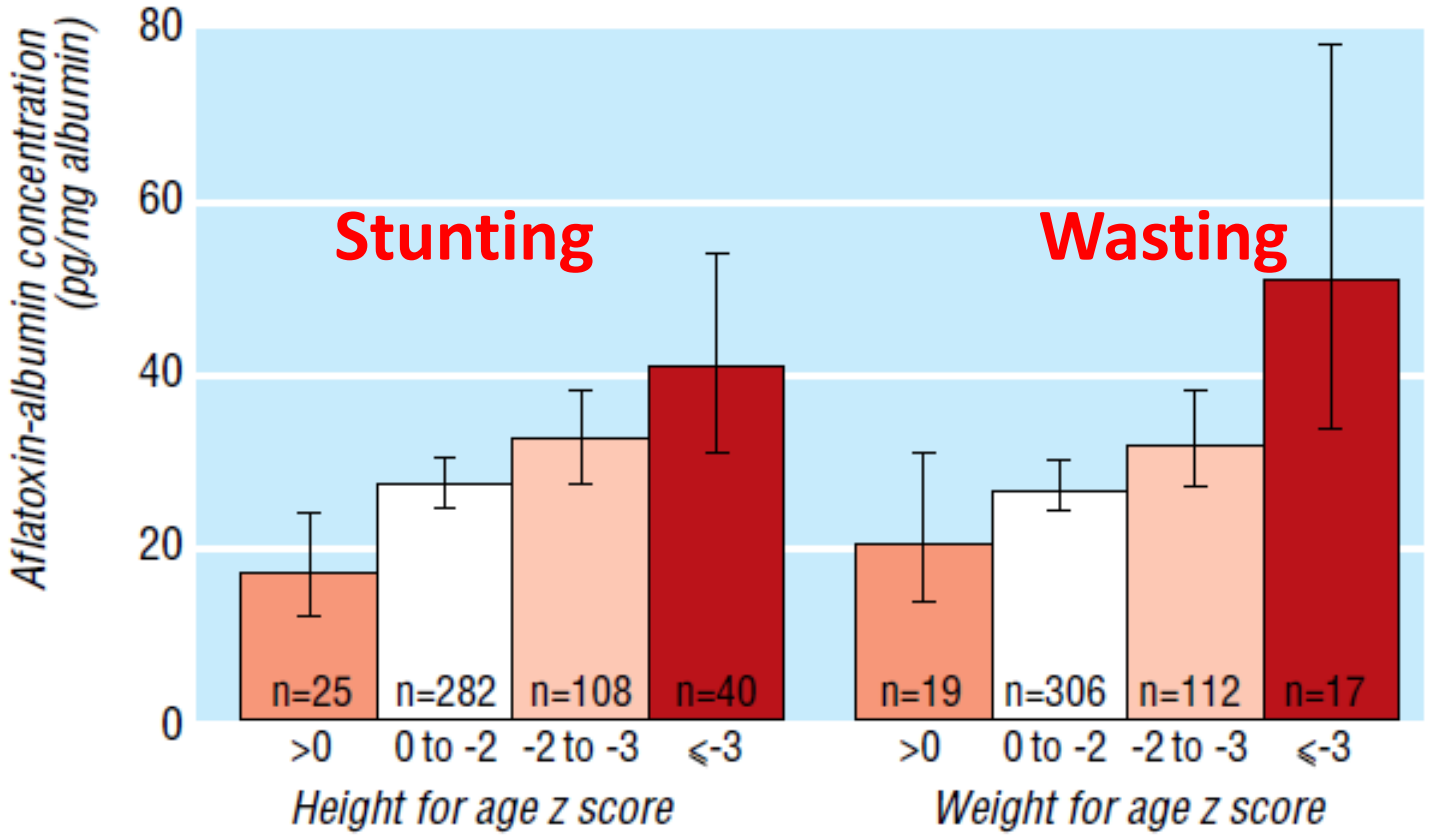
Exposure to Aflatoxin

Utero exposure: detectable levels in samples
(Wild *et al*., 1992; Turner *et al*., 2007; Gong *et al*., 2002; Hernandez-Vargas, 2015)

Breastfeeding: High levels of aflatoxin detected in breast milk samples
(Lamplugh *et al*., 1988; Wild *et al*., 1991, Tchana *et al*., 2010)

Complementary foods: High levels detected especially where maize and groundnuts are dietary staples including cow's milk
(Gong et al., 2012, Adejumo et al., 2013, Mwanza, 2007, Tuner, 2013, Kumi *et al*., 2014)

- Gong et al (BMJ, 2002) showed that **stunting** and **weight for age** was inversely related to aflatoxin levels in Gambia. Jolly and colleagues (Peanut Innovation Lab) have shown the same in Ghana.



Gong et al, BMJ 2002

How does Aflatoxin cause stunting? Exact Mechanism is still missing; however several has been proposed:

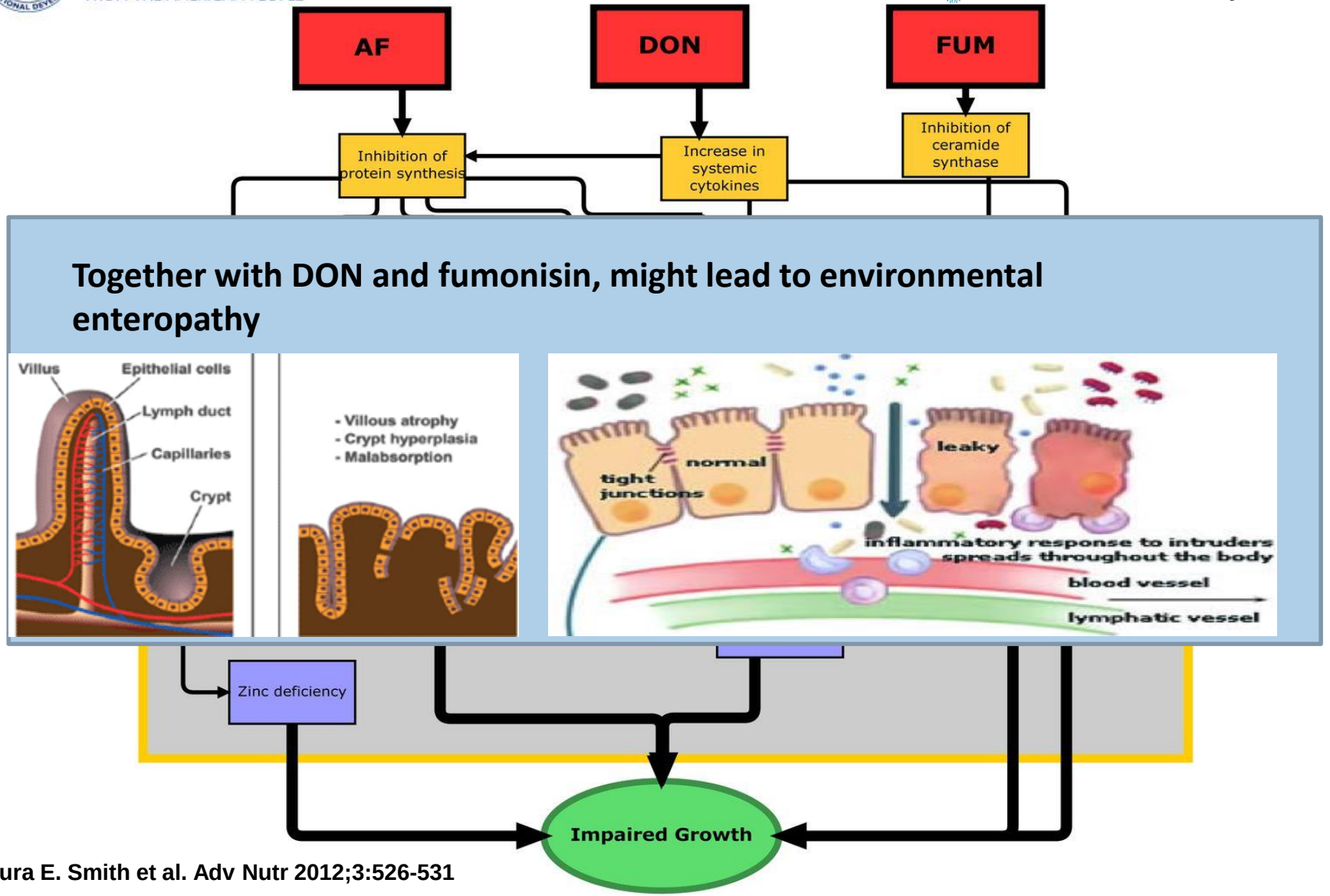
1) Immunomodulation associated with aflatoxin exposure (Bondy and Pestka, 2000; Turner *et al*., 2003) ---cause recurrent infections in children, which can lead to growth impairment (Gong *et al*., 2008)

2) Changes in intestinal integrity (possibly in part resulting from immunomodulation) could make hosts more vulnerable to intestinal foreign microbes (Gong *et al*., 2008)

3) Downregulation of genes associated with energy production and fatty acid metabolism (Yarru *et al*., 2009)

4) Impairment of protein synthesis and the inability to mobilize fat (Kocabas *et al*., 2003)

5) Changes in hepatic metabolism of vitamins and micronutrients (Schaeffer and Hamilton, 1991).



Laura E. Smith et al. Adv Nutr 2012;3:526-531

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Interventions to reduce aflatoxin risk

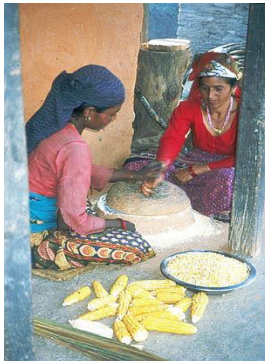
Reduce Exposure

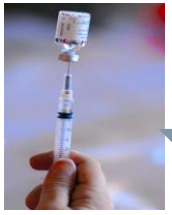
Preharvest

- Good agricultural practices
- Genetically enhancing plants' resistance
- Biocontrol
- Biotechnology/breeding

Postharvest

- Improved sorting, drying, food storage
- Crops not prone to aflatoxin (e.g. Soybean)





Mitigation

Dietary

- Improved dietary diversity
- Dietary enterosorbents
- Dietary chemoprevention
  - Curcumin
  - Compounds in cruciferous & Allium vegetables
  - Green tea polyphenols

Hepatitis B vaccine:

- Aflatoxin consumption in HBV+ patients increase risk of Liver cancer

Wu F, Khlangwiset P (2010). "Health economic impacts and cost-effectiveness of aflatoxin reduction strategies in Africa: Case studies in biocontrol and postharvest interventions."*Food Addit. Contam* 27:496-507.

Conclusions

- Aflatoxin relation with Stunting? → It is strongly associated with it and likely a cause
- What is needed next? → Controlled experimental studies urgently needed.
- Is USAID doing anything to add to the evidence base? → **Yes;** 1) The Nutrition Innovation lab studies in Nepal and Uganda 2) The SHINE trials in Zimbabwae 3) PMIL in Ghana/Malawi/Mozambique/Zambia
- Are we doing enough? → **NO;** This is a Global health and an Agriculture issue that is equally important to both sectors and GH community needs to engage actively to add to the evidence base and find solutions

- Will Aflatoxin reduction improve the health problems associated with stunting
- e.g. cognition problems?

We don't know

- Should we wait to take an action for more evidence ?

Absolutely not; we have enough evidence from animal and human studies and we need to take actions urgently.

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