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The U.S. Government's Global Hunger & Food Security Initiative

Emerging Understanding of Mycotoxin Threats: USAID support for implementation science on Agriculture-to-Nutrition programming

Patrick Webb

Tufts University/Feed the Future Innovation Lab for Nutrition

December 7, 2017



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Friedman School of
Nutrition Science and Policy



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“Food safety is a hidden, and often overlooked, problem. The pool of those people at greatest risk of disease is expanding.”

We must align “policies in agriculture, trade, health, education, and social protection to provide a safe and healthy diet for all.”

Margaret Chan, former DG of WHO – *Lancet* 2014 (Nov 29 issue)



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Mycotoxins

- Widely occurring natural carcinogens; known to cause human and livestock impairment/death:
 - *Farming implications*: seed quality; field ops; diversification?
 - *Value chain implications*: import restrictions; drying/storage
 - *Dietary implications*: own production; diversification?
 - *Nutrition/Health implications*: knowledge; practices; implications for birth outcomes and child growth?





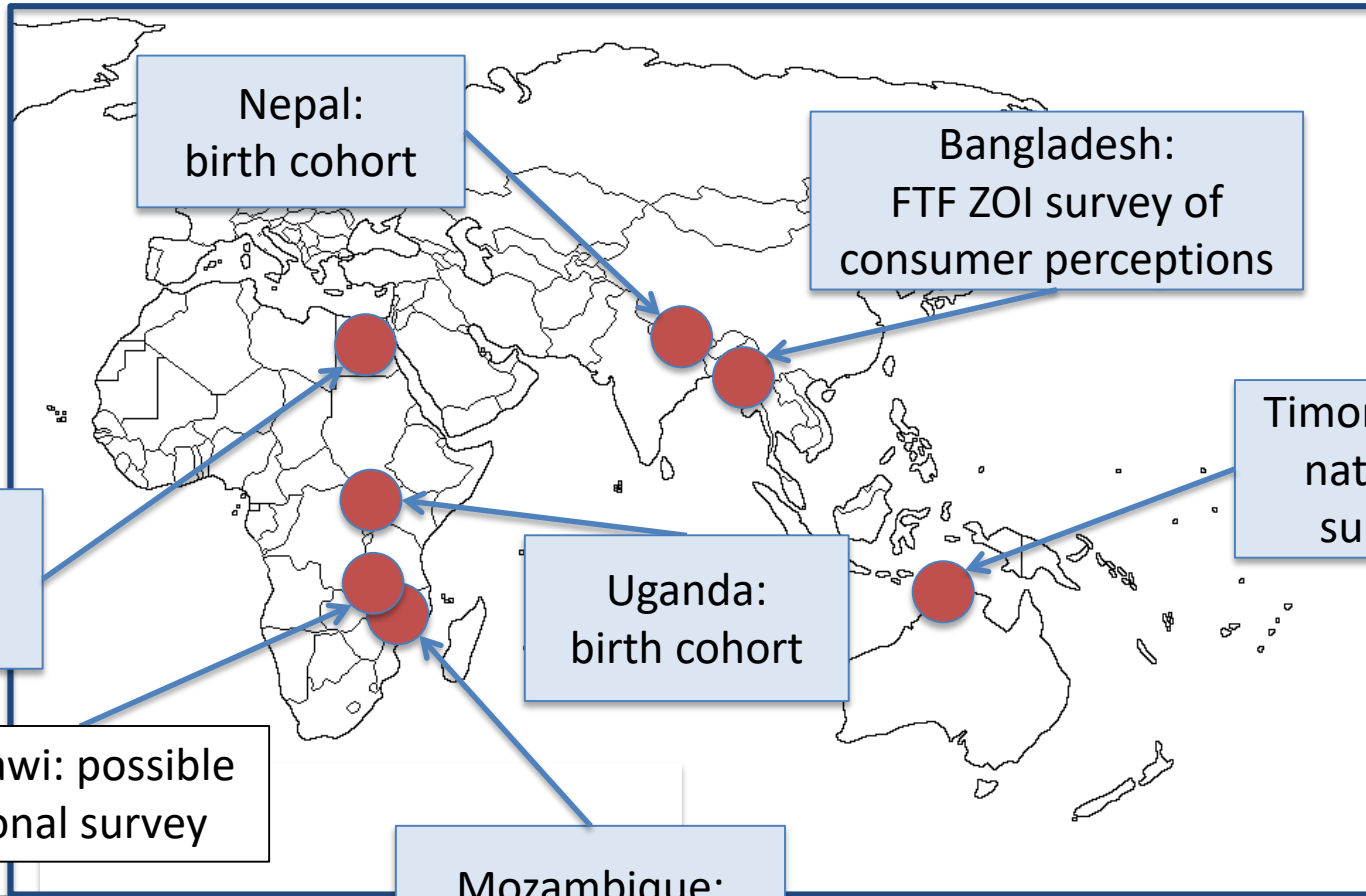
WHY THE NUTRITION INNOVATION LAB?

- What *measurable* impacts does **agriculture** have on nutrition (positive and/or negative)?
- What nutrition impacts can be attributed (via rigorous analytical methods) to **policies and programs** ?
- What *human* **biological mechanisms** must be better understood to determine how agronomic, pathogenic and ecological mechanisms impact nutrition?





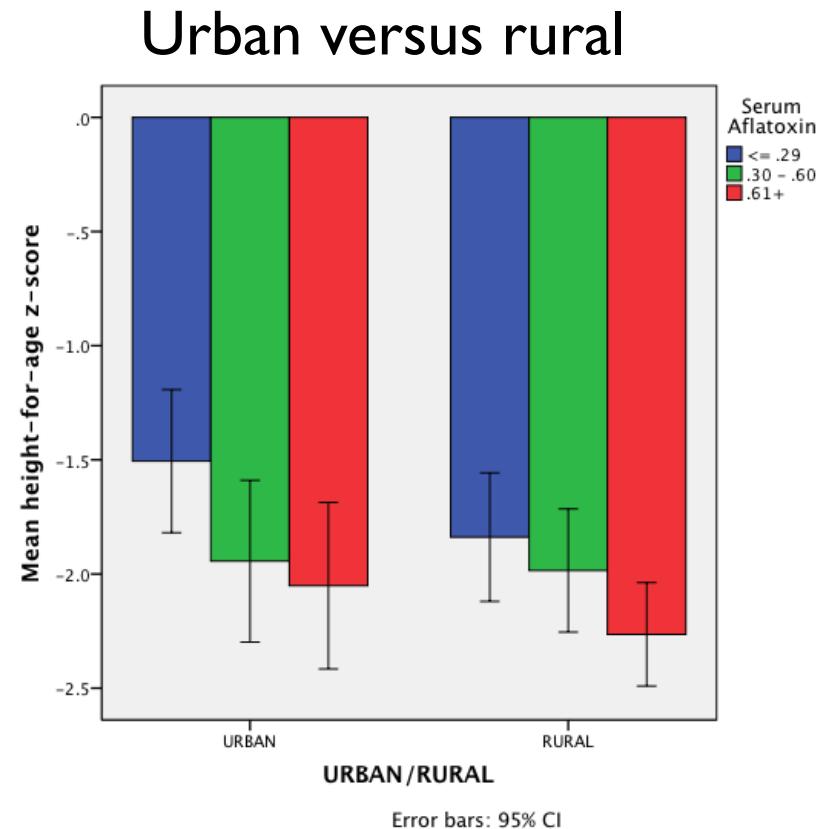
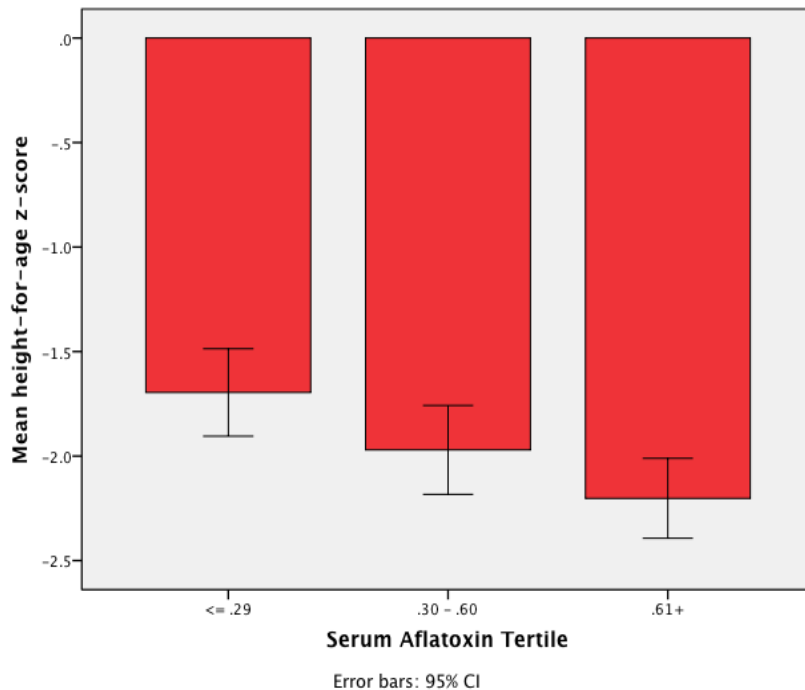
NUTRITION INNOVATION LAB – ‘Food Safety’ Research





AFLATOXIN = MALNUTRITION?

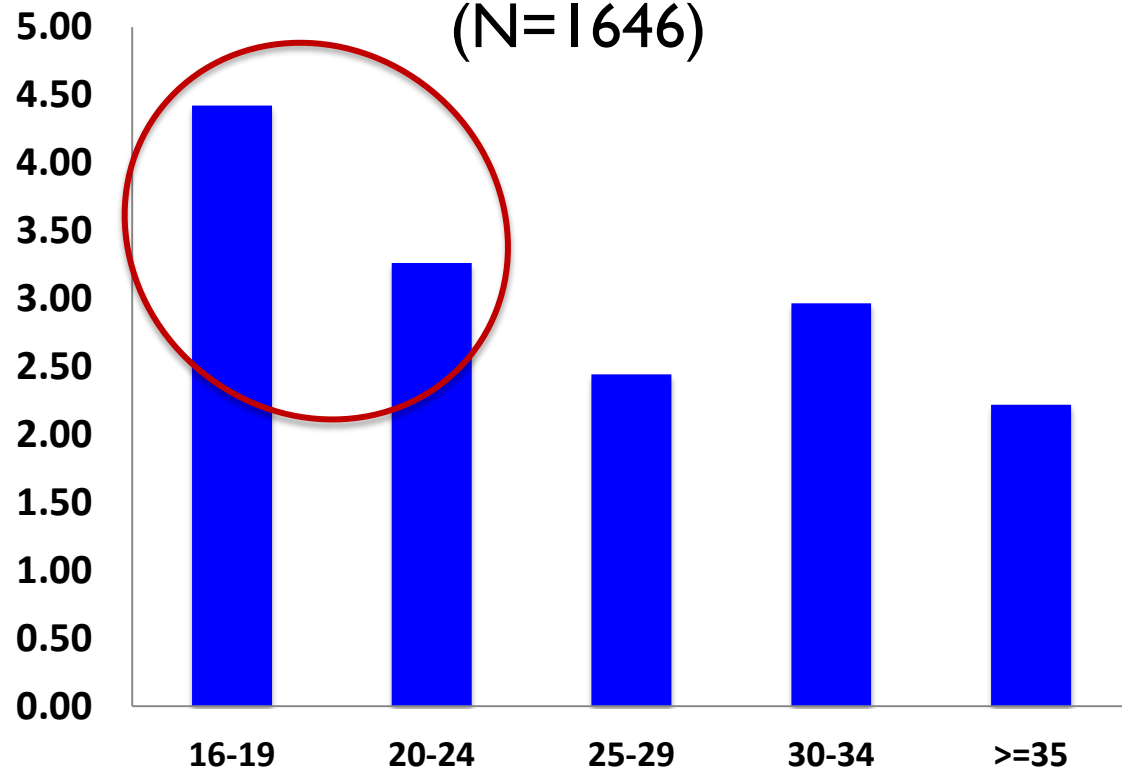
Stunting by aflatoxin level in blood (Timor Leste 2013)





Nepal birth cohort

Mean blood Aflatoxin by age (N=1646)





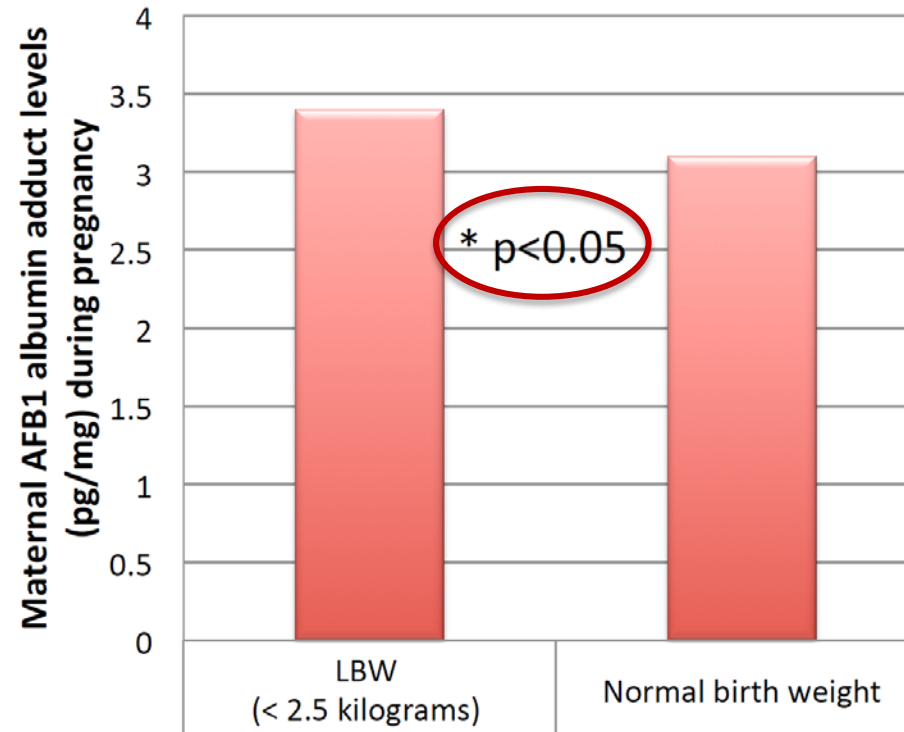
MATERNAL AFB1 AND LOW BIRTH WEIGHT (LBW)

Nepal birth cohort

N=1484

LBW <2.5 kg

Prevalence of LBW: 20%

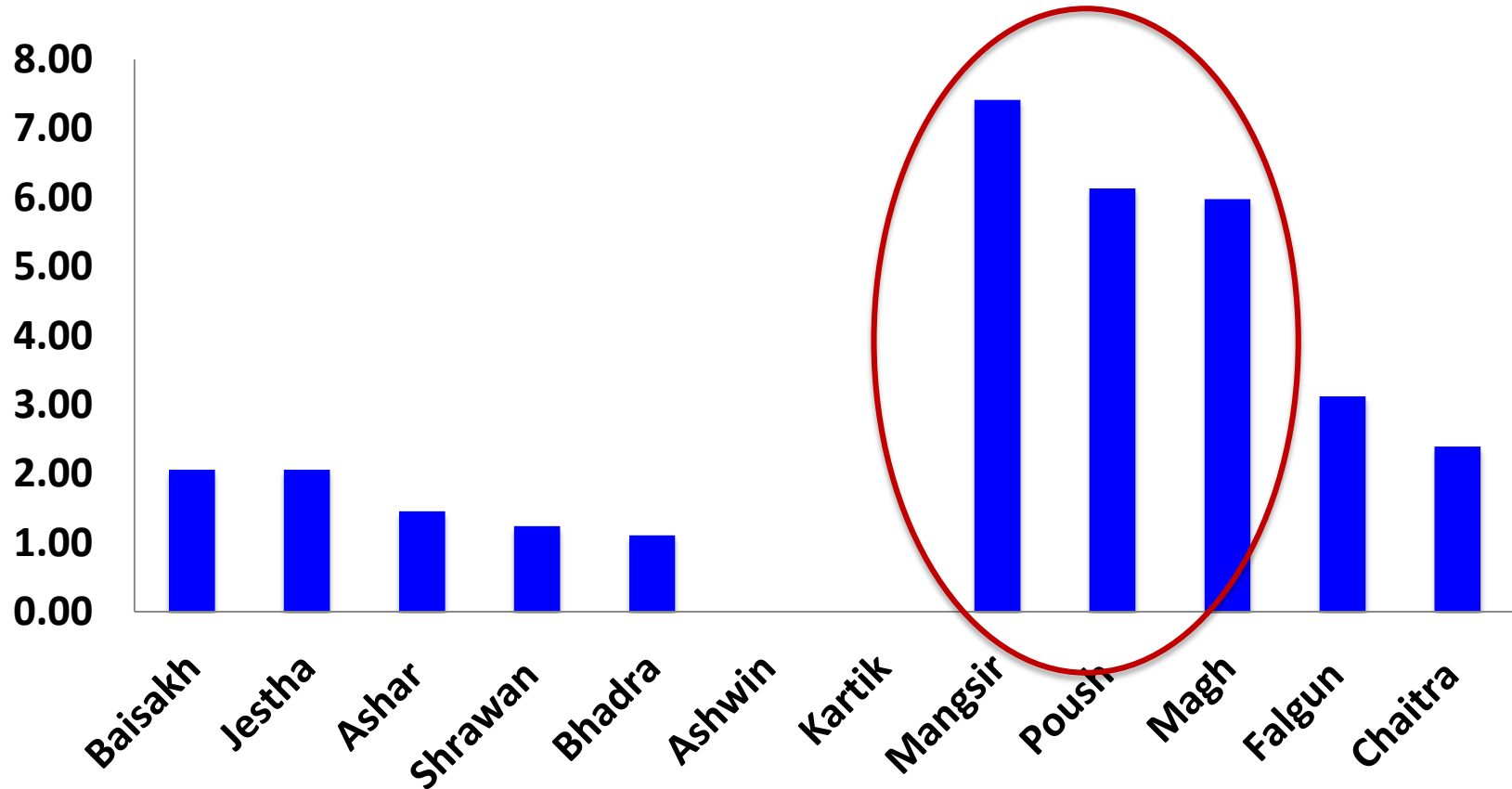




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MEAN AF LEVEL BY MONTH (NEPAL)



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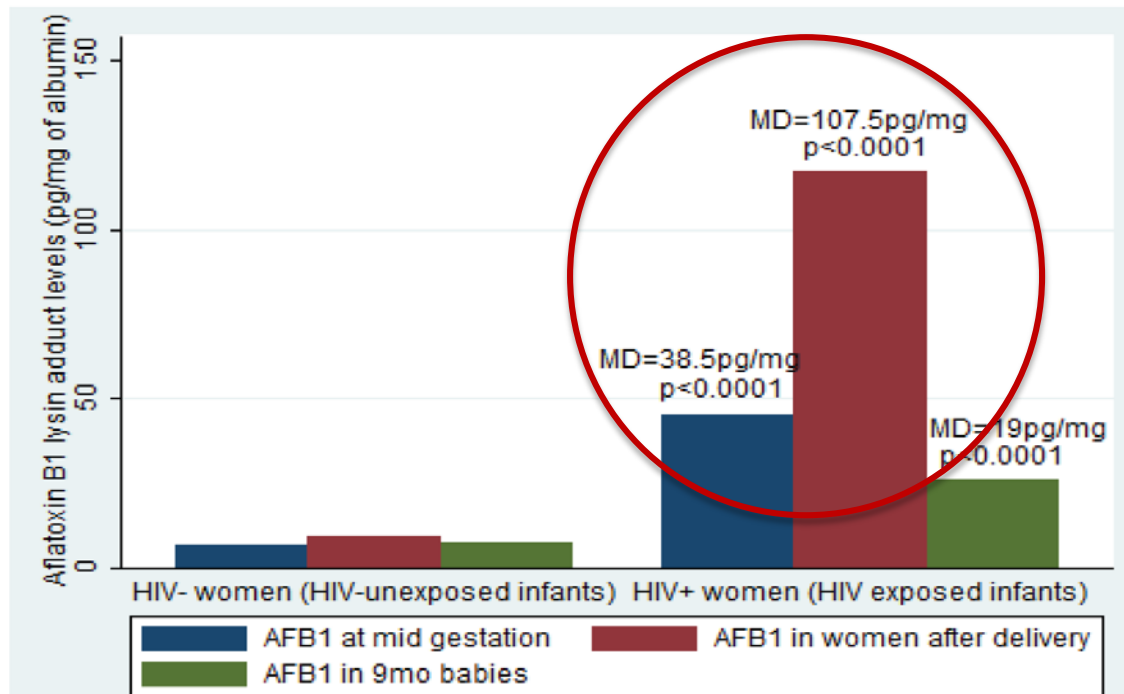


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Uganda birth cohort

AFLATOXIN LEVELS HIGHER IN HIV (+) WOMEN AND THEIR INFANTS





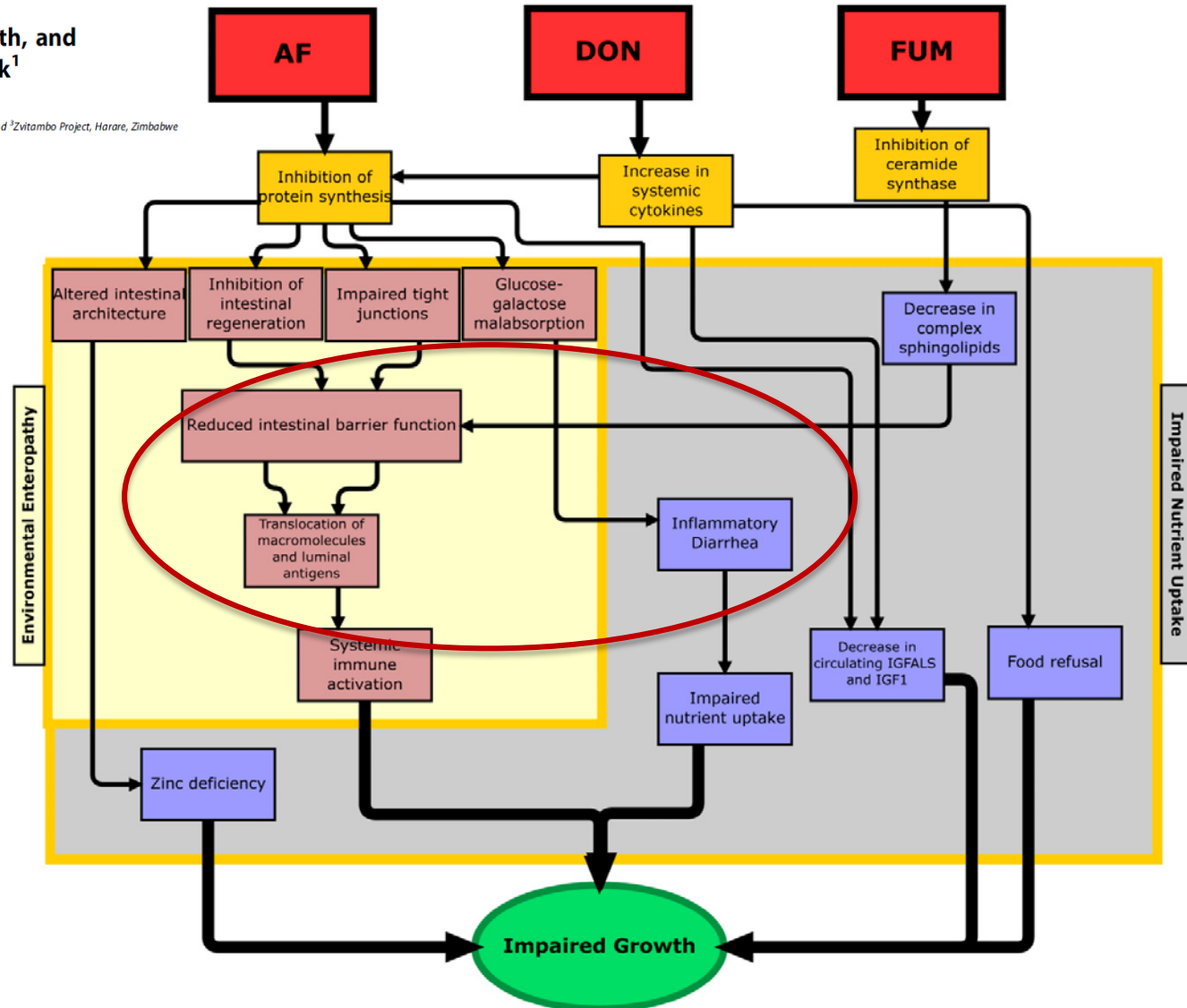
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Food Chain Mycotoxin Exposure, Gut Health, and Impaired Growth: A Conceptual Framework¹

Laura E. Smith,^{2*} Rebecca J. Stoltzfus,² and Andrew Prendergast³

²Division of Nutritional Sciences, Cornell University, Ithaca, NY; ³Queen Mary University of London, UK; and ³Zvitambo Project, Harare, Zimbabwe



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“Leaky gut” (EED) = inflammation and loss of nutrients.

➤ **385 children 12-16 m. 58% moderate, 22% severe EED**

1. Infants **stunted or wasted** at 6-9m = **higher EED**

2. If **goats/sheep inside home**, much worse EED ($P < 0.05$)

3. **Improved water source** = **lower EED** ($P < 0.05$).





USG is supporting cutting edge research

- Mycotoxins are one more piece of the puzzle. They link agriculture through value chains to nutrition and health.
- Rigorous evidence finally growing (through prospective studies) on hypothesized causal links between mycotoxins and nutrition-relevant human outcomes.
- More detailed understanding growing of producer **and** consumer a) understanding of threats, b) perception of threats, and c) actions taken in context of threats.



IMPLICATIONS FOR USG PROGRAMMING

- Improved seed quality and field management practices critical to preventing mycotoxin spread.
- Seasonality offers entry point for tailoring value chain interventions (improved drying, new storage tech., container cleaning products).
- Crop and/or diet diversification may not help if market supply contaminated (testing, policy action on regulations, trade concerns).
- Relative contribution of **MULTIPLE mycotoxins** to biological pathways that link agriculture to nutrition needs to be understood (gut microbiome, DNA, mycotoxins, HIV, shared pathogens, etc.).





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