



FEED THE FUTURE

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

Undernutrition, Environmental Enteric Dysfunction and the potential role of legumes to improve child health

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Legume Innovation Lab

**Feed the Future Innovation
Lab for Collaborative
Research on Grain Legumes**



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Presentation outline

- Importance of Undernutrition (stunting)
- Environmental Enteric Dysfunction (EED)
- EED and stunting
- EED interventions
- Potential role of grain legumes

Undernutrition is a Major Cause of Child Mortality



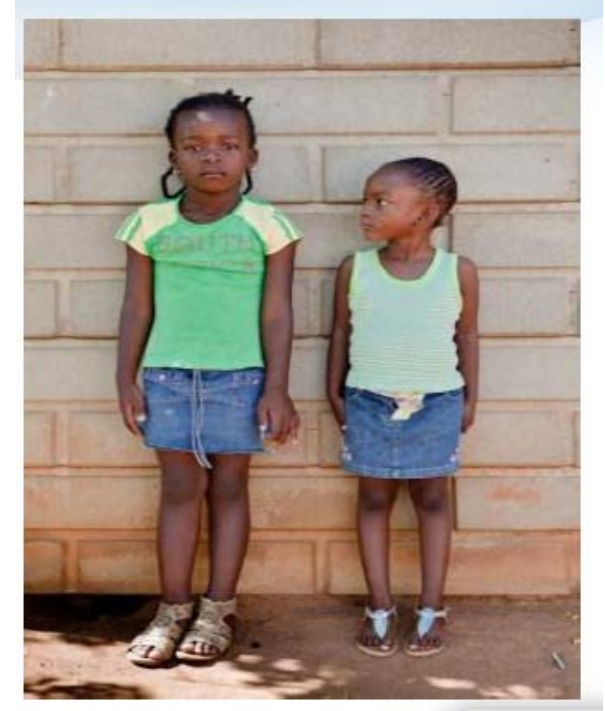
| | Attributable deaths with UN prevalences* | Proportion of total deaths of children younger than 5 years | Attributable deaths with NIMS prevalences† | Proportion of total deaths of children younger than 5 years |
|--|--|---|--|---|
| Fetal growth restriction (<1 month) | 817 000 | 11.8% | 817 000 | 11.8% |
| Stunting (1-59 months) | 1 017 000* | 14.7% | 1 179 000† | 17.0% |
| Underweight (1-59 months) | 999 000* | 14.4% | 1 180 000† | 17.0% |
| Wasting (1-59 months) | 875 000* | 12.6% | 800 000† | 11.5% |
| Severe wasting (1-59 months) | 516 000* | 7.4% | 540 000† | 7.8% |
| Zinc deficiency (12-59 months) | 116 000 | 1.7% | 116 000 | 1.7% |
| Vitamin A deficiency (6-59 months) | 157 000 | 2.3% | 157 000 | 2.3% |
| Suboptimum breastfeeding (0-23 months) | 804 000 | 11.6% | 804 000 | 11.6% |
| Joint effects of fetal growth restriction and suboptimum breastfeeding in neonates | 1 348 000 | 19.4% | 1 348 000 | 19.4% |
| Joint effects of fetal growth restriction, suboptimum breastfeeding, stunting, wasting, and vitamin A and zinc deficiencies (<5 years) | 3 097 000 | 44.7% | 3 149 000 | 45.4% |

Data are to the nearest thousand. *Prevalence estimates from the UN. †Prevalence estimates from Nutrition Impact Model Study (NIMS).

Table 2: Global deaths in children younger than 5 years attributed to nutritional disorders

Stunting

- Affects 25% of children globally, 35% in Africa, 37% in Malawi.
- Stunting is associated with:
- Increased mortality from diarrhoea, pneumonia, other infectious diseases
- Impaired cognitive development
- Reduced income (by up to 22%)
- Reduced life expectancy by up to 17%
- A significant portion of stunting comes from EED which comes from marginal diet + microbial imbalance
- Need for interventions to improve diet and correct microbial imbalance

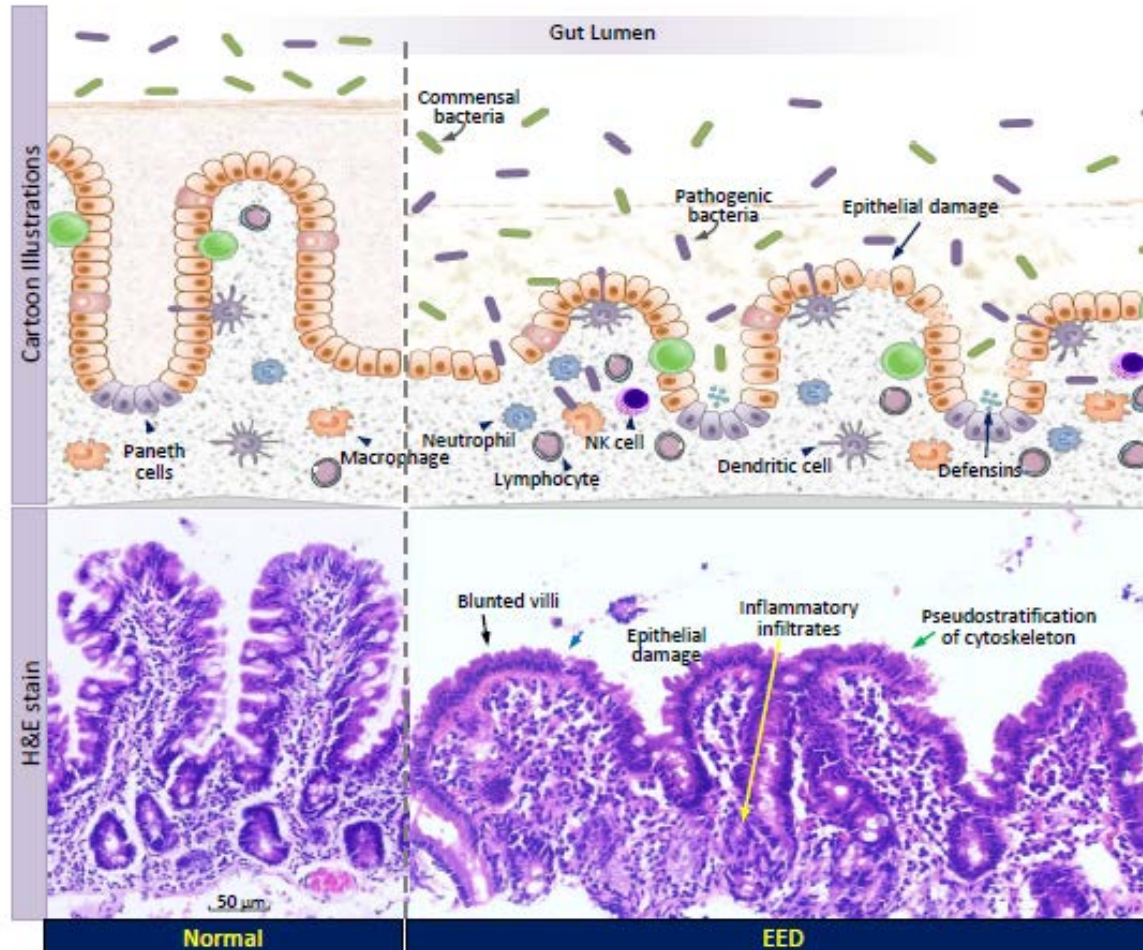




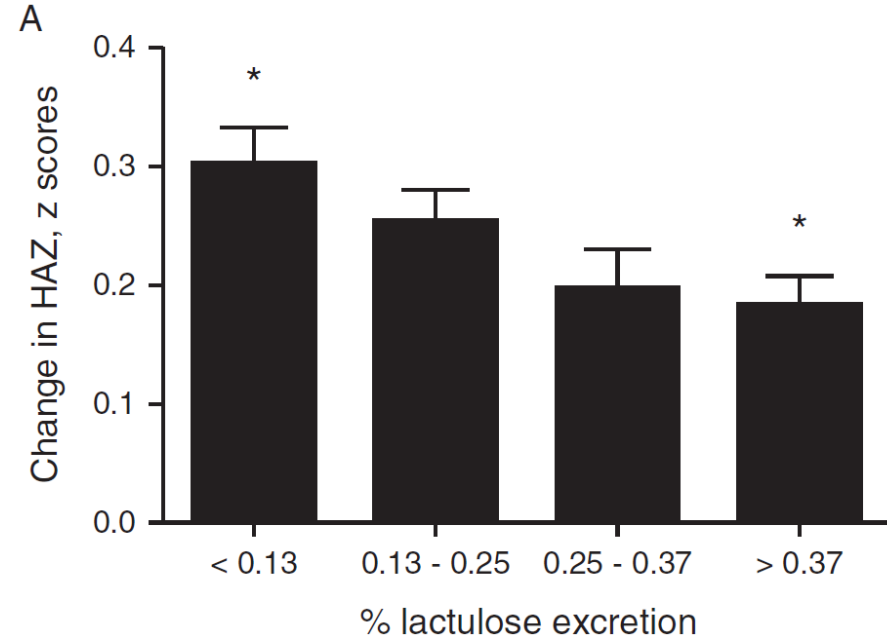
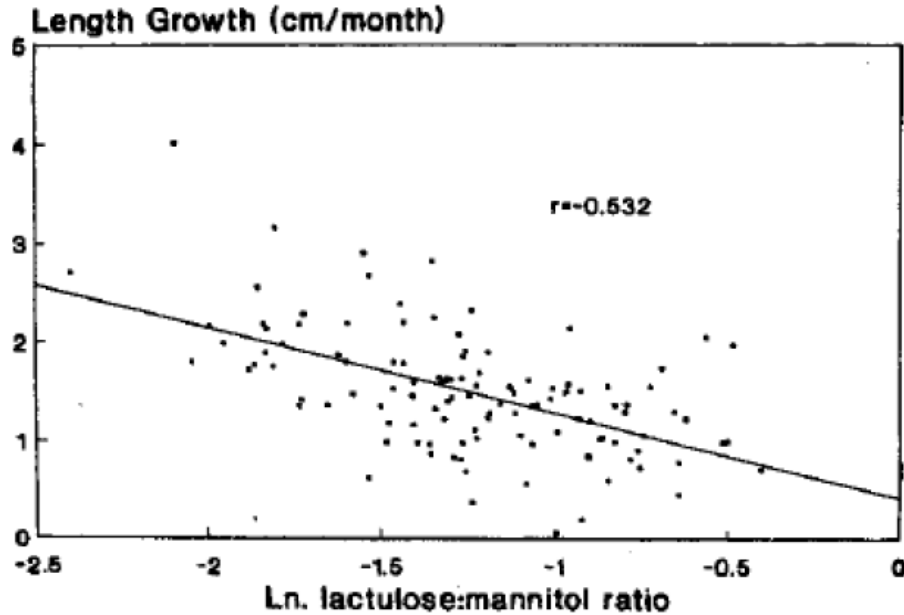
Environmental Enteric Dysfunction

- Chronic inflammatory state of the gut
- Subclinical: No direct and easily measurable clinical case definition
- Linked to unsanitary living conditions
- High risk in the first three years of life

What happens in EED?



EED is Associated with Stunting



better growth →

worse EED / gut health →

Prior attempts to treat EED

- Probiotics and antibiotics don't work
- Promotion of access to clean water and sanitation (WASH and SHINE trials)
- Micronutrient supplementation shows some improvement
 - Glutamine, vitamin A and zinc improve intestinal barrier function
- Deworming with albendazole or high-dose zinc slows EED progression
- Poly-unsaturated fatty acid supplementation not effective
 - Used for anti-inflammatory effects in Crohn's



AJCN 2005; 82: 1040; *Am J Gastro* 2009; 104: 2326
Lancet 2009; 374: 1032; *Clinics* 2014; 69: 225;
Clin Gastro Hep 2014; in press

How might legumes fit in

Diets enriched in legumes decrease markers of inflammation

Increased legume intake is inversely correlated with illnesses with inflammatory components such as colorectal cancer and cardiovascular disease

Nutritional role: May serve as a major source of protein and micronutrients in populations where carbohydrate consumption predominates in complementary feeding.

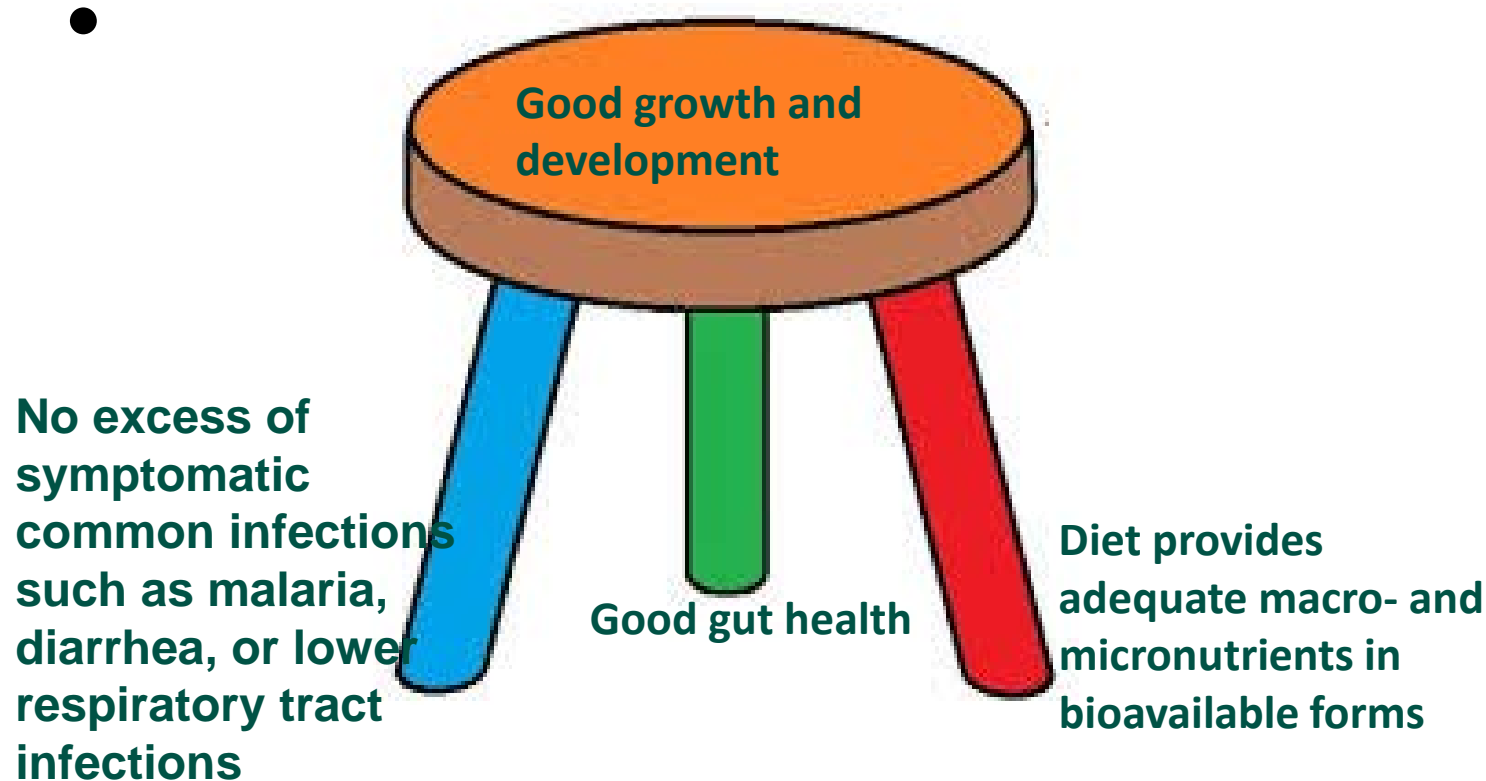
Cheapest source for added nutrition for women and children

Low protein consumption (essential amino acids) associated with stunting



J Nutr 2012; 142: 334; *Nitric Oxide* 1997; 1: 476
Lipids 2010; 45: 765; *Eur J Clin Nutr* 2011; 65: 415
Dry Beans and Pulses 2012; *JPGN* 2007; 44: 487

For normal growth and development 3 conditions must be met



Acknowledgements



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