Global Food Security: What role for livestock?

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OUTLINE

• Food security – why study and understand?
• Long term impact of stunting on child and societal development
• Food security as a component of stunting - UNICEF framework
• SDG Target 2
• Threats to food security
• Example of the Sahel
• Role of livestock in food security
• Value of ASF for child growth and development
• Role of livestock in SDGs more generally
FOOD SECURITY

“The condition in which all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”

- UN Committee on World Food Security
DIMENSIONS OF FOOD SECURITY

Food security is multi-dimensional and must consider:

- **Food availability**
  Sufficient quantities of food available on a consistent basis.

- **Food access**
  Having sufficient resources to obtain appropriate foods for a nutritious diet.

- **Food utilization**
  Appropriate use based on knowledge of basic nutrition and care, adequate water and sanitation, and feeding and care practices within the household.
Food security necessary for nutrition but not sufficient

UNICEF model

Neither food aid nor food security is predictive of nutritional outcomes (McKune and Hood, 2015)

FOOD SECURITY AND MALNUTRITION

Immediate causes operating at the individual level

Underlying causes influencing households and communities

Basic causes around the structure and processes of societies

modified by Black et al, Lancet 2008
STUNTING (LOW HEIGHT FOR AGE)

• Best measure of undernutrition
• Kills 45% of children; 155 million under fives affected
• Impairs cognitive and motor development
• Increases incidence of chronic diseases (diabetes, obesity, etc.)

(de Onis et al., 2013; Black et al., 2013, UNICEF/WHO/World)

http://miraclesinaction.org
• Reduces the GDP of African / Asian countries by 10% on average (World Bank, 2017)
• Must be reduced by 40% by 2030 (World Health Assembly)
IMPACTS OF STUNTING IN THE FIRST 1000 DAYS

• “Associated with nearly irreversible brain damage.” Senior nutritionist, World Food Program.

• “Condemns children to a life time of underachievement and underperformance”. Roger Thurrow, Former Wall Street Journal Foreign Correspondent

• “If our children are stunted today, our economies will be stunted tomorrow”. Akinwumi Adesina, President, Africa Development Bank; 2017 World Food Prize Winner
Food security necessary for nutrition but not sufficient

UNICEF model

Neither food aid nor food security is predictive of nutritional outcomes (McKune and Hood, 2015)

Threats to food security undermine efforts to improve maternal and child nutrition.

Interventions that improve underlying causes of food insecurity, may improve nutritional outcomes as well.
SUSTAINABLE DEVELOPMENT GOAL 2

• How to feed almost 800 million hungry today?
• How to feed a global population projected to rise from 7.3 billion to 9.5 billion by 2050?
THREATS TO FOOD SECURITY

- Climate change
- Population growth
- Food production
- Food prices
- Loss of food varieties
- Land and water scarcity
CLIMATE CHANGE IMPACT ON DIMENSIONS OF FOOD SECURITY

• Food Availability
  Changes in rainfall patterns may reduce agricultural production, limiting the availability of food, both at the household and market level

• Food Access
  Access to food for people who rely on market exchange of animal products for grains is constrained during climate related crisis (e.g. drought) through poor terms of trade

• Food Utilization
  Increased demands on time required for activities of daily life (i.e., herding, water collection, fuel collection, etc.) reduce the time available for child feeding (breastfeeding and young child feeding)
VULNERABILITY TO FOOD INSECURITY

• Intersectional
  Gender
  Class
  Ethnicity
  Livelihood
  Age
  Caste
  Geography
VULNERABILITY TO FOOD INSECURITY: Example: the Sahel

- Climate change impacts + increasing population (Potts, et al., 2013)
- Ability to produce food (NPP) being outpaced by consumption (Abdi et al., 2014)
- Focus has been on agricultural improvements to increase yields, but production has not (cannot?) keep up.
LIVESTOCK AND NUTRITIONAL OUTCOMES

Livestock → Food PRODUCTION → Agricultural INCOME → Women’s EMPOWERMENT → Human nutrition
LIVESTOCK AND FOOD SECURITY

Livestock to improve nutrition

- Household consumption of animal-source foods (Iannotti et al., 2017)
- Incomes to purchase enough food of nutritional quality (IFPRI, 2017)
- Resilience, livelihood diversification in the face of CC (Jones and Thornton, 2009)
- Women’s control over assets and income (Jin and Iannotti, 2014)
LIVESTOCK AND FOOD SECURITY

- Growth in agriculture yields greater reduction in nutritional stunting than other economic growth (Webb and Block, 2012).

- Significantly food and nutrition insecure households are those who rely on agriculture, including livestock, for their livelihood (World Bank 2007; World Bank 2013).

- Livestock holders are more likely than counterparts to consume Animal-Source Foods (FAO, 2009).
IMPORTANCE OF ANIMAL-SOURCE FOODS

**Best source** of high-quality, nutrient-rich foods for children aged 6 to 23 months (WHO, 2017)

ASF contain important bioavailable nutrients:

- **Ideal protein** – contains all essential amino acids

- **The four most deficient micronutrients globally**
  Iron, zinc, iodine and vitamin A

- **Other nutrients** – Calcium, choline, EPA, DHA, vitamins D₃, B₁₂ and B₂, etc.
## Micronutrients in ASF

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Source</th>
<th>Consequences of deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Dairy products</td>
<td>Nutritional rickets</td>
</tr>
<tr>
<td>Zinc</td>
<td>Meats</td>
<td>Dermatitis, diarrhoea, growth faltering and stunting, impaired immune function and increased risk of infections</td>
</tr>
<tr>
<td>Iron</td>
<td>Meats</td>
<td>Children: impaired growth and cognitive development and reduced immune function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adults: lowered work capacity</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Dairy products, liver, egg-yolk</td>
<td>Night blindness, corneal ulceration, loss of vision, growth faltering, increased risk of infectious disease, morbidity and mortality</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>ASFs are only source</td>
<td>Anaemia, disorders of central nervous system</td>
</tr>
<tr>
<td>Vitamin B2 (riboflavin)</td>
<td>Dairy products, meats, eggs, organs</td>
<td>Skin lesions, angular stomatitis, glossitis, cheilosis</td>
</tr>
<tr>
<td>Iodine</td>
<td>Dairy products, eggs</td>
<td>Mental retardation, low IQ, stunting</td>
</tr>
<tr>
<td>DHA, EPA</td>
<td>Fish, eggs</td>
<td>Rough, scaly skin and dermatitis, increased coronary heart disease risk</td>
</tr>
</tbody>
</table>

(FAO, 2016)
**NUTRIENTS BY FOOD SOURCE**

### Protein biological value

- Meat: 92%
- Milk: 124%
- Egg: 118%
- Rice: 65%
- Beans: 72%
- Corn: 52%
- Potato: 82%

Source: [http://www.food-info.net/uk/protein/bv.htm](http://www.food-info.net/uk/protein/bv.htm)

### Iodine

- Beef: 11 mcg/100g
- Chicken: 15 mcg/100g
- Milk: 56 mcg/100g
- Eggs: 24 mcg/100g
- Rice: 8 mcg/100g
- Beans: 5 mcg/100g
- Corn: 4 mcg/100g

Source: Pennington et al. Young et al., 1995

### Vitamin A

- Meat: 9 µg RAE per 100g
- Milk: 46 µg RAE per 100g
- Eggs: 160 µg RAE per 100g
- Rice: 11 µg RAE per 100g

Source: USDA, ARS

### Vitamin B12

- Meat: 0.36 µg per 100g
- Milk: 0.45 µg per 100g
- Eggs: 1 µg per 100g

LULUN EGG PROJECT, ECUADOR

(Ianotti, 2017)

- Giving one egg per day to 6-9 month olds in Ecuador for six months
- Reduced stunting (low height or length for age) by 47%
- Reduced wasting (low weight for age) by 74%

One egg per day boosts infant growth

-Newsweek
ASF SUPPLEMENTATION EFFECTS ON SCHOOL TEST SCORES

Adapted from Weldon, 2016; Hullet et al., 2014
ASF EFFECTS ON SCHOOL TEST SCORES

**Meat group**
- Highest Raven scores
- Higher Vit. B12 status
- More physically active
- More Arm muscle mass
- More leadership and initiative
- Higher test scores
- More playful

**Milk group**
- Improved growth
- Higher test scores
- Higher B12 status

Adapted from Demment, 2013
Stunting is inversely related to meat consumption

Adapted from OECD 2018 and UNICEF-WHO, 2017
Animal protein consumption increases with income

% of animal protein of total protein

Per capita GDP ($/person)
Drivers of increased demand for ASF

- Urbanization, Income growth and Population growth
- 70% more food needed for approx. 10 billion people in 2050

(Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat)
Developed in 2015 by UN to transform the world by 2030
End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

How do livestock contribute to SDG 2?
GLOBAL LIVESTOCK CONTRIBUTIONS

- Wealth
- Status
- Insurance
- Resilience
- Manure
- Building materials
- Traction
- Cooking/heating fuel
GLOBAL LIVESTOCK CONTRIBUTIONS

• Employs over 1.5 billion, with over ¾ billion dependent livelihoods

• Contributes 40% (mean) to the ag. GDP of developing countries

• Supplied 25% of protein and 18% of calories consumed globally in 2016

• Provided traction for about 50% of the world’s farmers in 2009 (World Bank)

(Smith, 2017)
GLOBAL LIVESTOCK CONTRIBUTIONS

Supports and empowers many of the world’s smallholder women farmers who own no other assets.

Livestock manure supports more than half of the worlds crops (World Bank)
GLOBAL LIVESTOCK CONTRIBUTIONS

• Offers greatest opportunity to reduce greenhouse gas emissions from agriculture

• Allows food production on 57% of earth’s land that cannot be used for crop production

• Converts millions of tons of agroindustrial by-products that cannot be consumed by humans into livestock feeds, turning waste into food and reducing pollution.

• Only about 14% of the feed dry matter ingested by livestock is edible to humans based on recent FAO data
Livestock contribute to equitable livelihoods

ASF improve nutrition and health

Livestock contribute to inclusive sustainable economic growth

Livestock and sustainable ecosystems

Tarawali, 2015
CONCLUSIONS

- Chronic malnutrition, or stunting, kills about half of all children who die worldwide and constrains their growth, health, education, and future productivity
- Food insecurity is an underlying cause of malnutrition
- Animal-source foods are an important source of vital nutrients and are effective in preventing malnutrition in children and PLW
- Livestock production is vital for the educational, nutritional, economic and sustainability needs of the world.
- Sustainably increasing livestock production is crucial to ensuring food and nutritional security of future populations
- Increasing access, availability, affordability, safety, environment stewardship and consumption of ASF in the developing world is critical
Thank you!

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For more information about the Livestock System Innovation Lab at UF:
http://livestocklab.ifas.ufl.edu/
@Livestock_Lab
www.facebook.com/LivestockLab
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

www.feedthefuture.gov
Brain Food: Clever Eating
(Gupta, 2016; Nature)

- Early human meat eaters developed bigger brains than plant eaters.

- Iron is crucial for the growth and branching of neurons in the womb;

- Zinc is found in high concentrations in brain regions for learning and memory;

- Vitamin B12 maintains the sheaths that protect nerves;

- Deficiencies in micronutrients in meat linked with disorders like - low IQ, autism, depression and dementia.
Milk consumption in many developing countries is one tenth or less than that in many developed countries.
Meat consumption in many developing countries is one seventh or less than that in many developed countries.
Stunting Levels per Country

http://www.who.int/nutgrowthdb/estimates2014/en/
GREENHOUSE GAS EMISSIONS FROM DIFFERENT SECTORS IN THE US

(EPA, 2015) (Mitloehner, 2016)

More Milk Produced per Cow = Less Methane and Waste

U.S. Cow

500 g

Methane Production

800 g

Mexican Cows

4000 g

Indian Cows

22,248 lbs/yr/cow

10,500 lbs/yr/cow

2,500 lbs/yr/cow

USDA and Compassion in World Farming

(Mitloehner, 2016)
GREENHOUSE GAS EMISSION INTENSITIES

• Amount of greenhouse gas produced per unit of livestock product produced.

• Vital measurement for meeting the nutritional needs of the poor with livestock and increasing the global demand for animal-source food while decreasing environmental impact of livestock.
GREENHOUSE GAS EMISSIONS FROM LIVESTOCK CAN BE CUT BY 30% BY

• Improving animal and herd efficiency

• Improved breeding and animal health interventions to shrink herd sizes (meaning fewer, more productive animals)

• Manure management to recover and recycle nutrients and energy,

• Grazing land management to improve productivity and create carbon sinks.

• Precision feeding, breeding, and better animal health care

(FAO, 2013)

ASF AND THE ENVIRONMENT

• Allows productive use of 30-40% of the earth’s surface which is unsuitable for crop production (Sayre et al., 2013)

• ASF consumption prevents dumping of over 1 billion metric tons/year of agroindustrial co and by-products that we can’t eat (Smith, 2017)