Delia Grace Randolph
Health Program ILRI co-lead, Food Safety Flagship A4NH leader

ASF, health, nutrition - latest evidence
Outline

- Why we need evidence
- Latest evidence on livestock and nutrition and health from ILRI & partners
- How scientists mislead with evidence
Avoiding meat and dairy is ‘single biggest way’ to reduce your impact on Earth

Biggest analysis to date reveals huge footprint of livestock - it provides just 18% of calories but takes up 83% of farmland
If you want tall kids should you feed them milk or meat?
Do aflatoxins stunt or stimulate growth?
If you want smart kids should you feed them cheese or eggs?
Which has a bigger health burden?  
Chemicals or bacteria in food?
If you want to improve your iron levels
Should you eat spinach or liver?
The economics of food safety in India – a rapid assessment

Zuzana Smeets Kostikova (Wageningen Economic Research)
Delia Grace (ILRI)
Manjole Kuiper (Wageningen Economic Research)

White paper

Food safety in developing countries: research gaps and opportunities
The influence of livestock-derived foods on nutrition during the first 1,000 days of life

Food Safety
WORKING GROUP: TECHNICAL BRIEF

Food safety metrics relevant to low and middle income countries
Screening process: PRISMA Flow chart for paper selection

**ABSTRACT IDENTIFICATION**
- 1669 records identified through database after removal of duplicates
- PubMed, CabDirect, Cochrane libraries

**SCREENING**
- 59 abstracts identified for consideration
- Double blind screening of abstracts (4 reviewers)

**PAPER OBTENTION**
- 53 Full text articles obtained to assess eligibility
- 35 excluded for not meeting eligibility criteria

**INCLUSION/DATA EXTRACTION**
- 13 papers selected
- Double data extraction (4 reviewers)
Livestock products and nutrition

240ml milk/day = 0.4cm taller/year
(more if stunted or adolescence)

Eggs in Early Complementary Feeding and Child Growth: A Randomized Controlled Trial

One egg a day = almost halved stunting
Strong Conclusions

Some consistency:

- Positive role of milk in linear growth and MUAC (not in all) => supported with results from other countries (meta-analysis by de Beer 2011)
- Cognitive skills more promoted by meat than by milk
- Limited role of egg => New evidence on eggs to be incorporated (Iannotti, 2017)
- The more under-nourished, the better the results

Not consistency in:

- Micronutrient results
Causes of Food Borne Disease

Burden LMIC (DALYs)

- Microbes
- Helminths (worms)
- Aflatoxins
- Other toxins

World Health Organisation, 2016
Foods implicated in FBD

World Health Organisation, 2017
Applying the human capital approach (foregone output due to premature mortality) the 2010 economic costs are in range of USD 12 billion to 55 billion USD.

Best estimates of current FBD burden in India – about 100 million cases per year with and economic costs in the range of USD 12 billion to 55 billion USD.

Expected FBD burden in India to rise from 100 up to 170 million in 2030 – increasing from one out of 12 to one out of 9 people falling sick on average.
## 2014 Food Safety Progress Report

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Healthy People 2020 Target Rate</th>
<th>2014 Rate</th>
<th>Change Compared with 2006-2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>8.5</td>
<td>13.45</td>
<td>13% increase</td>
</tr>
<tr>
<td>E. coli O157&lt;sup&gt;+&lt;/sup&gt;</td>
<td>0.6</td>
<td>0.92</td>
<td>32% decrease</td>
</tr>
<tr>
<td>Listeria</td>
<td>0.2</td>
<td>0.24</td>
<td>No change</td>
</tr>
<tr>
<td>Salmonella</td>
<td>11.4</td>
<td>15.45</td>
<td>No change</td>
</tr>
<tr>
<td>Vibrio</td>
<td>0.2</td>
<td>0.45</td>
<td>52% increase</td>
</tr>
<tr>
<td>Yersinia</td>
<td>0.3</td>
<td>0.28</td>
<td>22% decrease</td>
</tr>
</tbody>
</table>

*Culture-confirmed infections per 100,000 population

<sup>+</sup> 2006-2008 were the baseline years used to establish Healthy People 2020 targets
<sup>+</sup> Shiga toxin-producing Escherichia coli O157

For more information, visit [www.cdc.gov/foodnet](http://www.cdc.gov/foodnet)
Most experiments evaluating the effectiveness of technologies were successful

• Irradiation successfully reduced bio-amines in sausages.
• Sealing the anus and throat of cattle during slaughter successfully reduced carcase contamination.
• Spraying carcases with vinegar reduced contamination.
• The biocontrol agent, *Trichoderma harzianum*, reduced *Aspergillus flavus* infection of groundnut in the field and increased yields.

Many training interventions were successful:

• Simple hygiene messages were given to mothers and microbial quality of complementary food improved as evaluated by a RCT.
• School canteens were given hygiene training. After the intervention, staff hygiene knowledge and practice scores, food temperature, aerobic colony count (ACC) and *Staphylococcus aureus* load in ready to eat (RTE) meal improved significantly compared to baseline.
• Farmers were trained to remove visibly contaminated maize kernels and to wash the remainder. Compared to baseline, mycotoxins in urine significantly decreased.

Interventions around introducing new processes could lead to improvements:

• The introduction of HACCP to an ice-cream making plant resulted in a reduction in microbial contamination of the product.
• Certified green bean farms in Kenya had much better safety performance than non-certified pepper farms in Uganda.
• Detailed abattoir inspection led to a higher detection of tuberculosis infected carcases than routine inspection.

All willingness to pay experiments indicated consumers were WTP for safer food
How scientists lie about evidence

- Weasel words
- Creative causality
- Ignore guidelines
Weasel words

- Depends on
- Significant
- Controls for
- Determines, associated with, linked with, protects
Creative causality

Non experimental designs can only suggest
- Can’t control completely with a regression model or propensity score
  - Models can only say might
- Can’t get causality from a cross sectional (with –without) study
- Can’t get causality from a before and after study
MVP mid-term evaluation report highlights “Proportion of households that own a mobile phone increased fourfold” as one of the project’s “biggest impacts” in Bar-Sauri.

Observational studies

- Book “Uncontrolled” (Manzi) summarized: 90% of large RCT replicated
  - as compared to only 20% of non-RCT

- Young and Carr looked at 52 claims made in medical observational studies
  - NONE (zero) of the claims replicated in RCTs,
  - 5 claims were stat-sig in the opposite direction in the RCT
  - Their summary: any claim coming from a non-RCT is most likely to be wrong

- Even well-controlled, published non-RCT have been reversed by RCT
Cross-sectional studies

- Many studies show an association between red and processed meat and increases in total mortality, cancer mortality and CVD mortality even after statistical control.

- Recent, large, multi-country study found high CHO intake linked to worse total mortality and CVD outcomes, high fat intake associated with lower risk. Animal protein was associated with lower risk of total mortality, plant protein was not.

- A very large observational study found red meat increased the risk total mortality and white meat decreased it. Is red meat and white meat so different, or are these divergent outcomes a product of who eats red meat vs who eats white meat?
Creative causality

RCT can be done wrong too
- Must be controlled, controls must be random
- Must follow best practice guidelines
- Comparisons require corrections
- Can’t infer causality from a secondary outcome
JELLY BEANS CAUSE ACNE!

SCIENTISTS...

WE FOUND NO LINK BETWEEN PURPLE BEANS $P > 0$.

WE FOUND NO LINK BETWEEN SALMON BEANS $P > 0$.

WE FOUND NO LINK BETWEEN GREY BEANS $P > 0$.

WE FOUND NO LINK BETWEEN GREEN BEANS $P > 0$.

WE FOUND NO LINK BETWEEN DARK PURPLE BEANS $P > 0$.

GREAT JELLY BEANS LINKED TO ACNE!

95% CONFIDENCE

ONLY 5% CHANCE OF COINCIDENCE!
Doing it wrong

- Failure to evaluate large scale investments
- Interventions without measuring outcomes – yet some interventions make things worse
- Near-term, easy, un-important outcomes e.g. changes in knowledge
- Reliance on self-reporting (e.g. diarrhea)
- Short-term follow ups – no attention to sustainability
- Limited information on economic aspects – many likely unaffordable
- Lack of attention to incentives
- Limited cover of un-intended consequences especially gender and nutrition
Composite study on nutrition sensitive agricultural interventions

- Agricultural intervention in villages to improve nutrition of children
- Provided seeds, poultry, training, BCC

- Cluster randomised controlled trial
- Outcomes: HAZ, WHZ, wasting, stunting, Hb, anaemia, diarrhea, cognitive performance.

- No significant effect on HAZ, WHZ
- Marginally significant on Hb – p=0.06
- No change anaemia, significant improvement cognition
- Significant effect on diarrhea
- Girls between 6 months and 12 had significantly reduced stunting
Doing it right

- Do a RCT if you want to make claims about cause/impact
- Clearly specify a single primary outcome of the study or include few primary outcomes along with a strategy to account for multiplicity,
- Specify a limited number of secondary outcomes, along with a justification
- Published protocol in a recognized trial registry prior to the start of trial analysis,
- Ensure that the discussion of outcomes is consistent in the protocol, abstract, methods, results and tables, and,
- Use principled approaches to account for multiple outcomes to help minimize the chance of spurious results due to multiplicity and help to ensure maximal gain of evidence-based knowledge accrues from these important and expensive trials.
## Qualitative research review guidelines – RATS

<table>
<thead>
<tr>
<th>Reporting guideline provided for? (i.e. exactly what the authors state in the paper)</th>
<th>Qualitative research reviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Relevant URLs (full-text if available)</td>
<td>The RATS reporting guideline checklist is available at: <a href="http://old.biomedcentral.com/authors/rats">http://old.biomedcentral.com/authors/rats</a></td>
</tr>
<tr>
<td>Reporting guideline</td>
<td>RATS</td>
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</tbody>
</table>
If you want tall kids give them milk
If you want smart kids feed them eggs
Bugs have much larger impacts than chemicals
If you want to improve your iron eat liver

MEAT EFFICIENCY

A person would have to eat at least 8 times more spinach than cooked liver. Iron found in vegetables is also harder for the body to absorb, because it is usually bound to fiber.

Cooked bovine liver  Cooked beef  Cooked lentis/chickpeas  Cooked kidney/butter beans  Cooked peas  Spinach

These data are approximate and will vary depending on factors such as preparation techniques, soil or feeding conditions, and time between harvesting and intake. Analysis by F. Mori Sarti based on data from http://ndb.nal.usda.gov and http://www.unicamp.br
Do aflatoxins stunt or stimulate growth?