Addressing Food Safety in Animal Source Foods for Improved Nutrition

Speakers: Andrew Bisson (USAID), Hung Nguyen-Viet (ILRI), Silvia Alonso (ILRI), Dennis Karamuzi (Land O’Lakes)

Moderators: Carla Fernandez de Castro (KDAD) and Jennifer Lane (Land O’Lakes)

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Livestock, Animal Source Foods & Household Nutrition Learning Series

- January 2017 – Addressing Food Safety Concerns in Animal Source Foods for Improved Household Nutrition


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Andrew Bisson, USAID Bureau for Food Security

Andrew Bisson is the Livestock Adviser for the Bureau for Food Security at USAID. Andrew gained his DVM at Glasgow Veterinary School, UK and worked in small holder private veterinary practice before completing an MSc in Tropical Veterinary Medicine at Edinburgh University. He has field experience working with pastoral and small holder livestock production systems, strengthening animal health service delivery including community-based animal health, transboundary and zoonotic disease control, Avian Influenza control and One-Health, livestock market system development and resilience building with a focus on dryland communities. He has lived and worked in a number of countries in East and West Africa, Asia and the Middle East through appointments with DFID, Tufts University, FAO, ACDI-VOCA, FHI and Mercy Corps prior to joining BFS.
Hung Nguyen-Viet is the acting regional representative for East and Southeast Asia and senior scientist in food safety and Ecohealth at the International Livestock Research Institute (ILRI). He is based in Hanoi and a honorary professor at the Hanoi University of Public Health (HUPH). Prior to HUPH and ILRI, he completed a postdoc with the Swiss Tropical and Public Health Institute in Basel, Switzerland. Dr. Nguyen-Viet’s research focuses on the link between health and agriculture, food safety, infectious and zoonotic diseases with an emphasis on the use of integrative approaches (One Health and Ecohealth). He co-founded and led the Center for Public Health and Ecosystem Research (CENPHER) at the HUPH until 2013. Since 2012 he has been coordinating the regional program “Ecohealth Field Building Leadership Initiative in Southeast Asia.”
Silvia Alonso works for ILRI, as a Scientist epidemiologist in the Animal and Human Health team. She is a veterinarian with postgraduate training in epidemiology and public health. She graduated in veterinary medicine in Spain and completed a PhD in food safety at the University of Bologna, Italy, where she also worked for few years as a research assistant. She holds a MSc in Epidemiology from the London School of Hygiene and Tropical Medicine and is a Diplomate of the European College of Veterinary Public Health. Before joining ILRI, Silvia worked for 5 years as a lecturer at the Royal Veterinary College where she gained experience in teaching and training at undergraduate and postgraduate level, both nationally and internationally. Her research looks at the interface between livestock production and human health, including nutrition.
Dennis Karamuzi, USAID Rwanda Dairy Sector Competitiveness Project II

Dennis Karamuzi will outline the steps taken by the Government of Rwanda (GoR) and RDCPII in increasing the supply of clean milk for both rural and urban consumers. Working directly with milk collection centers and farmer cooperatives, the USAID Feed the Future funded RDCPII and GoR increased the supply of clean milk available to processors while decreasing the overall supply of adulterated milk. Using a multipronged approach, the project tackled the issue of improving accountability of producers and processors for clean milk while also increasing the supply and affordability of milk.
Animal Source Foods and Food Borne Diseases: The Good, the Bad and the Challenges

Speaker: Andrew Bisson, USAID Bureau for Food Security
Animal Source Foods (ASF) and Food borne diseases: The Good, the Bad and the Challenges

Outline

• Rising Demand for Animal Source Foods

• Animal Source Foods and their contribution to the burden of food borne disease

• Key challenges of informal ASF marketing systems
The important role of livestock and animal source foods

- Increasing incomes and poverty alleviation
- Improved nutritional outcomes
- Building resilience

Photo credit: Land O’Lakes
Drivers shaping ASF systems

- Population growth & urbanization
- Economic development
- Agricultural intensification
- Globalization
- Nutritional transformation

Governance and Enabling environment
- Policies
- Institutions
- Regulation
- Infrastructure
- Communications/education

Struggling to keep pace with surging growth in demand for ASF
Annual % growth in consumption of livestock products between 1995 and 2005

- Meat
- Pork
- Poultry
- Eggs
- Milk

- High income
- Developing/emerging
- SSA

FAO, 2012
The burden of foodborne diseases is substantial

Every year foodborne diseases cause:
- almost in 10 people to fall ill
- 33 million healthy life years lost

Foodborne diseases can be deadly, especially in children <5
- Children account for almost 1/3 of deaths from foodborne diseases

FOODBORNE DISEASES ARE PREVENTABLE. EVERYONE HAS A ROLE TO PLAY.

For more information: [www.who.int/foodsafety](http://www.who.int/foodsafety)
#SafeFood

Causes of foodborne disease?

30-80% of FBD are ASF origin

- **Microbial pathogens** (viruses, bacteria)
- **Food borne parasites** (Helminths and protozoa)
- **Toxins** (including mycotoxins & chemicals) (linkages with stunting and immunosuppression)

Diarrhoeal diseases responsible for >½ global burden of FBD

Adapted from Havelaar et al., 2015
WHO Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010  
(Havelaar et al, 2015)

Regional variation in burden of FBD and the underlying causes

Africa

Europe

S & E Asia
Wet markets and the informal sector

• Most FBD is the result of consuming fresh, perishable foods from informal markets
  
(formal markets not necessarily safe)

• Regulatory control is difficult in informal markets (Do no harm!)

• Need to balance trade-offs between food safety, livelihoods and access to ASFs (‘meat in the middle’)
Practical solutions in low resource settings:

- ‘Farm to fork’ approach
- Use of risk management
- Recognize/support the risk laden informal sector
- Stakeholder engagement and training
- Create inclusive pathways to formalization
- Align improved policies and practices to incentives and motivations of actors and consumers
- Use of appropriate technologies
- Strengthen policy/food system governance

Photo: Land of Lakes
Risk assessment for food safety management in Vietnam

Speaker: Hung Nguyen-Viet, International Livestock Research Institute (ILRI) & Hanoi University of Public Health
Contribution

- Delia Grace
- Fred Unger
- Max Barot
- Lucy Lapar
- Dang Xuan Sinh
- Tran Tuyet Hanh
- Pham Duc Phuc
- Hoang Van Minh
- Tran Thi Ngan
- National Food Safety Risk Assessment Taskforce
Outline

• Animal source food and food safety in informal markets in Vietnam
• Evidence from risk assessment for food safety: pork and fish value chains within a One health / Ecohealth context
• From food safety research to policy translation
Food safety in Vietnam

• Food safety among the most pressing issues for people in Vietnam, more important than education or health care
• Vietnam has a modern food safety legislation system but the use of risk based approach is limited
• Risk perception towards chemical hazards is important
• Willing to pay 5-10% premium for food safety
• Food exports relatively well managed but deficits in domestic markets
Importance of pork for food security in Vietnam

Pork is an **important component** of the Vietnamese diet

- More than 70% of consumed meat is pork, 27kg/capita/year
- 83% produced by very small or small farms
- 76% of pigs are processed in small slaughtering, nearly 30,000
- Preference for fresh “warm” pork supplied in retail traditional markets (80% of all pork marketed)
  - affordable, address local demands
  - often escape effective control

- Consumption of risky pork products is common (raw fermented/blood pudding)
Risk assessment

- *Salmonella* risk pathways developed for producers, slaughterhouse and consumers, quantitative microbial risk assessment (QMRA) risk for consumer
- Chemical risk assessment


1275 samples (farms, slaughterhouse, market) collected during 1 year
## PigRISK - microbial (*Salmonella*) contamination

<table>
<thead>
<tr>
<th>Actor</th>
<th>Sample type</th>
<th>Prev (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer</td>
<td>Drink water</td>
<td>19.4</td>
</tr>
<tr>
<td>Producer</td>
<td>Floor swab</td>
<td>36.1</td>
</tr>
<tr>
<td>Producer</td>
<td>Waste water</td>
<td>38.9</td>
</tr>
<tr>
<td>Slaughter house</td>
<td>Carcass swab</td>
<td>38.9</td>
</tr>
<tr>
<td>Slaughter house</td>
<td>Feces</td>
<td>33.6</td>
</tr>
<tr>
<td>Slaughter house</td>
<td>Mesenteric</td>
<td>35.6</td>
</tr>
<tr>
<td>Slaughter house</td>
<td>Floor swab</td>
<td>22.4</td>
</tr>
<tr>
<td>Slaughter house</td>
<td>Water</td>
<td>20.4</td>
</tr>
<tr>
<td>Market</td>
<td>Overall</td>
<td>34.1</td>
</tr>
</tbody>
</table>
**Selected key results: QMRA**

*Streptococcus suis* in slaughter pigs (N=147): *S. suis* type 2, low prevalence (1.4%)

**Potential risk behaviors** such as consumption of “Tiet canh” (raw pig blood food) was common in slaughterhouse workers (43.1%)

**Cross-contamination survey** (*Salmonella*) (N=153): using the same cutting board induced the highest risk of cross-contamination with *Salmonella* (66.7%), followed by the same knife (11.1%) respectively

**Health risk by QMRA:**

- The annual incidence rate of salmonellosis: **12.6% (90% CI: 0.5 – 42.6).**

- The factors most influencing the risk: household pork handling practice and **prevalence in pork** sold in the market.

*Dang Xuan Sinh et al, 2017, IJPH*
514 pig feed, kidney, liver and pork samples were pooled into 18 samples were analyzed for antibiotic residues, β-agonists, and heavy metals, compared with current regulations.

Presence of banned substances (e.g. chloramphenicol and the growth promoter salbutamol in pig feed and sold pork)
### Selected key results: Chemical risk assessment

<table>
<thead>
<tr>
<th>Chemical hazards</th>
<th>Limit of detection (µg/kg)</th>
<th>Liver</th>
<th>Kidney</th>
<th>Meat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. positive/n (%)</td>
<td>Residue level [mean (min–max)] µg/kg</td>
<td>No. positive/n (%)</td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>50</td>
<td>0/18</td>
<td>–</td>
<td>0/18</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>30</td>
<td>0/18</td>
<td>–</td>
<td>0/18</td>
</tr>
<tr>
<td>Sulfonamides</td>
<td>2/18 (11)</td>
<td>2/18 (11)</td>
<td>2/18 (11)</td>
<td>9/18(50)</td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>15</td>
<td>2</td>
<td>68 (45–91)</td>
<td>1</td>
</tr>
<tr>
<td>Sulfadiazine</td>
<td>15</td>
<td>0</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>0.15</td>
<td>0/18</td>
<td>–</td>
<td>0/18</td>
</tr>
<tr>
<td>β-agonists</td>
<td>2/18(11)</td>
<td>2/18(11)</td>
<td>0/18</td>
<td>1/18 (5)</td>
</tr>
<tr>
<td>Salbutamol</td>
<td>3</td>
<td>2</td>
<td>4.24 (2.77–5.71)</td>
<td>0</td>
</tr>
<tr>
<td>Clenbuterol</td>
<td>3</td>
<td>0</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>18/18 (100)</td>
<td>18/18 (100)</td>
<td>18/18 (100)</td>
<td>5/18 (28)</td>
</tr>
<tr>
<td>Lead</td>
<td>70</td>
<td>10/18 (55)</td>
<td>117 (71–303)</td>
<td>7/18 (39)</td>
</tr>
<tr>
<td>Cadmium</td>
<td>10</td>
<td>18/18 (100)</td>
<td>17.5 (10.4–31.6)</td>
<td>18/18 (100)</td>
</tr>
<tr>
<td>Arsenic</td>
<td>50</td>
<td>0</td>
<td>–</td>
<td>0</td>
</tr>
</tbody>
</table>

Most of samples: negative or did not exceed current MRL

Tuyet Hanh et al, 2017, IJPH
Contaminated fish and health risk in an integrated agriculture system

Health and environmental issues & livestock?  
Nguyen-Viet et al, 2014
Risk assessment: fish from wastewater in Hanam province

- Wastewater from Hanoi and sanitation system → canal → fish contaminated by heavy metal and pathogens → health risk
- Conducting a risk assessment of tapalia
Risk assessment: fish from wastewater in Hanam province

- Tilapia from Nhue river.
- Highly contaminated Pb level, but low risk for tilapia.
- Local people seem to be aware of the risk, they sell contaminated fish/vegetables to other towns.

<table>
<thead>
<tr>
<th>Mẫu</th>
<th>n</th>
<th>Positive (%)</th>
<th>Pb (µg/kg)</th>
<th>Cd (µg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canal water</td>
<td>27</td>
<td>100</td>
<td>40,7</td>
<td>3,7</td>
</tr>
<tr>
<td>Talapia</td>
<td>27</td>
<td>100</td>
<td>96,3</td>
<td>149</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mẫu</th>
<th>Pb (mg/kg)</th>
<th>Cd (µg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOAEL</td>
<td>1,4</td>
<td>0,01</td>
</tr>
<tr>
<td>LOAEL</td>
<td>0,5</td>
<td>3,5-7,5</td>
</tr>
<tr>
<td>MRL</td>
<td>10</td>
<td>0,1</td>
</tr>
<tr>
<td>TDI</td>
<td>25 µg/kg/week</td>
<td>25 µg/kg/day</td>
</tr>
<tr>
<td>TDI</td>
<td>0,35 ± 0,206</td>
<td>1,88 ± 1,113</td>
</tr>
</tbody>
</table>

Toan et al (2014)
Key messages from pork and fish risk assessment

- “One Health” food safety risk assessment
- Risk misperception: what people worry about and what makes them sick are not the same
  - Chemical risk is low in both pork and fish
  - *Salmonella* risk is high (annual incidence rate of salmonellosis was estimated to be 12.6%)
- The factors most influencing the estimate were household pork handling practice followed by prevalence in pork sold in the central market.
Policy translation: food safety

2011 Meeting with VFA, Photo: CENPHER

2012 Meeting with DAH, Photo: CENPHER

2016 Meeting with Deputy Prime Minister Vietnam, 2 Dec 2016 (Photo: Tuyet Hanh)
Top Takeaways

1. Pork and fish are important for Vietnamese diet. Balance between formal and “wet/traditional” markets.

2. Risk assessment: useful tool for food safety management but adaptation and capacity are needed.

3. Risk misperception: what people worry about and what makes them sick are not the same.

4. Control & command approaches don’t work but solutions based on working with the informal sector more promising.

5. Food safety policy influence: persistence, opportunistic and time sensitive.
Improving markets to protect food access: an intervention in informal dairy markets in Kenya

Speakers: Silvia Alonso, International Livestock Research Institute
Milk – the white gold

Highly nutritious:
• Macro/micro nutrients
• High bioavailability
• improve anthropometric indices
• reduce nutritional deficiencies among undernourished children

Compared to other ASF:
• Very suitable for children
• More available
• More affordable
Raw milk

Most available and affordable form of dairy in many low income countries

In rural areas in LIC fresh raw milk is easily available (incl. self-production)

In urban areas co-exists with pasteurized milk:

- Wide distribution channels (incl. door to door)
- Cheaper
- Taste preference
- Cultural values
Raw milk and public health

Concerns over the safety of raw milk

- Is it a health risk in Kenya?
- Is pasteurized milk safer?
Raw milk and public health

Concerns over the safety of raw milk

- Is it a health risk in Kenya?
- Is pasteurized milk safer?

PUBLIC HEALTH INTERVENTIONS IN KENYA

- Based on increased regulation and penalization of raw milk
  VC actors (unsuccessful)
- Promoting selling of boiled milk
- Ban raw milk VC and promote pasteurization
The “informal” (raw milk) dairy sector

- Poor infrastructure, lack of cold chain, informal agreement mechanisms between actors, often unlicensed, poorly regulated (government and self-regulation)
The “informal” (raw milk) dairy sector

- Poor infrastructure, lack of cold chain, informal agreement mechanisms between actors, often unlicensed, poorly regulated (government and self-regulation)

- But… Informal dairy markets have an essential role in at least three main aspects:
  - Food security (especially diet and nutrition needs of children)
  - Source of livelihoods for the population (higher prices for producers, gives jobs to a good amount of people)
  - Support women and youth
A ban in the informal sector

- A ban of raw milk could have unintended consequences
  - livelihoods of many people
  - access to nutritious food
  - Increased price of pasteurized milk
A ban in the informal sector

- A ban of raw milk could have unintended consequences
  - livelihoods of many people
  - access to nutritious food
  - Increased price of pasteurized milk

While in the long term markets will formalize, in the short and medium terms interventions that seek to suppress informal markets can be **ineffective, anti-poor and gender-inequitable**
So do win-win options exist that will protect nutrition and livelihoods provided by these markets and still protect public health?
Upscaling the informal market

Training and certification
  Milk quality/ milk hygiene
  business skills / value addition
  Sustainable/self-sustained
Upscaling the informal market

Training and certification
Milk quality/ milk hygiene
Business skills / value addition
Sustainable/self-sustained

FINDINGS:
• Improved milk safety
• Happy traders/ customers
• Limited government buy-in
• Successful in other contexts
Giving T&C another chance!

“MoreMilk: making the most of milk” project (2016-2021)

TCM scheme to improve milk safety and health & nutrition outcomes in children in peri-urban Nairobi

• Training: milk quality, safety and hygiene
• Certification: “quality mark”
• Marketing: milk consumption messages to mothers/consumers
MoreMilk for better health and nutrition
More Milk for better health and nutrition

Milk safety and quality

- Pathogens
- Adulteration
+ Quality

Traders

Promotion milk consumption
More Milk for better health and nutrition

Milk safety and quality

- Pathogens
- Adulteration
+ Quality

- Diarrhea/FBD
- Waste

Better nutrition

Traders

Promotion milk consumption
MoreMilk for better health and nutrition

Milk safety and quality

- Pathogens
- Adulteration
+ Quality

Better nutrition

- Diarrhea/FBD
- Waste

Promotion milk consumption

- Waste

+ Consumption

Traders
MoreMilk for better health and nutrition

Milk safety and quality
- Pathogens
- Adulteration
+ Quality

Promotion milk consumption

Better nutrition
- Diarrhea/FBD
- Waste

Traders

More loyal customers

Higher returns

+ Consumption

Waste
Take home messages

• Raw milk and raw milk markets – essential roles in many countries (nutrition, health, livelihoods)

• Can’t look at food safety in isolation

• Food safety interventions: one size DOES NOT always fit all. Interventions that penalize informal actors can do more harm than good.

• Take holistic look at problem and find innovative approaches

• Light-touch interventions in informal markets can improve food safety, and contribute to improved health and nutrition outcomes.
A Multipronged Approach to Cleaning Up the Milk Supply in Rwanda

Speaker: Dennis Karamuzi, Land O’Lakes International Development
RDCP I (2007-2012):
Limited regional focus, few milking cows, low sector marketing capacity, nascent consumer demand

RDCP II (2012-2017):
Builds on GOR sector policy, sector-level leadership, growing urbanization and middle class demand, new investment in transport, processing, retail

- **USAID**: project funder $14,999,988
- **Land O’Lakes International Development**: lead project implementer
- **ABS-TCM, Nairobi Kenya**: training on animal husbandry
- **INSPIRED**: Developing financial products for dairy farmers with Rwandan banks
- **University of California, Davis**: Training on mastitis prevention, animal care and milk safety.

**RDCP II Partnership: A 10-year Investment**
RDCPII Goal

“Rwandan Dairy Products Competitive in regional markets”

NDS Goal

“A competitive dairy sector providing quality dairy products which are affordable, available and accessible to all Rwandans and other consumers in the region (Dairy Sector Working Group, July 2012).”
Primary Producer → Milk Collection Center → Milk Processing Plants → Milk Sellers, Supermarkets, Milk Bars & Kiosks → End User

PUSH effect - production
- Input support
  - Feed plans
  - Breeding plans
  - Herd Health
- Quality Training
  - Equipment & Kitting
  - Incentives System

PULL effect - consumption
- Quality Training
  - Equipment & Kitting
  - QMS
- QMS Incentive based pricing Relations

Aggregation Point → Milk Collection Center

Large Processors
Raw Milk Vendors
Cottage Processors
Policy – enabling environment
- Lack of enforcement of milk quality regulations
- No incentives provided for improved quality milk
- Limited cold chain
- Traditional consumer preferences dictate quality expectations
- Limited processing facilities
- Lack of electricity in some areas
- Limited Packaging materials
Quality of milk a priority
- Combining ‘Software’ and ‘Hardware’ to achieve quality goals
- Development of the Seal of Quality Concept
- Distribution of milk quality testing kits
- Enhancing milk transport logistics
- Advocating for certification services through support to RALIS
- Trained cheese makers and their staff about milk quality, testing, processing and marketing of their dairy products.
Individual MCCs aggregate milk from hundreds of small producers with 1 or 2 cows – high risk of contaminated milk entering bulk cooling tanks.

SOQ-enabled milk collectors – “Gatekeeper” for raw milk quality pushed to aggregation points that can ensure compliance from producers.

Less milk rejected from MCCs.

Provides instant feedback to producer on milk quality.

SOQ-enabled Milk Collectors
FROM HERE (Using bans and bamboo) TO HERE (Batch Pasteurizer – 1000 liters)

FROM HERE (Poor operating area) TO HERE (Clean area, Quality butter)
Kigali’s raw milk traditionally marketed through “kiosks” – shops with stainless steel tanks that don’t always properly cool milk.

Cost-effective for consumers, who can avoid costly packaging by purchasing small quantities of milk.

Before RDCP II, kiosks had very little sanitation oversight by authorities.

Bulk milk sold in the Milk Zone is screened and pasteurized.

Links best practices for raw milk safety with consumer demand for low cost and convenience.
Shisha Wumva: Feel the Goodness

- Milk consumption campaign that associates milk with a healthy body
- Backed by best practices at farm, MCC, processor and retail outlet
- Links the entire sector around best practices for milk safety and quality
- Allows for differentiation from “informal market”
- Promotes consumer demand
- Promotes investor confidence
Complementary to “one cup per child”
Multipronged Approach

Cleaner
Safer
Affordable
Available
Accessible

MILK products for ALL
Increased access to affordable, nutritious, cleaner MILK

Balance between PUSH & PULL elements is ESSENTIAL

ON-FARM testing of MILK – extended accountability along value chain

Incentive Based Payments for adhering to MILK safety standards

Government policy enforcement of clean MILK standards

Bulk tank sales of clean MILK into consumer container at desired amount

Processor collaboration with milk collection centers

Nationwide Milk Consumption Promotion Campaign
Thank you
Nutritious AND Safe Animal Source Foods
There are strong demand drivers but also significant microbial food borne disease risks. Integrate food safety into ag-nutrition programming

Use risk assessment and risk management to achieve greatest impact

Work with the informal sector; identify incentives to control risks and provide an inclusive pathway to formalization appropriate to culture and context

Farm to Fork - Implement control measures (good practices, technologies, behaviors and regulation) across the food system

Big carrots, small sticks - Balance light touch regulatory approaches with positive support to stakeholders and create incentives to meet realistic standards
Contact: jmaccartee@usaid.gov or koplanick@usaid.gov

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