Food Safety Challenges in the 21st Century

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Team

- PI
- 13 Co-PI
- 21 AI
- ~10 Post-docs
- ~50 M.Sc.
- Ph.D.
- Techni cal support
- Administration
Research

Systems Biology in Foods

Food, Nutrition and Health

Food Quality and Safety

New Technologies and Innovation
Food Safety Challenges in the 21st Century
Recent estimates indicate that the world’s population will rise to 10 billion in 2050

How to ensure safe food for all?
What is Food Safety?

Food Safety is defined as assurance that food will not cause harm to the consumer when is prepared and eaten according to its intended use.

FAO/WHO, 1997
98% of Apples have Pesticide Residues, USA

Eat at Your Own Risk
Societal, technological or environmental changes as result of human activity

Emergence or re-emergence of food safety concerns
Drivers

- New knowledge
- New technologies
- Emergence of new hazards
- Changes in global trade of foods and ingredients
- Changes in food types and formulations
- Changes in law and regulations
- Changes in economic conditions
- Changes in communications and perceptions
Driver #1: Global demographics

- Increasing population
  - Ease for secondary spread of hazardous agents
  - Increased demand for food

- Aging population
  - Increased susceptibility to foodborne hazards

- Population getting obese
  - Increase in obesity-related chronic diseases, leading to increased susceptibility to hazardous agents

- Increased expectation that children will reach adulthood
Driver #2: Global trade

- Increased demand for food in combination with rising incomes causes increases in global marketing of food
Net International Food Flows
(in mmt)

Source: ICMSF
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Source: ICMSF
Driver #3: Globalization of the food industry

International acquisition of raw ingredients
Worldwide distribution of products
Setting Food Safety Standards

www.codexalimentarius.net
International Food Standards?

High level of regional harmonization

Harmonization starting
# Modern Food Safety Management

<table>
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<th>now</th>
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Risk Analysis

Risk Assessment
• Scientific

Risk Management
• Practical

Risk Communication
Risk Analysis

Risk Assessment
• Scientific

Risk Estimate

Risk Management
• Practical

Risk Communication
Risk Analysis

Application of predictive modelling to food safety
Risk Assessment: farm to fork approach
Risk Assessment: farm to fork approach

**Vibrio parahaemolyticus in raw oysters**


**Salmonella, Listeria monocytogenes and STEC in beef production chain**

Risk Assessment: *farm to fork* approach

**Cross-contamination at retail level**

*Sant’Ana et al.* A semi-mechanistic model to describe the transference of *Salmonella* spp during grinding of bovine meat. *International Journal of Food Microbiology*, submitted

*Lopes et al.* Meat Safety: an innovative modelling approach to evaluate microbial pathogen transfer and cross-contamination at retail level. *On-going PhD work*

*Maffei et al.* Modelling cross-contamination during vegetable washing and risk of infection by *Salmonella*. *On-going PhD work*


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![Retail](image1.png)

**Retail**

![Retail](image2.png)

**Retail**
Risk Assessment: *farm to fork* approach

**Salmonella & Listeria in ready-to-eat vegetables**


SANT'ANA et al. Risk of infection with *Salmonella* and *Listeria monocytogenes* due to consumption of ready-to-eat leafy vegetables in Brazil. *Food Control*, v. 42, p. 1-8, 2014
Risk Management

Exploring bacterial interactions for food safety

Biopreservation

Antimicrobial compounds produced by lactic acid bacteria from foods

- organic acids
- diacetyl
- hydrogen peroxide
- carbone dioxide
- bacteriocins
- low molecular weight antimicrobial substances
Publications on bacteriocin-producing lactic acid bacteria
Screening and applications of bacteriocin-producing LAB in food matrices

- Milk, cheeses and other fermented dairy products
- Fermented meat-products: salami, salted ready-to-eat products

1. Inhibition of bacteria, molds and viruses (biopreservation) in different types of foods

2. Extension of shelf-life

3. Prevention of biofilm formation on food processing surfaces
Other applications of LAB in foods

a. Exploring the proteolytic activity of lactic acid bacteria to reduce allergenicity to milk proteins

b. Exploring the capability of lactic acid bacteria to produce vitamins (riboflavin and folate) to improve nutritional value of dairy products
Acknowledgements

Food Microbiology Lab
Thanks!