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Ekspectations and Needs in Food Safety Research

Prof. dr. sc. Vlasta Piližota
Sveučilište Josipa Jurja Strossmayera u Osijeku
Prehrambeno-tehnološki fakultet Osijek
Vlasta.Pilizota@ptfos.hr

The global availability of safe and wholesome food products

The Function of Food

- ***Food*** **is important for life.**
- **To be healthy and active, we should certainly have enough food.**
- **Foods we eat should also be safe and rich in all the nutrients our body needs.**
- **The challenge is of securing the availability of safe, nutritious and affordable food.**
- **A safe food supply is an imperative for health, social, and economic reasons.**

Food Safety and Consumers

- **Consumers want**
  - **Health**
  - **Functional foods**
  - **Safe**
  - **Quality**
  - **Convenience**
  - **Value for money**

- **Consumers are increasingly concerned about food safety.**

  - **How consumers perceive food risks?**

  - **How best to develop effective risk communication with consumers in order *to improve public health* through *improved food handling practices*.**

- **Need for**

  - **development and**
  - **implementation of food safety education strategies to improve specific food safety behaviors.**

- **When a sufficient number of knowledgeable consumers exists to generate a demand for safety that is representative of the preferences of the general population.**

- **Recent food safety crises have created a high degree of concern among consumers. (Loss of consumers' confidence associated with some lapses in food safety "mad cow", *Listeria* outbreaks…)**

- **Consumer perception has evolved to a high level of awareness and a much-reduced certainty, a combination, which has led to a generalised lack of confidence.**

- **The safety of foods has become a key issue for consumers as well as regulators around the globe.**

- **Maintaining the quality and safety of food throughout the food chain requires:**
  - **operating procedures to ensure the wholesomeness of food and**
  - **monitoring procedures to ensure operations that are carried out as intended.**

- **Food safety regulations have been devised to protect the consumer.**
- **Substances that had harmed humans were listed as toxic and therefore considered unacceptable in food.**
- **Absence of such substances merely meant undetectable by the methods available.**
- **At the time that most of the regulations were developed, however, analytical techniques were not well refined yet and *absence* usually meant *less than a few milligrams per kg* of product.**
- **Unintentionally, absence has got a different meaning with time as with time, the *detection limits* went down and currently many substances may be detectable in *nano-* or even *picograms* per kg of product.**

- **In practice this means that where absence of substances is required, the concentration must be between a *million* or a *billion* times lower than at the time the regulations were established.**

- **Governments have a duty to ensure that the law is maintained.**

- **Many compounds are essential *for good health* in certain concentrations while *toxic* in another higher concentration ("All substances are poisons: there is none which is not a poison. The right dose differentiates a poison and a remedy." Paracelsus, 1493–1541).**

Food preservation and desirable properties

- **Because safe food must be available around the year, food and food products must be preserved.**
- ***Modernization in food production* and *supply systems* has led to increased concentration in the food supply chain.**
- ***Globalization* has added to the complexities of the food supply chain, making issues like food safety, quality and logistics even more torturous than before.**
- **Food producers, processors and manufacturers are turning to Food Safety Management Systems (FSMSs) as effective tools to manage this problem.**
- **Although a controlled manufacturing environment will produce 98–99 % contamination-free products, companies must be prepared to deal with potential contamination.**

There is a need to:

- ***evolve*** **and**
- ***redesign traditional unit processes*** **and technologies by**
- **applying** ***innovations*** **and**
- ***novel techniques*****, or** ***procedures*** **(like nanotechnology, smart packaging,…),**
- ***new ingredients*****,**
- ***bio-based packaging materials*****,**
- ***biosensors*****,**
- ***non-destructive food testing*****…**

It has been demonstrated that many food products may be preserved by *novel methods* (such as "hurdle technology", "nonthermal technologies") with much less damage to the product than with the traditional methods, thus meeting consumer demands.

Food Safety

- ***Food safety*** **is generally recognized as the *biological*, *chemical* or *physical status* of a food.**
- **Risk (reduction) of injury, morbidity or mortality associated with consuming foods contaminated with microbial pathogens and other hazards.**
- **Development of models and value reductions in health risk.**
- ***Risk-based system should be the foundation upon which the industry and regulators can maximize the effectiveness of their resources by focusing on those products and ingredients that have the greatist toxic potential.***

Food safety **is about**

- **handling,**
- **storing and**
- **preparing food**

to prevent infection and help to make sure that our food keeps enough nutrients for us to have a healthy diet.

- ***Who's responsible for food safety?***
- **It's everyone's responsibility, from the farmers who grow the food to the people who place the food on our table.**
- **Food safety remains a national and international priority.**
- ***Ultimately, the quality and safety of food depends on the efforts of everyone involved in the complex chain of agriculture production, processing, transport, food production and consumption.***

- **If a link in this continuum is broken, the safety and integrity of food supply can be threatened.**

- ***Due to scientific results regulatory decisions have been made for design of most legislation acts dealing with human health risk and food safety.***

- **The European food safety system is based on the premise that safety must be guaranteed throughout the food chain if the health of consumers is to be protected.**

Risk Assessment and Risk Management

- **The food scares of the previous decade emphasised the need to functionally separate risk assessment and risk management and the implementation of this new food safety model has been instrumental in efforts to strengthen food safety in the EU and restore the confidence of consumers and trading partners in food supply.**

- **The risk assessment of compounds in food is a mature process that follows a well-developed scientific approach.**
- **Such a risk assessment has served society well to the extent that it has protected consumers from the potentially harmful effects of compounds to which they might otherwise have been exposed through food consumption.**

Expectations and Needs in Food Safety

Food Safety Goals

Assuring safe foods that consumers can trust

- ***Predicting*** **and** ***monitoring*** **the behaviour and fate of relevant known and emerging** ***(micro-)biological hazards***
- ***Predicting*** **and** ***monitoring*** **the behaviour and fate of relevant known and emerging** ***chemical hazards*** **including** ***toxins*** **of biological origin**
- **Improving** ***risk assessment*** **and** ***risk-benefit evaluation***
- **Developing the** ***tools to ensure the security*** **of the food chain e.g. Application of Biomarkers (advanced application of** ***biomarkers*** **in studying metabolic pathways of particular food ingredients)**
- ***Understanding*** **and** ***addressing*** **consumer concerns with food safety issues**

Food Safety Research

The role of research is to improve food safety and security.

- **The research broadly follows three lines:**

1. **Improved *understanding of hazards* and *their risks* at the different steps in the food chain, e.g. the knowledge base needed to support the rational *application of control measures* and the *development of new methods and systems*,**
2. ***Tools* to further secure the food chain, e.g. the development of *systems* and *technologies* for continuously improving the safe production and supply of foods,**
3. ***Understanding of the human factor* i.e. consumer perception of risks and the *need for communication.***

- **Research activities are increasingly focused on**

- ***quantification*** **of microbial contamination of food products at various stages in the food chain,**
- ***modeling*** **the impact of contamination on human health;**
- ***safety of food*** **(to monitor and screen foods and food ingredients for all contaminants);**
- **better use of *modelling* involving *more knowledge* about reactions, physico-chemical changes during processing, to define the best parameters to control, to design new processes, to predict product quality,…**

- **Research is needed to further develop the science and to make**

- **tools for prevention,**
- **control,**
- **traceability (focus on managing recalls and not on prevention),**
- **authenticity and**
- **food defence (adulteration and bioterrorism) more widely available at appropriate points in operational food chains.**

- **Adapt to the complexity of the food composition, food processes, and the food supply chain.**
- **Development of innovative detection methods and portable devices to detect toxins, pathogens and chemicals in foodstuffs on the spot.**
- **The trend will be towards risk/benefit assessment.**
- **The food industry should continue to identify and promote its own research into aspects of food safety, which may influence the *development*, and *application* of control measures.**

- **The researchers note that if education about food safety is to be *effective*, it must be *simple, easy* to follow, and, if possible, *unobtrusive*.**

- **A new approach based on *close collaboration* of scientists and engineers from different scientific and technological areas is needed.**

Novel platforms

Several platforms, which have been used for the first time in food safety studies:

- **bioimaging,**
- **laser tweezers,**
- **phage display/convergent evaluation,**
- **functional mammalian cell models,**
- **functional genomics,**
- **microarray technology and**
- **management platform which is focused on food safety systems and covers technological as well as managerial aspects.**

FP6 PathogenCombat

Pamphlet was distributed in 5th CEEFood Congress, 19th - 22nd May 2010, Bratislava, Slovak Republic

- ***New biotechnological platforms***

Novel methods to:

- **analyze the interactions at cellular and molecular level between pathogens and food and feed matrices and contact surfaces (surface decontamination) in the food chain, including the intestinal tract of farm animals.**
- **understand the mechanisms, by which pathogens enter, adapt, persist and express virulence in the food chain.**

(e.g. Fluorescence Ration Imaging Microscopy, Atomic Force Microscopy, Functional Genomics, Functional Mammalian Cell Models).

- Novel molecular approaches to understand and to combat emerging pathogens

- **Detection methods and virulence expression.**

- Rapid and meaningful detection methods

- **Rapid detecting biosensors**
  - **A quick, easy and reliable pathogen testing device**
  - **New standards for microbial monitoring**
  - **Portable pathogen detection sensors with higher sensitivity**

- **Molecular biology culture-independent techniques for pathogens. The methods include a new approach to estimate viability and virulence of pathogens throughout the food chain.**

- Virulence expression in food matrices

- **A novel strategy for food formulation, food preservation and quantitative risk assessment.**

- Methods for breaking the transmission of pathogens along the food chain

- **Prevention of cross contamination by hygienic design to close the present gap between technology and hygiene and development of cleaning and disinfection procedures to remove biofilms in the food chain.**
- **Inactivation of pathogens by *mild processing techniques* (e.g. organic acids, intense UV light pulses, microwaves, ohmic heating, ultrasound, and hydrostatic pressure).**
- **New protective and probiotic cultures for control or elimination of pathogens, including viruses, in the food chain.**

- Mammalian functional cell models

- **Cell models for host-pathogen interactions and selection of protective and probiotic cultures to inactivate pathogens, including viruses.**
- **Determinations of dose-response and risk assessment.**

- Food Safety Management

- **Diagnostic instruments and tools for Small and Medium sized Enterprises (SME´s) for identification of technological and managerial interventions which can improve food safety management systems (FSMS) and lead to integration of the new knowledge and methods**

- **New pathogens will continue to emerge and our understanding of current pathogens and their resistance or stress adaptation will change.**

- **Scientific knowledge and understanding of many pathogens has greatly increased (e.g. *Listeria monocytogens, Vibrio parahaemolyticus, Enterobacter sakazakii…*) as a result of fundamental information relating to these pathogens.**

To address fully food safety would require risk assessment and an analysis of the complete food chain

- **from seed or livestock genotype,**
- **through primary agriculture,**
- **primary, secondary and tertiary processing,**
- **food formulation,**
- **packaging,**
- **distribution,**
- **retailing,**
- **domestic storage and**
- **finally consumption.**

The Global Harmonization Initiative

A few years ago, scientists involved in various scientific organisations, dealing with food science and technology, decided that it ought to be possible *to harmonise food regulations* and *legislation*, i.e. having the same rules and food laws everywhere on the globe.

In 2004 the International Division of IFT and the European Federation of Food Science and Technology (EFFoST), in cooperation with Food Safety Magazine and Elsevier Science launched the Global Harmonization Initiative (GHI) *to try to eliminate differences in regulations and legislation.*

GHI was specifically established to help build global consensus on the scientific evidence underpinning food safety policymaking.

Soon after this event, many other organisations have joined, including the International Union of Food Science and Technology (IUFoST), the Federation of European Microbiological Societies (FEMS), the Food Chemistry Division of the European Association for Chemical and Molecular Sciences (EuCheMS) and the European Hygienic Engineering and Design Group (EHEDG).

In addition, scientific research organisations, such as the National Center for Food Safety & Technology (NCFST) in Chicago and food science & technology departments of universities all over the world have joined.

Harmonising organisations

It is realised that *many organisations attempt to harmonise regulations and standards* to which legislation refers.

These organisations include Codex Alimentarius (a joint United Nations and World Health Organization commission), the World Trade Organisation (WTO), standardisation organisations such as ISO and organisations such as the European Food Safety Authority (EFSA).

By far *not all nations participate in these organisations* and some may be politically biased or perceived to be biased.

Nevertheless, the GHI will not repeat work done. To the contrary, where statements based on scientific evidence exist, they will be *reviewed* and most likely often be *adopted* as DRAFT consensus statements.

Such statements may originate from organisations such as Codex Alimentarius, the International Commission for the Microbiological Specifications for Food (ICMSF), the European Food Safety Authority (EFSA), and the International Life Sciences Institute (ILSI).

The GHI therefore is very pleased with participation of scientists involved in these and other organisations with similar goals.

Scientific consensus

It is realised that GHI on its own will not be able to change regulations anywhere - let alone globally.

GHI intends to establish whether global consensus is possible on issues that buttress such regulations.

This requires the *participation of responsible food scientists* from all over the world and identification of experts.

Publication of the results of the Global Harmonization Initiative will make it more difficult to abuse science.

By obtaining global scientific consensus on food related issues, it will be hard for antis to find scientists who are willing to support unjustified statements.

It will also be hard to counter or deny requests to governments for changes in regulations that are not *based on sound scientific data*.

The intention is not to promote a "no" or "yes" for particular cases, but *to carefully review available evidence* to see whether or not a consensus statement on safety can be made.

There may be issues where the "yes" or "no" depend on circumstances, e.g. the method of use or the use by certain populations.

For instance, lactose is a natural constituent of bovine milk. While for some populations lactose is a harmless energy source, for other populations it is a toxic substance.

Likewise, peanuts are a staple in the diets of billions of people around the world, whereas for thousands of others they are a constant threat of anaphylaxis.

In other cases there may be lack of evidence either way. In such cases research to obtain such evidence shall be proposed.

Book, recently published
Ensuring Global Food Safety - Exploring Global Harmonization

Academic Press is an imprint of Elsevier, 2010

The book provides a detailed insight into food safety regulations and discusses methods to determine the safety of foods, ingredients and food-contact materials.

Thank you for your attention