

Integrating surveillance of animal health, food pathogens and foodborne disease in the European Union

F. Berthe*, M. Hugas & P. Makela

European Food Safety Authority, Risk Assessment and Scientific Assistance Directorate, Via Carlo Magno 1/A, Parma, I-43126, Italy

*Corresponding author: Franck.BERTHE@efsa.europa.eu

Summary

The European Food Safety Authority (EFSA) is the keystone of European Union (EU) risk assessment for food and feed safety. In collaboration with national authorities and in consultation with its stakeholders, EFSA provides independent scientific advice and information about existing and emerging risks. Assessing biological risks at the human–animal interface is becoming ever more challenging because this interface is in a permanent state of flux. In addition, questions about food safety cannot usually be categorised under one discipline; most of the time, they need to be addressed in a transdisciplinary way. Two scientific panels of EFSA, on biological hazards (BIOHAZ) and on animal health and welfare (AHAW), have, in many instances, jointly addressed such complex, multifaceted questions of risk. This paper reviews the integrated approach of the EU towards risk assessment, with a special focus on human health and the whole food chain, and on science-based interventions to lower the risk to consumers.

Keywords

Animal health – Animal welfare – Antimicrobial resistance – Biological hazard – Biological monitoring – Food hygiene – Food microbiology – Food safety – Foodborne disease – Zoonosis.

Introduction

Food safety should be addressed with an integrated approach, most frequently referred to as ‘from farm to fork’. A brief historical look at food safety in the European Union (EU) shows that the main focus in the 1980s was on using good hygiene practices (GHP), but that this shifted in the 1990s to the hazard analysis critical control point (HACCP) concept, and moved in the 2000s towards the risk analysis framework, first developed by the Codex Alimentarius Commission (CAC) in the 1990s. In the EU, both the European Commission (EC) and the European Food Safety Authority (EFSA) use this risk analysis framework as a basis for their work on food safety, as per EFSA’s Founding Regulation (10). This regulation also establishes EFSA as an independent body to perform risk assessment and risk communication, to provide scientific advice, and to disseminate information on risks related to the food chain. Thus, EFSA has a broad remit, covering the entire food chain from farm to fork, including topics related to animal

health and welfare, biological hazards, pesticides and contaminants, genetically modified organisms, nutrition and food and feed additives, as well as plant health. While EFSA plays its role in assessing risks related to food and feed, the EC, the European Parliament and the EU Member States are the actual risk managers, or decision-makers, with ultimate responsibility for legislative initiatives.

Societal questions about food safety cannot usually be answered from the perspective of a single discipline. Most of the time, such questions are complex and multifaceted, and need to be addressed in a transdisciplinary manner. This paper reviews the integrated approach of the EU towards risk assessment with a special focus on human health and the whole food chain, as well as on science-based interventions to lower the risk to consumers. The authors explore the example of recent work undertaken on meat inspection to illustrate the unique capacity of EFSA to integrate animal health, food pathogen and foodborne disease surveillance in the EU.

Animal health, animal welfare, food pathogens, zoonoses and foodborne diseases

Two scientific panels of EFSA are particularly relevant to the integrated surveillance of animal health, food pathogens and foodborne diseases in the EU. The Panel on Biological Hazards (BIOHAZ) addresses these risks in relation to food safety and foodborne diseases (13). It covers foodborne zoonoses, food microbiology, food hygiene, antimicrobial resistance, transmissible spongiform encephalopathies and issues associated with waste management. The core activity of the Panel on Animal Health and Welfare (AHAW) is to assess all aspects of health and welfare related to animal production systems and practices employed in the EU, as well as conditions that result from animal interactions with wildlife and the risks arising at the human–animal–environment interface (2). Thus, the AHAW panel covers all aspects of animal health and welfare, including those that have implications for human health. The European Food Safety Authority has therefore established a rather unique capacity to tackle the real breadth of farm food safety issues.

Interestingly enough, the concept of animal welfare, as far as EFSA is concerned, has implications far beyond the protection and well-being of the animals themselves. The welfare of animals has an overall impact on their condition, including possible implications for their health and for food safety. These aspects have been considered in many of EFSA's scientific opinions on animal welfare. For example, tail biting in pigs is a major welfare issue, and also a risk factor for increased frequency of abscesses and infections in carcasses (6). On the other hand, the risk of contamination with *Salmonella* Enteritidis might be higher when eggs are produced in non-cage systems, because this exposes laying hens and their eggs to more environmental contamination (4). When requested by the EC to assess the welfare of fish species at the time of stunning and killing, EFSA also included food safety considerations in its assessment (e.g. such potential hazards as post-mortem chemical changes in the fish and the possible effects of stunning/killing systems on their microbiological safety), thus providing risk managers with a comprehensive, fit-for-purpose response.

On several occasions, the two panels have addressed risk issues jointly; for example, the question of Rift Valley fever virus (3) and, more specifically, the probability of humans becoming infected with it through handling or consuming products derived from infected animals. Assessing biological risks at the human–animal interface often challenges the apparently clear-cut concept of foodborne zoonoses. An interesting example, from this point of view, was the opinion provided in 2010 by the AHAW and BIOHAZ panels on

Q fever, following a significant increase in human cases in the Netherlands (7). This scientific opinion was prepared to help determine:

- the magnitude, distribution, impact and significance of infection and disease in domestic ruminants and humans
- risk factors for the maintenance of Q fever in domestic ruminant populations
- spillover of *Coxiella burnetii*, the causative agent, from these populations to humans.

The widespread distribution of *C. burnetii* in food-producing animals and its occurrence in the milk supply led to questioning the role of food as a vehicle for the transmission of this zoonotic bacterium to humans. There is some epidemiological indication that the consumption of milk and/or milk products containing *C. burnetii* has been associated with seroconversion in humans. However, the assessment concluded that there was no conclusive evidence that the consumption of milk and milk products containing *C. burnetii* resulted in clinical Q fever in humans (7). This risk assessment also involved the European Centre for Disease Prevention and Control (ECDC), which was established as an EU agency to strengthen Europe's defences against infectious diseases.

Collecting data that are relevant to food safety is central to EFSA, because such data are an integral part of risk assessment. These data are particularly valuable for quantitatively estimating risks and/or for identifying to what extent a given control measure or intervention strategy can reduce the burden of a zoonotic disease in humans (12). Annual monitoring data provide updates on the current situation and help to inform risk managers and Member States of recent developments.

In the field of biological risks for human health, Directive 2003/99/EC2 lays down the requirement for an EU system for monitoring and reporting information, which obliges EU Member States to collect relevant and comparable data on zoonoses, zoonotic agents, antimicrobial resistance and foodborne outbreaks and to report these data annually to the EC (11). The European Food Safety Authority is assigned the tasks of examining the collected data and preparing the annual EU summary reports, in collaboration with the ECDC (9), which collects and analyses corresponding data on human cases. In addition, EFSA runs the data collection applications on behalf of the EC.

According to Directive 2003/99/EC2 on zoonoses, monitoring is based on the systems already in place in Member States. However, the Directive also foresees that detailed rules for monitoring may, where necessary, be laid down in EU legislation, to make the data easier to compile and compare. In addition, EFSA issues technical

specifications and submits external reports for monitoring and reporting certain zoonoses, antimicrobial resistance and foodborne outbreaks, to improve analyses and make it easier to compare the data between Member States.

The AHAW and BIOHAZ panels have regularly been consulted about the EC summary reports (5). A yearly report of the distribution and other epidemiological characteristics of zoonoses in EU Member States is an essential component of assessing the impact of these diseases and potential preventive measures. However, these reports do not provide real-time information on the current disease situation, which can be a major drawback in their usefulness for risk assessment. It has also been noted that the reports do not always clearly identify the reference population, the data sources, and data collection approaches (surveillance methodology) used for the various diseases. There is a need to consider these three essential elements in order to make appropriate inferences about the sources and trends of the diseases being examined. In addition, EFSA regularly reviews its data requirements to improve its preparedness to answer risk assessment questions, by ensuring that it continues to collect readily available, stable data and has a good knowledge of *ad hoc* data sources throughout the EU (1).

A practical example: meat inspection of poultry

The main purpose of meat inspection is to detect and prevent public health hazards, such as foodborne pathogens or chemical contaminants, in foods of animal origin. Inspecting slaughter animals can also provide a valuable contribution to surveillance for specific diseases of animal health importance, particularly exotic diseases.

After a request from the EC, EFSA recently published a risk assessment of the public health hazards (biological and chemical, respectively) that should be covered when inspecting poultry meat (8). Briefly, the request was to:

- identify and rank the main risks for public health that should be addressed by meat inspection
- assess the strengths and weaknesses of the current meat inspection methodology
- recommend inspection methods fit for the purpose of meeting the overall objectives of meat inspection for hazards not currently covered by the meat inspection system
- recommend adaptations of inspection methods and/or frequencies of inspection to provide an equivalent level of protection.

In addition, EFSA was asked to consider the implications for animal health and welfare of any changes proposed to current meat inspection methods.

To carry out this risk assessment, an integrated approach was established, with the involvement of the BIOHAZ panel for assessing biological risks and the AHAW panel for assessing the impact of modernising meat inspections on animal health and welfare surveillance systems. The EFSA Panel on Contaminants (CONTAM) addressed the specific risks related to chemical contaminants. The aim was to provide EU risk managers with comprehensive scientific advice, and to make meat inspection more risk based.

For biological hazards, a decision tree was developed and used to rank the risks of meat-borne hazards in poultry. This ranking was based on:

- the magnitude of the hazard's overall impact on human health
- the severity of the disease in humans
- the proportion of human cases that could be attributed to the handling, preparation and consumption of poultry meat
- the occurrence of these hazards in poultry flocks and carcasses.

Campylobacter spp. and *Salmonella* spp. were considered to be of great public health relevance for poultry meat inspection. Extended spectrum-beta-lactamase (ESBL)/AmpC gene-carrying bacteria were considered to be of medium-to-high public health relevance (*Escherichia coli*) and low-to-medium relevance (*Salmonella*). Data for ranking *Clostridium difficile* were insufficient but – based on the limited information available – the present risk was considered to be low. All other hazards were considered to have low public health relevance. The ranking of biological hazards into specific risk categories was based on current knowledge and the available data and thus mainly refers to broilers and turkeys.

An assessment of the strengths and weaknesses of current meat inspections for biological hazards focused on the public health risks that may occur through the handling, preparation and/or consumption of poultry meat. Among the strengths identified were the fact that food chain information (FCI), gathered as a part of ante-mortem inspection, provides information on disease occurrence during rearing and veterinary treatments. This enables a more focused ante-mortem inspection of flocks with animal health concerns. Ante-mortem inspection can be used to verify FCI provided by the farmer and to give feedback to the producers on any other problems detected, which are usually not related to public health. In addition, visually

inspecting live animals can detect birds that are heavily contaminated with faeces. Such birds increase the risk of cross-contaminating carcasses with biological hazards during slaughter and may consequently constitute a food-safety risk that can be reduced, if such birds/carcasses are dealt with adequately. Visual detection of faecal contamination of carcasses at a post-mortem inspection can also be an indicator of slaughter hygiene, but other approaches to verify slaughter hygiene were considered more appropriate.

The following food safety weaknesses were identified in the field of biological hazards:

- FCI lacks adequate and standardised indicators for the main public health hazards, except for *Salmonella* in broiler and turkey flocks
- current ante- and post-mortem visual inspections are not able to detect any of the public health hazards identified as the main concerns for food safety.

This is because ante-mortem examination is only carried out on birds in a sample of crates and observing individual birds in the crates is difficult. The high speed of the slaughter lines reduces the ability to detect lesions or faecal carcass contamination by visual inspection and, at best, only a sample of the birds can be thoroughly examined.

For chemical hazards, a major weakness is the limited value of the visual ante-mortem and post-mortem inspection for identifying chemical residues and contaminants. In addition, National Residues Control Plans prescribe the number of samples that need to be taken, but do not necessarily take into account actual FCI related to feed control or environmental monitoring of substances of potential health concern. Further integration and exchange of information from these activities is recommended.

As none of the main biological hazards of public health relevance associated with poultry meat can be detected by traditional visual meat inspections, the BIOHAZ panel proposed the establishment of an integrated food safety assurance system, to be achieved through improved FCI and interventions based on risk. This system includes clear and measurable targets for carcasses and, when appropriate, for flocks, clearly indicating what food business operators (FBOs) should achieve in respect to a particular hazard. An important element of an integrated food safety assurance system is risk categorisation of poultry flocks based on FCI. In addition to flock-specific information, farm descriptions provided through farm audits could also be included, to assess the risk and protective factors for these flocks in terms of potential hazards. Classifying abattoirs according to their ability to prevent or reduce faecal contamination of carcasses could be based on technology, for example, whether the best equipment has been installed and an

HACCP programme put into place. Classification could also be based on how hygienic the process is, something that could be measured by, for example, the numbers of indicator organisms, such as *E. coli* or *Enterobacteriaceae*, on the carcasses. This is known as the establishment of process hygiene criteria (PHC). Classifying abattoirs in this way could lead to the decision to send flocks that present specific risks to specially adapted slaughter lines or abattoirs.

In conclusion, for biological hazards it was determined that a wider range of FCI, together with a more systematic and better focused use of the information gathered, would help considerably in controlling the main public health hazards associated with poultry meat. Ante-mortem inspections can help to detect birds that are heavily contaminated with faeces and to assess the general health status of the flock. No adaptations to the existing visual ante-mortem inspection were found to be required. In contrast, it was proposed that the current post-mortem visual inspection be replaced by the establishment of targets for the main hazards on the carcass and by verification of the FBOs' own hygiene management through the use of PHC. It is noted, though, that current post-mortem inspection does not increase the microbiological risk to public health unless the carcasses are handled (as a consequence of visually detecting abnormalities), leading to cross-contamination. A series of recommendations were made on:

- data collection
- interpreting monitoring results
- future evaluations of the meat inspection system and hazard identification/ranking
- training all parties involved in the poultry carcass safety assurance system
- the need for research on optimal ways to use FCI and approaches for assessing the public health benefits.

The implications of these proposed changes to the meat inspection system for animal health and welfare, particularly the omission of visual post-mortem inspections and extensive use of FCI, were investigated and an assessment of consumers' health risks carried out. Two broad methods were used during this assessment, including a qualitative approach (a review of the scientific literature, expert opinions) and the results from quantitative modelling.

In the meat inspection system, ante- and post-mortem inspections are recognised as valuable tools for the surveillance and monitoring of specific animal health and welfare issues. Meat inspection is often a key point for identifying outbreaks of new or existing disorders or disease syndromes in situations where clinical signs have not been detected on-farm. In the course of normal commercial procedures, ante- and post-mortem inspections of poultry

are an appropriate and practical way to evaluate the welfare of poultry on-farm, and the only way to evaluate the welfare of poultry during transport and associated handling.

Two key consequences of the omission of visual post-mortem inspection were identified:

- the loss of opportunities to collect data about the occurrence of new or existing disorders, disease syndromes and welfare conditions of poultry
- the potential for carcasses with pathological changes, currently condemned during visual post-mortem inspection, to be further processed without the infectious nature of some conditions being detected.

If visual post-mortem inspection is to be removed from the meat inspection procedure, other approaches should be explored and applied to compensate for any associated loss of information about the occurrence of animal disease and welfare conditions. Two approaches were outlined. First, it was recommended that post-mortem checks continue on each carcass that is removed from the food chain, for example, due to visible pathological changes or other abnormalities, as part of a meat quality assurance system. In addition, it was proposed that a detailed inspection be conducted on a defined subset of carcasses from each batch, guided by FCI and other epidemiological criteria, to obtain information about animal disease and welfare conditions. The intensity (number of birds sampled) of targeted surveillance within each batch should be risk based, with a random sampling of birds to provide a representative picture of the health and welfare of birds in the batch.

The extended use of FCI has the potential to compensate for some, but not all, of the information on animal health and welfare that would be lost if visual post-mortem inspection is removed. This can only occur if FCI is designed to identify indicators for the occurrence of animal health and welfare conditions. However, an FCI system for public health purposes is unlikely to have the best possible format for animal health and welfare purposes. Therefore, an integrated system should be developed in which FCI for public health and FCI for animal health and welfare can be used in parallel.

Conclusion

Public health is defined as the field of medicine concerned with safeguarding and improving the health of the community as a whole. Public health is inherently a function of many factors, and the food chain is a major one. Safeguarding animal and public health at the human–animal interface benefits all sectors of our society. The examples presented in this paper show how EFSA's work epitomises the EU's integrated approach to food safety, from farm to fork.

This work is performed in an increasingly demanding and challenging societal context. In recent years, there has been increasing public concern about the sustainability of production systems, such as those for producing food. Concepts of food quality have been refined, leading also to the concept of acceptability. Human health, but also animal health and welfare, are among the many components of sustainable systems and the acceptability of food.

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La surveillance intégrée de la santé animale, des agents pathogènes d'origine alimentaire et des toxi-infections alimentaires dans l'Union européenne

F. Berthe, M. Hugas & P. Makela

Résumé

L'Autorité européenne de sécurité des aliments (EFSA) est la clé de voûte de l'évaluation des risques associés aux denrées alimentaires et aux aliments pour animaux dans l'Union européenne (UE). L'EFSA fournit une expertise scientifique indépendante et des informations sur les risques actuels et émergents, en collaboration avec les autorités nationales et en consultation avec ses partenaires. L'évaluation des risques biologiques à l'interface entre l'homme et les animaux représente un défi croissant, en raison des flux permanents qui se déploient à cette interface. En outre, les questions relatives à la sécurité sanitaire des aliments ne relèvent pas d'une seule discipline ; en général, elles doivent faire l'objet d'un traitement transdisciplinaire. Deux groupes scientifiques de l'EFSA, chargés respectivement des dangers biologiques (BIOHAZ) et de la santé et du bien-être des animaux (AHAW) ont consacré plusieurs de leurs travaux à l'examen conjoint de ces problématiques du risque, qui s'avèrent complexes et pluridimensionnelles. Les auteurs font le point sur l'approche intégrée mise en œuvre par l'UE dans le domaine de l'évaluation du risque, en mettant particulièrement l'accent sur la santé publique et la chaîne de production alimentaire dans son ensemble, et sur les interventions, fondées scientifiquement, qui visent à atténuer le risque pour les consommateurs.

Mots-clés

Bien-être animal – Danger biologique – Innocuité alimentaire – Microbiologie alimentaire – Résistance aux agents antimicrobiens – Santé animale – Sécurité sanitaire des aliments – Surveillance biologique – Toxi-infection alimentaire – Zoonose.



Integración de la vigilancia de la sanidad animal, los patógenos alimentarios y las enfermedades transmitidas por los alimentos en la Unión Europea

F. Berthe, M. Hugas & P. Makela

Resumen

La Autoridad Europea de Seguridad Alimentaria (EFSA) es la piedra angular del proceso de determinación del riesgo que se aplica en la Unión Europea (UE) en materia de inocuidad de los alimentos y los piensos animales. En colaboración con las autoridades nacionales y en consulta con sus interlocutores, la EFSA proporciona información y asesoramiento científico independiente sobre los riesgos ya existentes o que empiezan a manifestarse. Determinar los riesgos biológicos presentes en la interfaz entre el hombre y los animales resulta cada

vez más difícil, porque esa interfaz es muy lábil en todo momento. Además, los temas relativos a la inocuidad de los alimentos rara vez pueden ser adscritos a una sola disciplina, sino que casi siempre exigen una óptica transdisciplinar. En muchos casos dos comisiones científicas de la EFSA, una dedicada a los peligros biológicos (Comisión BIOHAZ) y otra sobre salud y bienestar de los animales (Comisión AHAW), han abordado conjuntamente las cuestiones ligadas al riesgo, tan complejas como poliédricas. Los autores examinan el planteamiento integrado de la UE en materia de determinación del riesgo, prestando especial atención, por un lado, a la salud humana y la totalidad de la cadena alimentaria, y por el otro a las intervenciones científicamente fundamentadas para reducir el grado de riesgo para el consumidor.

Palabras clave

Bienestar animal – Enfermedad transmitida por los alimentos – Higiene de los alimentos – Inocuidad de los alimentos – Microbiología de los alimentos – Peligro biológico – Resistencia a los antimicrobianos – Sanidad animal – Vigilancia biológica – Zoonosis.



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