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Salmonella and *Campylobacter* in chicken meat

MEETING REPORT

WHO

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Declarations of interest

All participants completed a Declaration of Interest form in advance of the meeting. Eight of the experts who participated in the meeting declared an interest in the topics under consideration.

- Vivien Allen's research unit has received support for research on delivery methods for Salmonella vaccines.
- Ayachi Ammar's research unit is providing consultancy services and has received research support from the National Agency for the Development of Research in Health.
- Elyakum Berman's work is partly funded by the Israel egg and poultry board.
- Dane Bernard is an employee of a food company that includes broiler production operations.
- Charles L. Hofacre provides consulting services to a poultry breeding company.
- Geoffrey Charles Mead provides independent consultancy services as the Chairman of the technical advisory board for a farm assurance company.
- Stephen Jon Moore is an employee of a poultry processing company.
- Vladimir Pinheiro do Nascimento provides consulting services to a poultry producing company.

Upon detailed review of these declarations, it was considered that the interests declared by these experts should not prevent them from participating fully in the deliberations of the meeting. Their activities were not considered to represent a potential conflict of interest in the meeting. Nevertheless, for the purpose of transparency, the declarations were made known to all the participants at the beginning of the meeting. All the experts participated in their individual capacity and not as representatives of their country, government or organizations.

Abbreviations

ASC	Acidified Sodium Chlorite
CAC	Codex Alimentarius Commission
CCFH	Codex Committee on Food Hygiene
CE	Competitive Exclusion
cfu	colony-forming units
EU	European Union
FAC	Free Available Chlorine
FAO	Food and Agriculture Organization of the United Nations
FSA	Food Standards Agency [United Kingdom]
GHP	Good Hygiene Practice
HACCP	Hazard Analysis and Critical Control Points
IOBW	Inside/Outside Body Wash
JEMRA	Joint FAO/WHO Expert Meetings on Microbiological Risk Assessment
MRA	Microbiological Risk Assessment
OIE	World Organisation for Animal Health
OLR	On-line reprocessing
PIF	Powdered Infant Formula
ppm	parts per million
TSP	Trisodium Phosphate
WHO	World Health Organization

Foreword

The Members of the Food and Agriculture Organization of the United Nations (FAO) and of the World Health Organization (WHO) have expressed concern regarding the level of safety of food at both the national and international levels due to increasing foodborne disease incidence caused by microorganisms in food. This concern has been voiced in meetings of the Governing Bodies of both Organizations and in the Codex Alimentarius Commission. It is not easy to decide whether the suggested increase is real or an artefact of changes in other areas, such as improved disease surveillance or better detection methods for microorganisms in foods. However, the important issue is whether new tools or revised and improved actions can contribute to our ability to lower the disease burden and provide safer food. Fortunately, new tools, which can facilitate actions, seem to be on their way.

Over the past decade, Risk Analysis—a process consisting of risk assessment, risk management and risk communication—has emerged as a structured model for improving our food control systems, with the objectives of producing safer food, reducing the numbers of foodborne illnesses and facilitating domestic and international trade in food. Furthermore we are moving towards a more holistic approach to food safety where the entire food chain needs to be considered in efforts to produce safer food.

As with any model, tools are needed for the implementation of the risk analysis paradigm. Risk assessment is the science-based component of risk analysis. Science today provides us with in-depth information on life in the world we live in. It has allowed us to accumulate a wealth of knowledge on microscopic organisms, their growth, survival and death, even their genetic make-up. It has given us an understanding of food production, processing and preservation, and the link between the microscopic and the macroscopic worlds and how we can benefit from as well as suffer from these microorganisms. Risk assessment provides us with a framework for organizing all this data and information and to better understand the interaction between microorganisms, food and human illness. It provides us with the ability to estimate the risk to human health from specific microorganisms in foods and gives us a tool with which we can compare and evaluate different scenarios as well as identify what types of data are necessary for estimating and optimizing mitigating interventions.

Microbiological risk assessment (MRA) can be considered as a tool that can be used in the management of the risks posed by foodborne pathogens and in the elaboration of standards for food in international trade. However, undertaking an MRA, particularly quantitative MRA, is recognized as a resource-intensive task requiring a multidisciplinary approach. Yet foodborne illness is among the most widespread public health problems, creating social and economic burdens as well as leading to human suffering, making it a concern that all countries need to address. As risk assessment can also be used to justify the introduction of more stringent standards for imported foods, a knowledge of MRA is important for trade purposes, and there is a need to provide countries with the tools for understanding and, if possible, undertaking MRA. This need, combined with that of the Codex Alimentarius for risk-based scientific advice, led FAO and WHO to undertake a programme of activities on MRA at the international level.

The Nutrition and Consumer Protection Division, FAO, and the Department of Food Safety and Zoonoses, WHO, are the lead units responsible for this initiative. The two groups have worked together to develop the area of MRA at the international level for application at both the national and international levels. This work has been greatly facilitated by the contribution of

people from around the world with expertise in microbiology, mathematical modelling, epidemiology and food technology, to name but a few.

This Microbiological Risk Assessment series provides a range of data and information to those who need to understand MRA. It comprises risk assessment of particular pathogen-commodity combinations, interpretive summaries of the risk assessments, guidelines for undertaking and using risk assessment, and reports addressing other pertinent aspects of MRA.

We hope that this series will provide a greater insight into MRA, how it is undertaken and how it can be used. We strongly believe that this is an area that should be developed in the international sphere, and have already from the present work clear indications that an international approach and early agreement in this area will strengthen the future potential of use of this tool in all parts of the world, as well as in international standard setting. We would welcome comments and feedback on any document within this series so that we can endeavour to provide Member States, Codex Alimentarius and other users of this material with the information they need to use risk-based tools, with the ultimate objective of ensuring that safe food is available for all consumers.

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Executive summary

Salmonellosis and campylobacteriosis are among the most frequently reported foodborne diseases worldwide. While numerous potential vehicles of transmission exist, commercial chicken meat has been identified as one of the most important food vehicles for these organisms. Although specific data on the burden of foodborne disease associated with *Salmonella* and *Campylobacter* in poultry is limited, the role of poultry is considered to be significant in this respect; however, the risk in different countries varies according to control measures and practices implemented along the chain from primary production to final preparation of the meat for consumption.

In 2007, the Codex Alimentarius Commission agreed that the development of guidelines for the control of *Salmonella* and *Campylobacter* in poultry was a priority. The elaboration of these guidelines was initiated at the 39th Session of the Codex Committee on Food Hygiene (CCFH), in late 2007. The guidelines consist of three sections: one addressing good hygiene practices (GHP); another covering hazard-based control measures; and a third focusing on risk-based control measures. In the course of the following year, much work was undertaken on the first section, and this is nearing completion. Work also began on the hazard-based control measures; however, the limited availability of data on the quantification of effect and practical implementation of such measures had implications for this section of the guidelines. The third section was intended for use in conjunction with a user-friendly Web-based risk-management decision-support tool, to be developed by the Joint FAO/WHO Expert Meetings on Microbiological Risk Assessment (JEMRA), which would allow the risk manager to input data specific to their own production and processing systems and thereby evaluate measures that might be most effective for risk reduction in those particular conditions.

In order to continue with their work and ensure that it was underpinned with the most robust scientific data, the 40th Session of CCFH requested FAO and WHO to provide them with the necessary scientific advice. In response to that request, FAO and WHO convened an *ad hoc* Technical Meeting from 4 to 8 May 2009 in Rome, Italy. This report documents the discussions and the outcome of that meeting.

At the Technical Meeting, the experts carried out an independent assessment and review of all available scientific information on control of *Campylobacter* and *Salmonella* at relevant stages of the broiler supply chain. This entailed an evaluation of the scientific basis of the possible control measures described in the draft guidelines as prepared by the CCFH Working Group to date, and thereafter adding further interventions that had not been included. For every step of the production chain, an attempt was made to evaluate the interventions in quantitative terms i.e. according to their likely effects in reducing the prevalence and/or concentration of the hazard in each case. Particular attention was given to the likely outcome of hazard reduction in a commercial setting. For this purpose, the Experts decided to draw upon all available and documented expert data and evidence in support of the interventions described. Thus, the latest scientific evidence was used to supplement and expand the semi-systematic literature review that had formed the basis of the draft guidelines developed by the CCFH Working Group.

The Experts found that there were no quantitative data available on the effects of specific interventions applied during live animal production on the prevalence and/or level of contamination with *Salmonella* and *Campylobacter.* Furthermore, the effects of any

interventions aimed at primary production had not been validated fully in a commercial setting[1]. Therefore, interventions for application in the pre-harvest phase of poultry production were all classed as GHPs.

The GHP measures described in the Codex draft guidelines regarding scalding, de-feathering and evisceration were supported by the Technical Meeting. No further scientific data was presented by the Experts to warrant description of potential hazard-based control measures.

The GHP measures described in the Codex draft guidelines regarding washing and chilling, and also retail and consumer handling were also supported by the Technical Meeting. Quantitative data on potential hazard-based controls on account of their likely impact on prevalence and/or concentration of hazards on the carcass were reviewed and considered appropriate by the Technical Meeting, with additional data being provided in some cases.

In relation to the risk-management questions posed by CCFH, the feasibility of developing a Web-based risk-management decision-support tool was discussed and considered to be an appropriate next step by the Technical Meeting. The primary application of the tool would be to demonstrate in a simplified manner the relative effects of different control measures, either alone or in combination, on hazard reduction and consequently relative levels of foodborne illness. This would enable countries to evaluate combinations of control measures available within their processing systems using a risk-based approach. The decision tool should also be of considerable benefit to industry in designing HACCP plans and choosing critical limits for hazard-based control measures. In order to proceed with the development of the web-based risk-management tool a subgroup was formed to identify modelling challenges and discuss the benefits and limitations of different modelling approaches. Development of the prototype is now in progress, and initial outcomes will be presented at the forthcoming CCFH session.

1. The apparent absence of peer-reviewed scientific publications on the efficacy of specific interventions in commercial poultry flocks in terms of food safety of broiler meat needs to be seen in context. Such interventions have been widely used in many countries as part of national control programmes for *Salmonella* and, over a period of time, have been associated with significant reductions in prevalence of pathogens at the pre-harvest stage of broiler production. The countries include Finland, Sweden, Denmark and The Netherlands, and the effectiveness of their respective control strategies is described in peer-reviewed scientific publications and in national reports that include surveillance data for *Salmonella* in poultry. See, for example, Wegener et al., 2003; Maijala et al., 2005; Van der Fels-Klerx et al., 2009.