Risk Assessment of *Salmonella* and *Campylobacter* in poultry in the EU

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On behalf of the Unit on Biological Hazards (BIOHAZ): Contributions by L. Vivas-Alegre, P. Stella, M. Hempen. P. Romero-Barrios & M. Hugas (Head of Unit).
The Panel on Biological Hazards deals with questions on biological hazards relating to Food Safety and Food-borne Diseases, including:

- Food-borne Zoonoses;
- Food Hygiene;
- Microbiology;
- Transmissible Spongiform Encephalopathies;
- Associated Waste Management.
Salmonella in poultry
Quantitative Microbiological Risk Assessments
In February 2008, request from the Commission: Quantitative estimations of the public health impact of setting new target for the reduction of *Salmonella* in certain poultry populations (*Gallus gallus*).

Three different poultry populations assessed separately:

- **Breeding hens** (EFSA-Q-2008-291);
- **Laying hens** (EFSA-Q-2008-292);
- **Broilers** (EFSA-Q-2008-293).
QMRA *Salmonella* in poultry

**DATA**

1. *Salmonella* prevalence:
   - **Comparability** between MSs:
     - Verification of positive results?
     - Number samples in same flock?
   - **Correlation** between prevalence in breeding and in production lines? Between prevalence in layers and contamination eggs?
   - **Import and Export**?

2. *Salmonella* serovars with public health significance:
   - Consider *ALL* Salmonella serovars not host-specific;
   - Identify relative importance of individual serovars;
   - Pending validated source attribution studies;

**Models**

1. Validate current available models and/or develop new ones.
2. Tailor models to account for all different scenarios (e.g. variability within EU MS).
3. Address the degree of uncertainty.

**QMRA challenges**

**Provide quantifiable estimates**
QMRA *Salmonella* in breeding hens

Relative **impact on** the prevalence of *Salmonella* in flocks of **broilers and laying hens**, if new target for reduction is set in **breeding hens** being 1% or less flocks remaining positive for **all *Salmonella*** serovars with public health significance, compared to:

- The theoretical prevalence at the end of the transitional period (1% of five serovars: *S. Enteritidis*, *S. Typhimurium*, *S. Virchow*, *S. Hadar*, *S. Infantis*), **and**
- The real prevalence in **2007** to be reported by the EU MS.
Approach to the Mandate

• **Salmonella serovars of public health significance?**

• **Estimate of the impact of different *Salmonella* prevalence values in breeding flocks in layer and broiler sectors**
  – Explore quality and comparability of data available from EU monitoring programmes.
  – Identify available quantitative risk assessment models in the EU (2 models investigated: Finland, Netherlands).
Hands on…

**DG-SANCO**: Clarifications and follow up
**EUROSTAT**: Data on poultry populations, import, export.

**EFSA Unit on Zoonoses and Data Collection**: Reported data on *Salmonella* in poultry populations, 2004-2007.

EU wide industry bodies: AVEC, EEPT and EUWAP*, data on poultry populations and trade.

*AVEC= Association of Poultry Processors and Poultry Trade in the EU countries
EEPTA= European Egg Packers and Traders Association
EUWAP = European Union of Wholesale with Eggs, Egg products and Poultry and Game
Key messages (I)

• Any serovar that is not animal host-adapted is capable of causing human gastrointestinal disease, and as such should be considered of public health significance. Nevertheless, there are differences between serovars regarding their frequency in human illness, and their association with particular food chains.

• S. Enteritidis is the serovar most frequently associated with human illness related to broilers and broiler meat, as well as with eggs and egg products.

• S. Enteritidis and S. Typhimurium have the greatest potential for vertical and pseudo-vertical transmission, from breeders to production lines.

• Marginal benefits of additional EU-wide control for other serovars in breeders are relatively small.

• Biosecurity measures applied to control S. Enteritidis and S. Typhimurium will benefit the control of horizontal transmission of other serovars.
Key messages (II)

- Available risk assessment models are restricted to two EU Member States, and refer to earlier situations. There are indications that for those serovars, for which vertical transmission is possible, controlling *Salmonella* prevalence to very low levels in breeding flocks is necessary to achieve a low prevalence in production flocks.

- Despite important progress has been made, harmonised monitoring and reporting of *Salmonella* in poultry populations is still incomplete in EU. There is insufficient data for quantitative estimates. Therefore QMRA was not attempted in answering this mandate.
• Maintaining stringent targets and controls at the EU level for *S. Enteritidis* and *S. Typhimurium* in flocks of breeding hens.

• Further control policies for other *Salmonella* serovars in breeding hens *should* be guided by the level of their dissemination into production stock in individual EU MS and maybe considered in national control programs.

• Further consideration of the relationship on the prevalence of *Salmonella* between breeding and production flocks should be carried out when harmonised data from control programmes in each sector is available.
Relative **public health impact**, if a new target for reduction of *Salmonella* is set in laying hens being 1% or less remaining positive for all *Salmonella* serovars with public health significance, compared to:

- A theoretical prevalence of 2% of flocks remaining positive for *S. Enteritidis* or *S. Typhimurium* at the end of the transitional period, *and*
- The real prevalence in 2008 to be reported by the EU MS.
Approach to the Mandate

• **Salmonella** serovars of public health significance

• **Estimate of the public health impact of different *Salmonella* flock prevalence values?**
  – Mathematical modelling adapted from previous Finnish models for *S. Enteritidis* infection of poultry flocks.
  – Estimate of the number eggs contaminated with *S. Enteritidis* that would be laid under different flock prevalence scenarios: EU reported prevalences in 2008, 2% and 1%.
  – Separate consideration of pasteurised egg products and meat from spent hens.
Hands on…

**DG-SANCO:** Clarifications and follow up.

**SCoFCAH***: Detailed data on monitoring of *Salmonella* in flocks in MSs.

**ECDC:** Data on human salmonellosis.

**EUROSTAT:** Data on laying flocks population and trade. Data on consumption of egg and egg products and trade.

**DG RTD:** SAFEHOUSE project, regarding data on *Salmonella* contaminated eggs.

**EFSA Unit on Zoonoses and Data Collection:** Reported data on *Salmonella* in poultry populations, 2004-2007.

**EFSA Unit on Assessment Methodology:** Coordination of modelling of *Salmonella* Enteritidis in shell eggs.

**EU wide industry bodies:** EUWEP, data on industry practices regarding pasteurisation of egg products.

**Procurement:** Selected institutes for modelling of *Salmonella* in shell eggs.

*SCoFCAH=Standing Committee of the Food Chain and Animal Health*
Data used in the model

- Detailed data from MSs from the monitoring of *Salmonella in laying hen flocks* in 2008.
  - Follows a request for data made to SCoFCAH for sample level detailed data.
  - Data received from 6 MSs.
  - Data in suitable format and used in the model from 2 MSs.

- Data on *Salmonella contamination in eggs* from infected flocks.
  - Very limited egg data available.
  - Data from UK study on numbers of eggs contaminated with S. Enteritidis from infected flocks.
Key Messages (I)

- 4 different exposure pathways: internally and/or externally contaminated eggs, egg products, and meat from spent hens.

- In eggs, S. Enteritidis is, by far, the serovar most frequently associated with human illness.

- The public health benefit of including additional serovars other than S. Enteritidis in EU-wide prevalence targets for laying hens is expected to be small at present.

- The quantitative risk assessment model used in this Scientific Opinion suggests a linear relationship between the flock prevalence and the number of eggs contaminated with S. Enteritidis, which is assumed to be proportional to the public health risk.
Key Messages (II)

- The benefits of the reductions in flock prevalence modelled are highly uncertain.

- This is due to a lack of data on the number of contaminated eggs produced by infected flocks, and on the true number of egg-related cases of human salmonellosis (model fitting and validation is not possible).

- Egg pasteurisation, although proven successful in reducing contamination, may not be an absolute barrier to *Salmonella* contamination.

- Prevalence of *Salmonella* (including S. Enteritidis) in the meat from laying flocks might be higher than in meat from broiler flocks, in particular if sourced from *Salmonella*-positive laying hen flocks.
Other Important Messages

• Additional public health benefits, similar to those considered to be achievable by changing the EU target from 2% to 1% flock prevalence, may be achieved by implementing controls based on more sensitive sampling protocols (with the aim to reduce the number of false negative “undetected” flocks).

• The benefits that could be obtained by reducing flock prevalence in those Member States where observed prevalence remains higher than the current EU target would be higher than the benefit of changing the current EU target.
Key Recommendations

• The establishment of harmonised active surveillance of human salmonellosis in all Member States, including efforts to quantify the level of under-ascertainment and underreporting, in order to improve the evaluation of the human health effects of interventions in flocks of laying hens.

• The application of more intensive sampling on laying hen farms than the standard official sampling where a link to human salmonellosis cases is to be investigated, in order to increase the chances of detecting flock infection.

• Carry out further experimental research and collect data on Salmonella dynamics in the laying hen flock and production of contaminated eggs under field conditions to provide parameter estimates for quantitative models.
Relative public health impact, if a new target for reduction of *Salmonella* is set in broilers being 1% or less remaining positive for all *Salmonella* serovars with public health significance, compared to:

- The theoretical prevalence at the end of the transitional period (1% or less flocks remaining positive for *S. Enteritidis* or *S. Typhimurium*, and
- The real prevalence in 2009 to be reported by the EU MS.
**Campylobacter** in broiler meat

**Background:**

- Campylobacteriosis is the most frequently reported zoonosis
- Previous EFSA Opinion related to *Campylobacter* in animals and foodstuffs (January 2005)
- EU harmonised baseline survey on *Campylobacter* and *Salmonella* in broiler batches and on broiler carcasses (2008). Reports A and B recently published.
- EU legal basis to consider performance objectives and targets (Reg. 2160/2003 – Reg. 852/2004)
- EC requested EFSA advice (June 2008)
Campylobacter in broiler meat

- Over 190,000 reported campylobacteriosis cases in the EU in 2008

- Reported food-borne outbreaks in the EU are rare

- Campylobacteriosis occur most frequently as sporadic cases

9 MSs consistently reporting (AT-DK-FI-DE-IE-ES-SE-NL-UK)
EFSA was requested to:

- Assess the extent to which meat derived from broilers contributes to human campylobacteriosis at EU level. The importance may be expressed as a percentage of the total number of human campylobacteriosis cases.
- Identify and rank the possible control options within the broiler meat production chain, taking into account the expected efficiency in reducing human campylobacteriosis [...] 
- Propose potential performance objectives and/or targets at different stages of the food chain in order to obtain e.g. 50% and 90% reductions of the prevalence of human campylobacteriosis in the EU caused by broiler meat consumption or cross-contamination [...]
Campylobacter in broiler meat – ToR1

• Answers to the ToRs

  – Handling, preparation and consumption of broiler meat may account for 20% to 30% of human cases of campylobacteriosis
  – 50% to 80% may be attributed to the chicken reservoir as a whole.
  – Data for source attribution in the EU are limited.
  – There are indications that the epidemiology of human campylobacteriosis differs between regions.
  – Therefore conclusions must be interpreted with care.
Campylobacter in broiler meat – ToR1

• Some general conclusions:
  – There are multiple pathways of human exposure
  – There is considerable under ascertainment and underreporting. There may be not less than 2 million and possibly as high as 20 million cases of clinical campylobacteriosis per year (EU).
  – Travelling is a reported risk factor. A large proportion of cases is associated with travelling within the EU and would be preventable by EU-wide control measures
  – Few data available on certain reservoirs (e.g. pets, wild birds)
• Some recommendations:
  – To establish active surveillance of campylobacteriosis in all MS
  – To obtain a representative collection of isolates from humans and putative reservoirs
  – To develop research on: Campylobacter virulence and ecology, role of immunity on human campylobacteriosis
Campylobacter in broiler meat – ToR2

- EFSA-Q-2009-00233: *Campylobacter in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain*
  - Will answer second and third ToR from EC
  - Working Group set up and met several times already
  - Adoption of Opinion by BIOHAZ Panel expected in March 2011

- Outsourcing activities linked to this project
  - May 2009: Call for tender (Quantitative Microbiological Risk Assessment) → model developed by contractor
  - July 2009: Call for proposal (data collection) → unsuccessful
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