Risk factors for *Salmonella* in flocks of laying hens in Germany

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Introduction

Regulation No EC/2160/2003 requires a target for reducing *Salmonella* in flocks of laying hens. As comparable data was needed, an EU-wide baseline study was carried out to estimate the prevalence of *Salmonella*. Specifications were laid down in Decision 2004/665/EC and Technical Specifications SANCO/34/2004 Rev3. Data was collected between 1 October 2004 and 30 September 2005.

In Germany, 533 flocks were investigated in this study. The raw prevalence of *Salmonella* spp. was 29.8 % (CL: 25.9-33.6); accounting for regional allocation and farm size, prevalence was 25% (1).

Within the German study, hypotheses were generated regarding possible risk factors. To evaluate and specify the analyses, a statistical-epidemiological analysis was conducted (1).

(1) Käsbohrer A. Pilot Study on the Occurrence of Salmonella spp. In Laying hens in Germany. (BfR) [Master (MSE)]. Berlin, Hannover: "Master of Science Programme Epidemiology";2006.

Design

- Statistical analyses: SAS®, version 9.1 TS level 1M3
- Univariate logistic regression was used to validate the most important risk factors found in the cross sectional study (1):
  - Type of housing (free range, barn, cage systems)
  - Region (Northwest, East, West, South, Other)
  - Farm size (small, moderate, big)
  - Immunisation status (immunised, not immunised)
- Multifactorial risk factor analyses were carried out by estimating stratum-specific Odds Ratios
- Possible effects of interactions were investigated
- Special emphasis was laid on serovar-specific analyses

Results & Discussion

Serovar-specific risk factors

- S. enteritidis and S. Subspec. I rough form are the predominant types; as their occurrences are similar, both types have been analysed together.
- Serovar-specific analyses were complicated by the fact that S. enteritidis was diagnosed in most of the positive flocks. Therefore, Serovar-specific risk patterns cannot be differentiated clearly.
- Accumulation of serovars:

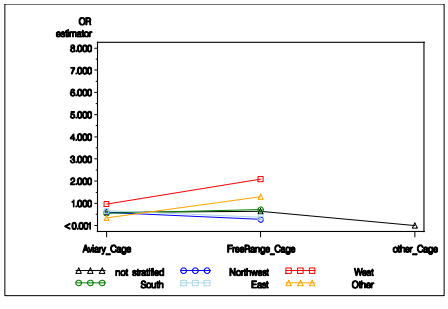
  S. Enteritidis including rough strains in immunised barn flocks and in immunised big farms

  S. Typhimurium in barn flocks in region “West” and free range systems in the South and in not immunised farms of moderate size.

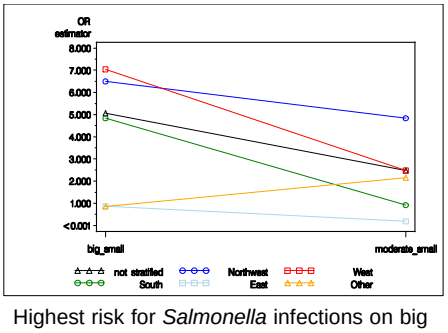
  Other *Salmonella* serovars in barn flocks in the Northwest and in all cage systems as well as in big and not immunised farms

Interaction between risk factors (all Serovars)

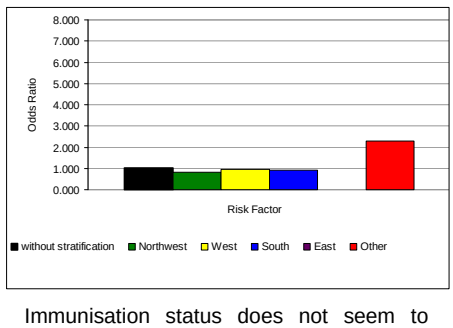
- Due to the variety of analyses with small subgroups results should not be interpreted as a reliable risk factor analyses but as an explorative characterisation of risks for *Salmonella* spp. in German laying hen flocks.
- Regardless of serovar detected, differences of prevalence concerning region, farm size, type of housing and immunization status could be confirmed.
- The regional allocation is a stratification variable rather than a risk factor. Differences between regions reflect different management and structure profiles.
- In the univariate approach the highest risk of *Salmonella* could be found in the Northwest of Germany, in cage systems and on big farms.



Highest risk for *Salmonella* infections in free Range systems in “West”.



Highest risk for *Salmonella* infections on big farms in “West” and farms of moderate size in “Northwest”.



Immunisation status does not seem to influence the probability of *Salmonella* infections.

- Results indicate interactions between the analysed risk factors. Associations are complex and cannot be separated easily.
- Risk factors interact strongly. This indicates influence of other risk factors that were not collected in the study and therefore not analysed here.