

## Serological research of *Salmonella* on Belgian pig farms

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**Summary:** Risk factors for Salmonellosis in pigs were investigated in a cross-sectional study on 144 Belgian farrow-to-finish herds belonging to one slaughterhouse co-operation. Herd data were collected using a questionnaire. The blood samples were serologically analyzed. Variables significantly related to the *Salmonella* prevalence in the univariate analyses were subsequently analysed in a multivariate model. Furthermore, the clustering of *Salmonella* infection within the herd, section and pen was studied. The average within-herd seroprevalence was: 73.4% when using OD 10%. In the multivariate analyses the structure of the feed seems to be the most important factor of the model with five factors. Feeding pigs meal instead of granulated or crumb is a protecting factor for *Salmonella*. Other risk factors in the multivariate model are natural ventilation, less than 3 days emptiness after wet cleansing, not dry cleansing of sows' pen before wet cleansing and the absence of dogs in the pig houses.

**Keywords:** within-herd seroprevalence, risk factors, s/p ratio

**Introduction:** For reasons of food safety and because of economic pressure, risk factor studies are required to have a scientific basis to initiate a control programme for *Salmonella* in pig herds in Belgium. The aim of the present study was to determine risk factors for the seroprevalence of *Salmonella* in Belgian slaughter pigs. This study was based on serological analysis on blood samples and differs from other risk factor studies in the level of analysis, i.e. at pig level. (Lo Fo Wong., 2001). Possible clustering of *Salmonella* infections between pigs from the same herd, section and pen was also investigated and corrected for in the risk factor analysis study.

**Materials and Methods:** From each of the 144 farrow-to-finish herds, 50 randomly selected pigs from an average delivery of 95 pigs were blood sampled at slaughter. The blood samples were serologically analyzed with an indirect ELISA (HerdChek) (Idexx Laboratories, Inc.). A questionnaire, consisting of 2 major parts, was used to collect the herd data. A general part concerned all pigs in the herd, a specific part concerned the slaughter pigs to be sampled. In both parts, following topics were included: housing and ventilation, management, hygiene and biosecurity and production parameters. The specific part additionally pertained to feeding, disease control and transport to the slaughterhouse. All study pigs were individually identified before transport to the slaughterhouse.

For the determination of the risk factors a Linear Mixed Model was used, PROC MIXED in SAS® release 8.02. This method was used with the S/P ratio as the depending variable on the pig level for the following reasons: - there are 3 possible cut-off values that could be used; - for each pig the farm, section and the pen are known, so that correcting for clustering is possible, and possible getting additional information about the spread of *Salmonella* (Lo Fo Wong., 2001); - analyses on pig level and with a continue depending variable have more power than analysis on herd level with a dichotomised variable. In a first step, each of the factors obtained from the questionnaire were separately introduced in the model to assess whether any of these factors was univariately associated with the S/P ratio. Categorical and continuous variables significantly related to the S/P ratio ( $p < 0.05$ ) were analysed jointly in a multivariate mixed model with herd, section and pen as random effect.

**Results:** In 142 (98.6%) herds, at least 1 sample was positive when using OD 10% as cut-off, 97.6% (OD 20%) and 91% (OD 40%). The average within-herd seroprevalence was: 73.4% (range 0 – 100%) when using OD 10% as cut-off, 51.8% (range 0 – 100%) (OD 20%), 30.1% (range 0 – 98%) (OD 40%). There was substantial and significant variation between the herds, with the variance being estimated as 0.023 (mean =0.39; s.e. =0.24). Categorical and continuous variables were studied by univariate analysis, of which 73 were significantly associated with *Salmonella* prevalence ( $p < 0.05$ ). The most important variables were selected for the multiple analyses based on the p-value, the estimate and the biological sense. The variables were introduced in the multivariate model. Following factors are significantly associated with the S/P ratio on pig level: less than 3 days emptiness after wet cleansing ( $p = 0.0026$ ; estimate = 0.082), natural ventilation in the pig stables ( $p = 0.0164$ ; estimate = 0.081), the absence of dogs in the pig stables ( $p = 0.0042$ ; estimate = 0.078) and not dry cleansing in the sows stable before wet cleansing ( $p = 0.0225$ ; estimate = 0.076). Besides these four factors the structure of the feed seems to be the most important ( $p = 0.0002$ ; estimate = 0.114). Feeding pigs meal instead of granulated or crumb is a protecting factor. These five factors incorporated in the multivariate model could reduce the variance between herds to 0.013 or 43.5 % could be explained by this factors. An Interclass Correlation Coefficient (ICC) of 0.36 was calculated for samples within herds, ICC = 0.54 for samples within sections and ICC = 0.68 for samples within pens.

**Discussion:** This study was based on serological results namely the S/P ratio of the sample. Using this S/P ratio instead of the dichotomous variable negative or positive has a few advantages in this study. For each pig farm, section and pen are known, so that correction for clustering was possible on all these levels, making a selection for a cut-off value unnecessary. From the multivariate model the most important factor seems the structure of the feed. Feeding pigs meal instead of granulated feed or crumb is a protecting factor for *Salmonella*. Jorgensen et al. (1999) found that pigs that received meal have the largest population of lactic acid bacteria in the stomach. The difference between meal and granulated feed can be explained by differences in the coarseness (Kjeldsen and Dahl, 1999). Beside the feed also hygienic measures and ventilation seems to be important. We found a high ICC on herd, section and pen level, which means that results of samples within a herd; section and pen have a tendency to be the same (van der Wolf P.J., 2000).

**Conclusions:** The statistical method can be used in this study. Feeding meal results in a lower S/P ratio value for *Salmonella* compared to granulated feed or crumb. There was clustering found between pigs from the same herd, section and pen this can be used in calculating the sample size.

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