

Correlation between *Salmonella* serology and results from bacteriological examinations of caecal contents, carcass swabs, pharyngeal swabs and caecal lymph nodes from Danish slaughterpigs

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Summary: The study included a total of 167 swine herds. From each herd samples were collected from 10 animals. From each animal one sample of caecal content, one carcass swab, one pharyngeal swab and a sample of the caecal lymph nodes were taken. These four samples were bacteriological examined. Furthermore, one meat sample was taken for serological analysis. Pigs from herds with sero-prevalence above 25 percent constitute almost the same risk for contamination with *Salmonella*. To minimize the risk for carcass contamination pigs from herds with sero-prevalence >25 percent could be kept apart from pigs from herds with lower prevalence during transport, lairage and slaughter.

Keywords: Pork, antibodies, public health.

Introduction: The Danish *Salmonella* Surveillance Program for slaughter pig herds is based on analyses of meat juice by use of the mix-ELISA. To reduce the number of people, that gets salmonellosis from pork, it is essential to minimize the risk of transferring salmonella-bacteria from the intestinal tract to the carcass and the meat during slaughter. To do so it is necessary to know the correlation between the prevalence of sero-positive samples from the herd and the risk of salmonella-contamination constituted by the pigs from the herd during slaughter. This demands prevalence-estimates of *Salmonella* in caecal contents, in the throat and subsequently on the carcass.

Furthermore, several countries make use of analyses of caecal lymph nodes to show the salmonella-prevalence in pigs and herds. To elucidate the correlation between the Danish serological surveillance and surveillance based on lymph nodes, analyses of caecal lymph nodes have been included in the study.

Materials and Methods: The study was carried out at three slaughterhouses, two of which perform special slaughter under increased hygiene precautions of pigs from level 3 herds according to the Danish classification scheme. A total of 167 herds were included in the study. The herds were divided into 8 strata depending on the proportion of sero-positive samples from the herd. From each herd samples were collected from 10 animals. From each animal one sample of caecal content, one carcass swab (1400 cm²), one pharyngeal swab and a sample of the caecal lymph nodes were taken. These four samples were bacteriological examined. If Salmonella was found in the caecal content, a semi-quantitative analysis was carried out. Furthermore, one meat sample was taken for serological analysis. All samples could be traced back to the carcass and thereby to the herd of origin.

The bacteriological examinations were performed according to the NMKL no. 71 or by use of the EiaFoss. The mix-ELISA was used for the serological analyses of meat juice and a cut-off of 40 OD% was used.

Statistical associations were analysed in a generalised linear mixed model, where salmonella-status of the carcass was explained by the salmonella-content in the caecal sample and the pharynx from the same pig. The Glimmix-macro (SAS Inst.) was used for the analyses. Sample date and herd were included as random effects, and the effect of caecal content and pharyngeal content was allowed to vary between herds in a random slopes model. The assumed distribution was the binomial distribution.

Results: The study showed a very good correlation between serology in the herd and bacteriological findings in the caecal content and on the carcass, fig. 1.

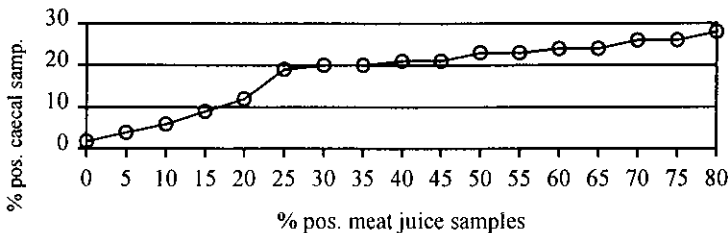


Figure 1: The correlation between sero-prevalence in the herd and the prevalence of positive caecal samples.

For herd sero-prevalence in the interval 0 to 25 percent, there was an OR (Odds Ratio = approximate relative risk) of 1,11 for culture positive caecal content samples. This means that if the herd sero-prevalence increased one percent the number of caecal content samples would increase with a factor 1,11. For herd prevalence > 25 the OR was only 1,01.

The results of the carcass swabs showed, that there was an increasing risk of positive carcass swabs with increasing sero-prevalence in the herd, fig. 2.

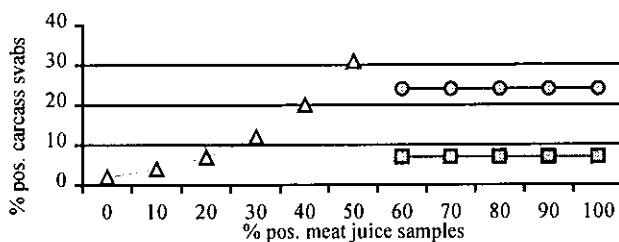


Figure 2. The correlation between percent positive serological samples from the herd and the prevalence of culture positive carcass swabs. Δ =normal slaughter, \square =special slaughter, slaughterhouse A, O=special slaughter, slaughterhouse C.

Consistent results were found for both pharyngeal swabs and caecal lymph nodes. Data-analysis on the association between salmonella-positive carcasses and the results from the caecal samples showed an increasing risk of positive carcasses, when the caecal sample was positive, but there was found no effect of an increasing quantitatively number of *Salmonella* in the caecum. A logistic regression model showed a significantly increased risk of a positive carcass, when the caecal sample of the pig was positive. If the pharyngeal swab was salmonella-positive, there was an increased risk of a positive carcass, but the effect was not significant.

Discussion: In this study a serological cut-off of 40 OD% was used, because it was the cut-off value used in the Danish Salmonella Surveillance program. Pigs from herds with increasing sero-prevalence above 25 percent constitute almost the same risk for contamination with *Salmonella*. To minimize the risk for carcass contamination pigs from herds with sero-prevalence >25 percent could be kept apart from pigs from herds with lower prevalence during transport, lairage and slaughter.

If we postulate, that the caecal content and the pharynx are possible sources of carcass-contamination, then the caecal content seems to be more important than the pharynx.