

# Salmonella Reduction at the Farm Level

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## Introduction

*Study A.* Three experiments were performed to study the influence of removal of pigs at different ages prior to the age when *S. typhimurium* had been detected in subclinically infected herds.

*Study B.* Based on these results, a model for *Salmonella* reduction on herd level was established. The model consisted of a microbiological survey in the herd to locate infected parts of the herd. Based on the microbiological results a plan for reduction of *Salmonella* was described for each individual farm. A typical plan consisted of hygienic measures combined with all in-all out measures on either pen-level or section level, in combination with an attempt to improve what we define as "enteric health" (absence of diarrhoea) in finishers without use of antibiotics.

*Study C.* A cross-sectional study was performed using data from a data-base from a Danish slaughterhouse cooperative.

## Material and methods

*Study A. Experimental design:* Three herds (A, B and C) with persistent high levels of infection with *S. typhimurium* were selected. Serological examinations performed for at least 3 months prior to the time of the investigations showed a high seroprevalence (above 50 %) of *Salmonella* infection in finishing pigs in all three herds. All herds used heat treated compound feed. No medical routine treatment was used before or after removal of pigs. 46 pigs were removed at weaning from herd A, 700 pigs were removed from the nurseries in herd B and 98 pigs were removed from the growers unit in herd C. Blood samples, pen samples and/or cecal samples were collected at slaughter.

*Study B. Criteria for success:* Samples obtained after intervention should place the herd in infection level 1.

*Definitions:* All in-all out on pen or section level means, that pigs are not moved between pens or sections. Pens or sections are cleaned between batches, precautions are taken to avoid transfer of infected feces between pens or sections.

*Procedure:* Management of nurseries were changed to all in-all out. Growers sections were either dropped, changed into all in-all out or emptied and cleaned once, and then used as all in-all out on pen level. In finishers sections all in-all out was performed either at pen level or section level. Hygienic procedures were improved, and transport of fecal material between sections or pens were minimized. Organic acids were administered in either water, fermented wet feed or dry feed in 6 herds.

Table 1. Effect of different types of intervention

All in-all out in sections			All in-all out in pens	
Success	Organic acids	No organic acids	Organic acids	No organic acids
Yes	3	2	3	0
No	0	2	0	2

In each herd approximately 30 blood samples were collected 5-6 times over a period of 3 months before herd intervention. For a period of at least 3 months after intervention, approximately 30 blood samples were collected 6 times. Only pigs ready for slaughter were sampled to obtain samples from pigs of comparable age.

*Study C.* A database with information from 5000 herds was used. All herds with insufficient or inconsistent data were rejected. 1531 herds were used for the analysis. Cases were defined as

herds with more than 33 % seropositive meat-juice samples in 1995. Non-cases were herds with less than 33 % seropositive meat-juice samples in 1995. Statistical analysis was performed using SAS genmod procedure.

## Results

**Study A.** No *Salmonella* was isolated from removed pigs in the three experiments. All blood samples were seronegative. *S. typhimurium* was isolated from controls in herd A and B (Controls in herd C were not examined bacteriologically). In herd A 39 out of 40 controls seroconverted, in herd B 10 out of 88 controls seroconverted and in herd C 16 out of 30 controls seroconverted.

**Study B.** Table 1 shows results of intervention.

**Study C.** The two factors with the greatest impact on the *Salmonella* level was use of home mixed feed (OR=0.17 Confidence interval 0.08-0.36) and use of fermented wet feed (OR=0.10 Confidence interval 0.02-0.45).

## Discussion

**Study A.** In three herds it was proven feasible to raise finishers void of *S. typhimurium* infection by removal to clean and disinfected facilities, despite the fact, that the pigs were born in herds with a high level of *Salmonella* infection in finishing pigs. It seems reasonable to assume, that the control pigs raised within the infected units were infected from either residual infection in the pens or from older pigs in the unit.

**Study B.** It is difficult to obtain results similar to results obtained by removing pigs to external facilities outside infected herds. No herds reached a zero level. Even when all in-all out management is performed, some herds are not able to reduce the seroprevalence sufficiently. The beneficial effects of fermented wet feed could in part be due to organic acids produced by fermentation (see study C). In all herds where organic acids were part of the intervention, a sufficient reduction was achieved.

**Study C.** *S. typhimurium* is the most important serotype in Danish swine herds. This serotype is not isolated from Danish feedstuff. The effects of wet feed and home-mixed feed is not a result of *Salmonella* in the feed, but probably an effect on the pigs resistance to *Salmonella*.