SALMONELLA REDUCTION AT THE FARM LEVEL

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An important part of the Danish salmonella program is surveillance of all Danish pig herds with a yearly deliverance of more than 100 slaughter pigs. Herds categorized in infection level 2 or 3 are obliged to take effort to reduce the seroprevalence of slaughter pigs to an acceptable level.

It has been shown, that it is possible to remove pigs from infected herds and raise them to the normal age of slaughter without detectable salmonella infection (Dahl and others, 1996).

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 colonization resistance by using organic acids in water or feed.

MATERIALS AND METHODS

13 studies were performed in 11 herds. One herd (no. 11) participated 3 times.

**Herds:** Inclusion criteria for the trial herds were: Infection with S. Typhimurium or S. Infantis, absence of *Serpulina Hyodysenteria*, all in-all out could be managed in weaners section before start of the trial, minimal herd size 100 sows, and the majority of the finishers should be produced either on the farm, or on a separate farm without pigs from other herds. All herds except herd 10 used purchased compound feed for growers and finishers. Herd 10 used home-mixed feed.

**Criteria for success:** Samples obtained before intervention should place the pigs in infection level 2 or 3. Samples obtained after intervention should place the herd in infection level 1 (Mousing, 1997).

**Definitions:** Continuous (cont) management means that no cleaning is practised between batches of pigs, and the section is never emptied totally. All in-all out on pen level (pen) means, that pigs are not moved between pens. Pens are cleaned between batches, precautions are taken to avoid transfer of infected faeces between pens (solid pen separations). But the section is never empty. All in-all out (a.-a.) means, that the section is emptied totally. No pigs are moved backwards. Thorough cleaning and disinfection is performed between batches.

**Procedure:** Management of weaners sections were changed to all in-all out. Microbiological surveillance of weaners sections until no salmonella was isolated. Growers sections were either dropped, changed into all in-all out or emptied and cleaned once, and then used as all in-all out.

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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 faecal material between sections or pens were minimized. In 3 herds formic acid (form) were administered in drinking water (1000 ppm) to improve "enteric health". In herd no 4 formic acid was administered in wet feed (1500 ppm) to obtain a pH in the fed at 4.5-4.7. In 2 herds 4000 ppm of an organic acid preparation (Bact-a-cid, (bact)) were administered in dry feed.

In each herd approximately 30 bloodsamples were collected 5-6 times over a period of 3 months before herd intervention. For a period of at least 3 months after intervention (follow-up period), approximately 30 bloodsamples were collected 6 times. Only pigs ready for slaughter were sampled to obtain samples from pigs of comparable age. Sampling was distributed between all pens with pigs ready for slaughter. Bloodsamples were analysed using the mix-ELISA. A cut-off value of 40 OD% herds was used to discriminate between positive and negative samples. This is the cut-off value used in the surveillance system (Mousing, 1997).

After the follow-up period, herds were followed on routine samples from the Danish salmonella surveillance system to evaluate the long-term effect of the interventions. Some herds changed management system or stopped using organic acids after a period. Table 1 summarizes these data and the apparent effects of these changes.

RESULTS

Follow-up period: Success was achieved in all herds, were organic acids was used as part of the intervention plan. In 2 herds out of 4, that changed into all in-all out without use of organic acids, succes was achieved, while the intervention failed in the remaining 2 herds. succesfully was not achieved in herds changing into all in-all out on the pen level, without use of organic acids (table 1).

Long-term effects: All herds that did not use organic acids as part of the intervention plan, or stopped using organic acids, have experienced problems after the follow-up period (table 1).

DISCUSSION

Intervention studies are not capable of proving causal associations between interventions and results. Yet they can be of value in generating hypotheses and documenting a possible outcome of events.

It is difficult to obtain results similar to results obtained by removing pigs to external facilities outside infected herds (Dahl and others, 1996). 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.

An epidemiological study (Dahl, 1997) has shown, that use of home-mixed feed in contrast to purchased feed, and use of fermented wet feed in contrast to dry feed, reduces the risk of salmonella-seropositivity and the risk of isolating salmonella from faecal pensamples. The beneficial effects of fermented wet feed could in part be due to organic acids produced by fermentation. This could explain the apparent effects of organic acids.

The epidemiological results and these intervention studies clearly demonstrates, that achieving a sufficient reduction of the salmonella infection level by hygienic and management procedures alone is difficult.

In order to achieve good results, it is important to enhance the colonisation resistance of