

A pilot randomised trial of an enhanced hygiene and biosecurity programme to control *Salmonella* infection in a group of pig finisher units in Great Britain

A.J.C. Cook^{1*}, R.H. Davies¹, A.M. Miller¹, R. Gopal¹, C. Byrne¹, P.J. Heath² and S. Cousens³. ¹Veterinary Laboratories Agency – Weybridge, Addlestone, Surrey, KT15 3NB, United Kingdom. ²VLA Bury St Edmunds, Rougham Hill, Suffolk IP33 2RX, UK ³Infectious Diseases Epidemiology Unit, London School of Hygiene & Tropical Medicine, London WC1E 7HT, UK

Summary

A hygiene and biosecurity programme to control *Salmonella* was devised in discussion with a group of finisher pig producers in Great Britain (GB). A pilot trial was conducted in 2002 - 2003, in which 11 farms followed the programme and 11 farms followed their usual management practices for one finisher cycle. Pooled pen faecal samples for culture of *Salmonella* were collected every 4 weeks and 40 samples for testing in a meat juice ELISA for antibodies to common *Salmonella* serotypes were collected at slaughter. A lower pen incidence rate of *Salmonella* infection and a lower prevalence of MJ ELISA positive pigs were seen in the intervention group, although these results did not attain statistical significance when adjusted for the pronounced cluster effect.

Introduction

An abattoir survey estimated that 23% of finisher pigs slaughtered in GB carried *Salmonella* infection and *S. Typhimurium* was isolated most frequently (Davies et al 2001). This serotype is an infrequent primary cause of clinical disease in pigs and is also found in other animals. However, *S. Typhimurium* is the second most commonly identified cause of human salmonellosis in GB and pigs are one potential source of these cases. In 2002, the British pig industry introduced the Zoonoses Action Plan *Salmonella* Monitoring Scheme (ZAP), which is based upon testing of meat juice samples from finisher pigs at slaughter with an enzyme-linked immunosorbent assay (MJ-ELISA) for antibodies to group B and C1 *Salmonella* serotypes lipopolysaccharide. Those herds with the greatest prevalence of MJ-ELISA positive pigs must develop an action plan to control *Salmonella*. The aims of ZAP are to reduce *Salmonella* prevalence in pigs and contribute to the protection of public health. Thus, there is an urgent need for proven effective interventions to achieve these aims.

Objectives

This paper describes a pilot intervention study to control *Salmonella* infection in finisher pigs in GB. The observed impact of the intervention and potential sources of bias are discussed.

Materials and methods

Twenty-two farms contracted to grow pigs for an integrated commercial pig production company volunteered to participate in an intervention study. The farms operated on an all in/all out basis, receiving pigs at approximately 10 weeks of age (30 kg liveweight) and growing them to slaughter weight (95 kg, 22 weeks of age approx.). A biosecurity and hygiene programme was devised to reduce the risks of a)

introducing *Salmonella* infection to the farm, b) maintaining infection between batches and c) transmission of infection between pens and buildings. Measures included: a) sourcing pigs from one weaner supplier, use of farm boots etc for visitors, improved rodent control; b) a strict between-batch cleaning and disinfection regime, with power washing and at least 48 hours for complete pen drying and c) regular cleaning and disinfection of all equipment and machinery. Farms were randomly assigned to either an intervention or comparison group. The former agreed to follow the biosecurity and hygiene programme and the latter followed their usual management practices. Each farm entered the study when it was completely emptied of all pigs. One batch of pigs was monitored and the study period for each farm ended when all pigs from that batch had been sent for slaughter. The following were collected from all units:

- Weekly records concerning biosecurity, hygiene and pig health
- Pooled pen floor faecal samples were collected for *Salmonella* culture every 4 weeks, from a random selection of up to 30 pens per farm. The same pen was sampled on every visit. The first samples were collected within 72 hours of the arrival of the trial pigs.
- MJ-ELISA tests were collected from 40 randomly selected pigs at slaughter.

The impact of the programme upon *Salmonella* infection was considered using two measures – the prevalence of MJ-ELISA positive pigs and the incidence rate of new pen infections with any *Salmonella* serotype. Details of the laboratory methods are described in our other paper in these proceedings (Cook et al 2003). All data were entered into an ACCESS database and analysed using Stata® release 8 (Stata Corporation, Texas, USA). Poisson regression was used to estimate the impact of the intervention measures upon the pen incidence rate. The estimates took account of clustering of pens on farms and the design effect was calculated.

Results

Farms joined the study as they were emptied of pigs, from April – September 2002 and completed the study as they were once more emptied of pigs, between October 2002 and March 2003. A total of 1,770 pooled faecal samples were collected from 513 randomly selected pens. Overall, *Salmonella* was isolated from 426 (24%) of the pen samples (see table 1). The predominant serotypes were *S. Typhimurium* (330 pen samples; 77% of positive samples) and *S. Derby* (42 pen samples; 10% of positive samples). At visit 1 the proportion of infected pen samples was approximately 37% in the comparison farms and 34% in the intervention farms – this difference was not significant ($p=0.463$) groups. The crude incidence rate ratio was 0.74 (95% confidence interval [ci] accounting for clustering 0.32 – 1.74) indicating a protective effect from the intervention. The design effect was estimated as 4.6, confirming that there was a strong cluster effect due to farm. The analysis was repeated using the pen incidence rate of *S. Typhimurium* or *S. Derby* as the outcome. The incidence rate ratios were 1.01 (ci 0.46 – 2.23) and 0.11 (ci 0.01 – 1.08) respectively, suggesting the intervention may have been more effective for *S. Derby*. The mean prevalence of MJ-ELISA positive pigs was 40% (ci 22% - 58%) for the intervention group and 58% (ci 41% - 75%) for the comparison group. One farm in the intervention group had no positive pen samples and only 1 MJ ELISA positive pig (40 tested).

Table 1. Isolation of *Salmonella* from pooled pen faecal samples on 22 GB finisher pig farms during an intervention study.

Visit number	Comparison farms		Intervention farms		TOTAL
	Positive	Negative	Positive	Negative	
1	89	151	82	160	482
2	66	177	81	189	513
3	55	186	35	206	482
4	8	119	10	156	293
TOTAL	218	633	208	711	1770

Table 2. Number of pig finisher farms that implemented all hygiene and biosecurity measures to control *Salmonella* infection in a study in GB.

Measure	Comparison (n=11)	Intervention (n=11)
Clean & disinfect between batches	2	8
Biosecurity	1	0
Hygiene during production	1	6

Discussion

All volunteers were contracted to one company, which demanded high standards of hygiene and biosecurity prior to the study. Thus, the results cannot be extrapolated to a wider population. Farmers in the intervention group reported higher standards of hygiene, although little difference was seen with respect to biosecurity measures. The results are consistent with an important reduction in *Salmonella* during one finisher cycle and it would be interesting to determine whether benefits increase in subsequent cycles. The interpretation of MJ ELISA and pen samples has been discussed in another paper (Cook et al 2003). The strong farm effect may reflect the prevalence of infection amongst introduced weaners as well as other farm characteristics. The possibility that the efficacy of control measures may vary according to serotype is worthy of further investigation. These results are being used to inform the design of a proposed national intervention study.

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References

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