

REDUCTION OF *SALMONELLA* SHEDDING OF FINISHING PIGS WITH THE IMPLEMENTATION OF SANITARY MEASURES IN A FRENCH FARROW TO FINISH FARM

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Introduction

In industrialised countries, *Salmonella enterica* is the most frequent cause of infectious food poisoning. About 15-25% of all human salmonellosis cases can be attributed to the consumption of contaminated pork and pork products (4; 8). Contamination of pig meat is related to asymptomatic intestinal carriage of *Salmonella* by living pigs arriving at the slaughterhouse (2). In order to reduce the occurrence of *Salmonella* contamination of pig meat, a decrease of *Salmonella* carriage at the farm level is expected. An analytic epidemiological survey was carried out in France in 2000-2001 to better assess the circumstances of *Salmonella* shedding by pigs at the end of the finishing phase (3). This study gave out a combination of risk factors. The aim of our study was to evaluate whether the implementation of a control programme based on this list of risk factors effectively reduced *Salmonella* shedding by fattening pigs.

Material and methods

A farm was selected on voluntary basis and according to the suspected positive *Salmonella* shedding status of the fattening pigs. The size of the farm and the rearing system were very common on the country. As the *Salmonella* status of the herd was unknown at the beginning of the study, a first check was carried out aiming at assessing the positive *Salmonella* shedding status of 3 distinct batches of finishing pigs from May to October 2003. The previously found risk factors were looked at for these batches (3). The list of 14 risk factors that came out of the previous large scale survey was used. Each factor was a qualitative variable. Depending on the level, the variable was found to be/or not to be a risky condition. A first profile of the farm according to the risk factors was also obtained and the subclinical *Salmonella* carriage of finishing pigs was confirmed. The failing factors were related to hygiene procedures: *Salmonella* contamination of the finishing room prior to loading of a new batch of pigs, short down period in the fattening room, lack of flushing the drinking trough,

feeding strategy during the finishing phase (2 dry feeds) and sanitary status of the pigs towards digestive and respiratory pathogens (seroconversion/*Lawsonia intracellularis*, PRCV and Swine influenza). In a second step, on the basis of these results, decisions were taken with the farmer in order to reduce the number of risk factors on 5 consecutive batches of pigs. As far as possible, the levels of the most failing parameters of the profile were changed. They were mainly related to hygiene procedures: washing, cleaning and disinfection strategies in post-weaning and fattening phases. Factors associated with feeding strategy and sanitary status could not be directly changed by the farmer. Nevertheless, proposed hygiene measures should help to prevent digestive and respiratory diseases. The profile of each of the 5 batches according to the risk factors is obtained by means of a questionnaire. The *Salmonella* status of the pens in the finishing room was assessed using sterile gauze swabs (Sodibox, France) after that the hygiene routines were realized *i.e.* just before the pigs entered the room. In each pen, one swab was used to wipe the bottom of the walls and the pen partitions and 1m² of the slatted floor of the pen. A room was considered *Salmonella*-residually contaminated as soon as one sample tested positive for *Salmonella*. At 115 days old, a group of 10 piglets was selected at random. The pigs were individually identified. Serum samples were obtained twice from 10 randomized pigs: at 115 days old and just before shipping. The serum samples obtained were submitted to antibody detection. The following infections were looked at: *Lawsonia intracellularis* (5), Swine influenza, PRRS and PRCV. For each of the 5 batches reared under hygiene improvements, a few days before slaughter, the *Salmonella* shedding was evaluated on the slatted floor soiled with faecal matter with Pedichifs, *i.e.* sterile pairs of gauze socks (Sodibox, France). For each pen, the sampling method consisted in walking on the floor wearing the Pedichifs. These sterile pieces of cotton cloth were pulled on sterile plastic over-boots. After use, the Sodibox soiled swabs and Pedichifs were placed into a sterile bag and brought to our laboratory on the day they were collected. The *Salmonella* detection protocol involved four steps and has been describe previously (3). All *Salmonella* isolates were serotyped by agglutination following the Kauffman-White scheme using *Salmonella* polyvalent O and H antisera (Diagnostics Pasteur, Paris, France) (7).

Results

The period of time between the first check of the positive *Salmonella* status of the farm and the second check aiming at assessing the effect of the changings on 5 batches of pigs varied from 11 (first followed batch) to 14 months (last followed batch). Table I and II show the situation of the farm before and after the implementation of sanitary measures.

Table 1: Profile of batches of pigs on the risk factors of Salmonella shedding at the end of the fattening phase before the implementation of a control programme (3 batches, Mai 2003 to October 2003)

Variable	Risky level	Before modifications (3 batches)
	. Frequency of sows' faeces removal in the farrowing room (/day)	< 2
. Emptying the pit below the slatted floor between two successive batches of sows in the farrowing room	No	Yes
. Duration of the down period in the farrowing room (days)	< 5	≥ 5
. Flushing the drinking trough in the post-weaning section prior to loading of piglets	No	No*
. Duration of the period while the post weaning room is "empty and clean" before loading the followed pigs (days)	< 7	≥ 7
. Duration of the period while the fattening room is "empty and clean" before loading the followed pigs (days)	≤ 3	> 3
. Salmonella contamination of the finishing room prior to the introduction of batches of piglets	Yes	Yes*
. Type of feeding during the fattening phase	Dry	Dry*
. Number of different diets during the fattening phase	≥ 2	2*
. Antibiotic treatment in the second half of the fattening period	Yes	Yes*
. Seroconversion against <i>Lawsonia intracellularis</i> in the second half of the fattening phase	Yes	Yes*
. Serological status of the followed batch regarding PRRS ³ at the end of the fattening phase	Pos. ¹	Neg. ²
. Serological status of the followed batch regarding PRCV ⁴ at the end of the survey	Pos.	Pos.*
. Serological status of the followed batch regarding swine influenza	Pos.	Pos.*
. Salmonella shedding status (number of positive swabs)	≥ 1	≥ 1

*: Risky level; ¹Pos.: Positive; ²Neg.: Negative; ³PRRS: Porcine and Respiratory Syndrome, ⁴PRCV: Porcine Respiratory Coronavirus

Table II : Profile of batches of pigs on the risk factors of Salmonella shedding at the end of the fattening phase after the implementation of a control programme (5 batches, April 2004 to July 2004)

Variable	After modifications (5 batches)				
	1	2	3	4	5
. Frequency of sows' faeces removal in the farrowing room (/day)	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2
. Emptying the pit below the slatted floor between two successive batches of sows in the farrowing room	Yes	Yes	Yes	Yes	Yes
. Duration of the down period in the farrowing room (days)	≥ 5	≥ 5	≥ 5	≥ 5	≥ 5
. Flushing the drinking trough in the post-weaning section prior to loading of piglets	Yes	Yes	Yes	Yes	Yes
. Duration of the period while the post weaning room is "empty and clean" before loading the followed pigs (days)	≥ 7	≥ 7	≥ 7	≥ 7	≥ 7
. Duration of the period while the fattening room is "empty and clean" before loading the followed pigs (days)	<3*	> 3	> 3	> 3	> 3
. Salmonella contamination of the finishing room prior to the introduction of batches of piglets	Yes*	No	Yes*	No	No
. Type of feeding during the fattening phase	Dry*	Dry*	Dry*	Dry*	Dry*
. Number of different diets during the fattening phase	2*	2*	2*	2*	2*
. Antibiotic treatment in the second half of the fattening period	No	No	No	No	No
. Seroconversion against <i>Lawsonia intracellularis</i> in the second half of the fattening phase	No	No	No	Yes*	Yes*
. Serological status of the followed batch regarding PRRS ³ at the end of the fattening phase	Neg.	Neg.	Neg.	Neg.	Neg.
. Serological status of the followed batch regarding PRCV ⁴ at the end of the survey	Neg.	Neg.	Pos.*	Pos.*	Pos.*
. Serological status of the followed batch regarding swine influenza	Neg.	Neg.	Neg.	Neg.	Neg.
. Salmonella shedding status (number of positive swabs)	0	0	0	0	0

On the 5 followed batches of pigs, no one was found to be *Salmonella* contaminated at the end of the finishing phase.

Discussion

The aim of our study was to evaluate the effect of the implementation of a preventive programme based on the results of a previous survey on *Salmonella* shedding of fattening pigs. In the present study, parallel modifications were undertaken so that the role of each risk factor could not be tested, priority was given to the role of profiles. *Salmonella* shedding was assessed by swabbing the environment of the pigs at the end of the finishing phase as it was tested in the previous survey in 2001 (3). So that, in both studies the same method and period of pig's life were used to describe the batch contamination. Among the risk factors identified in the first check, only parameters related to hygiene procedures could be immediately and directly improved. After implementation of a control programme, on the 5 followed batches of pigs, no one was found to be *Salmonella* carrier at the end of the finishing phase. The results of our study indicate that the *Salmonella* shedding status of the farm can be improved through the implementation of relevant sanitary measures especially for cleaning and disinfection. The implementation of strict hygiene protocols (*i.e.* clean facilities, all-in/all-out management) is often mentioned in the literature as a method to control *Salmonella* contamination in pig farms (1; 9). The type of approach here used that focussed more on profiles (*i.e.* on combinations of variables) than on one factor taken in isolation is an appropriate way to prevent those multifactorial animal health problems. It is also valuable to reduce the risk of *Salmonella* shedding of finishing pigs. More generally, the results of properly designed studies of analytic epidemiology might be taken into account in further prevention programmes of *Salmonella* contamination of finishing pigs.

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ISAH 2005 - Warsaw, Poland
Vol 1

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