RISK FACTORS AND CONTROL MEASURES FOR SUBCLINICAL
SALMONELLA INFECTION IN PIG HERDS

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In the last 20 years there was an enormous increase in pig production in several parts of the European Union. After entering of disease agents in such areas it is very easy for them to spread and to persist in the pig population. This has resulted in a situation in which a lot of pathogens continually occur in the pig population. The size of the pig farming operations and the small geographical distance between them makes it almost impossible to eliminate most of the disease agents from the populations. On the other hand there is a development in the EU-regulations that requires more and more guarantees with respect to the absence of some pathogens in the population in a non-vaccination policy. Only countries able to comply with these requirements have free entrance to the European market. A second development in this field is the increasing interest in a high quality standard of the products at the end of the pig production chain; first of all in relation to the safety of the product linked to residues and zoonoses, but further to the meat quality and at last the emotional quality for the consumer. These developments have lead to a health control policy in swine production that is based on two different tracks: the safeguarding strategy and the controlling strategy.

In the safeguarding strategy the goal is to give guarantees with respect to the absence of specific disease causing agents in the population or in a herd. This can be done by executing a surveillance program to monitor the disease free status for disease agents that are already absent. For those disease agents that are still present in the population this means the need for an elimination program to eradicate the disease in the farms or in the whole population. A good example of such a program is the Aujeszky's Disease eradication program in the Netherlands, based on a compulsory intensive vaccination program (Stegeman et al., 1994).

In the health controlling strategy the programs are not focused on the elimination of the pathogens. Presence of the disease in the herds is accepted and the program is dealing with the opportunity for the pigs to live in coexistence with these pathogens without allowing them to cause diseases and damages. Disease outbreaks depend on the infection pressure with the pathogen (quantity and quality) in the environment of the pigs on the one side and the resistance of the animals against these pathogens on the other side. Controlling strategies are focused on the measures that can contribute to keep the balance between these two.

Until now, the control of salmonella in the Netherlands in pigs is focused on the controlling strategy. Depending on the results of different research programs that are running now, it has to be decided later on if it is necessary to put salmonella in a safeguarding strategy program. This depends on the occurrence of this pathogen in the

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population, the economic damage in pigs, the relation between prevalence and farm conditions, the consequences of the presence of these germs in the herd for humans and the opportunities to eliminate the germ in the herds.

Occurrence of Salmonella

**Bacteriological:** The most common way to investigate the occurrence of salmonella in pig herds is to collect faecal samples and to examine them for salmonella. Very often pooled faecal samples are used for the examination after an enrichment. But we know, that even then the results in positive herds can be negative. Therefore results of prevalence studies based on sampling of faeces have to be treated very carefully. In a cross sectional survey on 165 fattening herds in the southern Netherlands in 1981 it was found after taking faecal samples of 5 individual pigs with, when possible, signs of diarrhoea that 38% of the herds were positive. (BAKK et al., 1983). There was no significant difference in daily gain during the fattening period between the positive (659 g/day) and the negative herd (661 g/day). In an extensive bacteriological investigation of Van Schie (1987) with a very intensive sampling scheme in 75 breeding, multiplying or fattening herds he found 66.6% positive herds. The last cross study in fattening farms in the Netherlands was executed in 1994. In 320 herds sampling was carried out in two different sections and 12 fresh droppings were collected and pooled in 2 pool samples. Based on the 4 pooled samples per herd we found that 24.4% of the herds were salmonella positive. In several herds there was only one of the two examined sections found salmonella positive.

**Serological:** The serological status of an animal regarding salmonella gives information with respect to an infection with salmonella during the lifetime before sampling. The extension of the information depends on the examination method. The research in the Netherlands in the last years in this field is based on the ELISA-method, developed by NIELSEN et al. (1995) in Denmark and especially focused on the B,C and D types of salmonella. In 1995, a longitudinal study was performed in 16 farrow to finish herds. The dams were sampled as well as 10 progeny pigs that were housed in one fattening compartment. The piglets were followed continuously each 4th week until slaughter. It was found, that on average 53% of the sows in these farms were seropositive and that seropositive sows were present in all of these farms. Prevalence of seropositive pigs decreased in the first 8 weeks of age and increased thereafter continuously until a level of 24% seropositive pigs at slaughter. In spite of the presence of seropositive sows in all the farms, there were still farms where all the sampled fattening pigs became negative and stayed negative until slaughter. In two different large cross sectional surveys based on the blood sampling of pigs in the Dutch slaughterhouses we are now investigating the prevalence of seropositive slaughter pigs in the Dutch pig population and differences in serostatus associated with farm conditions in fattening herds.

**Environmental risk factors:**

In the strategy to control salmonella in the Dutch pig population the controlling strategy on the farm level plays a very important role. Of course there are many ways for the introduction of salmonella by animals, feed and other environment vectors into the farm. First of all, attention has to be given to hygienic measures and feed treatment to prevent disease introduction. From our investigations there were indications that the serological status of the finishing herds was better in herds with a hygienic lock for entrance of visitors (KOPPEN, J.M.C.C., 1997). While accepting the presence of salmonella in many
herds, attention should be focused on decreasing the salmonella prevalence in the pigs. Therefore it is important to investigate the relationship between farm conditions and farm management and the prevalence of salmonella in the herd. In several studies there were indications for successful opportunities to control salmonella in the farms.

**All in-All out in small compartments:** This is the only way to create a high hygienic standard within the farm by cleaning and disinfecting each compartment after emptying and before introducing the new supply of pigs. As already mentioned before we found, that even in farrow to finish farms with a seropositive sow population it is still possible to place negative piglets into the finishing compartment and to keep them negative until slaughter. There has to be facilities in the compartments to keep high hygienic standards so that the pigs can not be infected from other parts of the farm. These hygienic requirements play an important role to prevent A. suum infections too. That could be the reason, that we found a clear higher prevalence of affected livers in the slaughter pigs in finishing farms with a high seropositive salmonella status.

**Feeding system:** The feed can be contaminated in the farm by salmonella in several ways. It is important to anticipate unbridled multiplication in the feed. Besides feed hygiene the feeding system turned out to be very important. In our bacteriological research on 320 fattening farms we found, that the odds for a salmonella positive status was 10 times lower in farms with porridge feeding from waste products in comparison to the dry feeding systems. It is known, that there is an acid environment in this porridge. Van SCHIE (1987) demonstrated, that the salmonella prevalence was very low in fattening herds that feed acidified cheese whey to the fatteners.

**Farm size and pig density:** In the already mentioned study of KOPPEN et al. (1997) with respect to relationship between salmonella serostatus and farm conditions, the preliminary results show a lower percentage seronegative herds in the bigger farms and in the regions with a higher pig density. Spread of salmonella between farms and persistence of this germ in bigger farms seems to play a role. That means, that in that situation special attention has to be paid to the salmonella prevention within and between farms.

**Other risk factors:** Further research is necessary to acquire sufficient information with respect to the contribution of other risk factors to the prevalence of salmonella in the production chain. In the Netherlands we perform at this moment different research projects. We are participating in the EU-project “Salinpork” that will be finished in April 1999 and we are executing a project on 400 finishing farms and in the connecting slaughterhouses to construct salmonella poor pig production.

**Integrated Quality Control:**
Producing healthy pigs with a high quality in the pig production chain is a joint responsibility for all the links in the chain. Therefore the slaughterhouses in the Netherlands set up an integrated quality control system. In this system minimal requirements for salmonella prevention will be incorporated in this IQC-system as soon as the results of the research programs lead to clear conclusions. In the slaughterhouse information with respect to the salmonella status of the farms will be collected and fed back to the farmers. Farm information is used in the meat inspection at the slaughterhouse too. Regular control visits are executed to the participating farms to check on the minimal requirements for salmo-
nella prevention. (Tielen, 1993).

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