Fact Sheet

“The risk of Salmonellosis and new aspects of Salmonella control”

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Results of the “Fourth International Symposium on Epidemiology and Control of Salmonella and other Foodborne Pathogens in Pork”, held in Leipzig (Germany) from September 2nd to September 5th 2001

The world-wide interest on Salmonella-aspects grew massively since the first International Symposium held in Ames (USA) in 1996. That was reflected in an increased number of participants and scientific contributions for the second and third symposium respectively in Copenhagen (Denmark) 1997 and Washington D.C. (USA) 1999. This year, there were more than 160 scientific presentations from 31 countries from all five continents.

Information on all aspects of foodborne pathogens in the pork production chain from “Feed to Fork” including – for the first time - a “Human Health Implications”-session was given at the symposium. Additionally, pathogens other than Salmonella were included. These pathogens, i.e. Campylobacter, Yersinia, Escherichia coli O:157, Clostridium, Listeria, Toxoplasma and Trichinella, were represented by more than 30 presentations.

Reasons for the growing interest in this issue in even more countries are:
- Consumers request an increased degree of food safety. Consumer protection is a high-level political question. Problems in consumer protection can lead swiftly to large economical problems in the agriculture and food industry.

- Pork is the major source of protein (of animal origin) intake in many countries of the world. Salmonella are widely distributed in the pork population. Thus, pork belongs to the major sources of food-associated Salmonellosis – the most important microbiological contamination of meat - in humans. At the highest risk-level are countries where pork is consumed raw or not thermally treated. Besides the risk of endogenous contamination, one has to take into account the risk of cross-contamination during slaughter and processing.

- The introduction of the new Salmonella surveillance and control program for pork production in the Scandinavian countries led to a reduction of the Salmonella-contamination of meat from slaughter pigs and demonstrated the feasibility of such an intention. By showing this, the interest in establishing such programs grew in even more countries. It is obvious that the successful marketing of pork products in the future will depend on the quality of the microbiological safety of such products (i.e. Salmonella-free products) The Salmonella-control program must be integrated in a broader quality assurance program for pork production. In this respect the aim of Salmonella-free pork production is closely linked with the interests of consumers and the economy.
The symposium supported the opinion that Salmonella-reduction schemes that aim on Salmonella-free pork products have to start at farm level. There is no doubt remaining that the first step has to be the bacteriological and serological classification of pig herds in high-, medium- and low-prevalence herds. Specific Salmonella-eradication schemes have to be established on the basis of scientific arguments. The classification of herds is, for example, based on the Serological Salmonella Index as used in Denmark. It was agreed by the participants of the symposium that it is necessary to standardise or at least harmonize the detection methods to make the comparison of results easier. Cross-border harmonisation of Salmonella-monitoring methods was discussed.

The next steps have to include the detection and eradication of the original sources of the Salmonella-infection in pig herds. That seems to be the most important and, at the same time, the most costly part of the tasks we have to tackle next. At the symposium further results on the influence of transportation and lairage on the prevalence of Salmonella in pigs and the possible risk of cross-contamination at the abattoir were presented.

The symposium dealt with different aspects of food-safety “from the stable to the table”. All presentations are summarized in the Proceedings (available as CD-ROM or a paper version). Some selected papers from different sessions are summarised below:

In the session ‘Control’, Nielsen et al describe the new Salmonella surveillance and control programme for pork production in Denmark. Changes are made in the sampling scheme for finisher herds: a simpler scheme, the reduction of the individual sample cut-off in the ELISA (OD% > 20 instead of OD% > 40), and the Serological Salmonella Index for slaughter pig herds as tool to determine the Salmonella herd status are introduced. The classification of herds is, however, still based on practical capacity constraints and not on scientific arguments. Special attention is given to herds that are infected with Salmonella Typhimurium DT104. As the leading country in the application of serological monitoring, Denmark has started the discussion on the necessity for an international standard cut-off for Salmonella ELISA’s. Paukatong and Kunawasen describe a fine example of the implementation for the HACCP procedures for the safe production of traditional pork sausages called Nahm in South Korea. Four critical control points were identified: the weighing of nitrite, stuffing (to prevent metal clips in sausages), fermentation (checked by Ph < 4.6), and labelling.

In the session ‘Intervention’, Funk et al. describe a risk factor analysis for the risks associated with the faecal shedding of Salmonella enterica by finishing pigs. Associated with increased prevalence were: lacking Bio-security and hygiene practices, low and variable environmental temperature, above median production performance, and decreased floor space allowance/pig at the time of sampling. The results of this study suggest caution in interpretation of faecal culture results when sampling from various marketing groups in swine production systems. Maes and co-workers describe a vaccine test trail under practical circumstances with a S. Choleraesuis modified live vaccine providing cross protection against naturally occurring Salmonella infections. Oral vaccination at 3 and 16 weeks of age leads to a decreased level of infected lymphnodes at slaughter: 0.6% vs 7.2% (p<0.001). Springer et al. also evaluate a live vaccine, however based on S. Typhimurium. Vaccinated animals had significantly higher antibody titers after the second vaccination than the unvaccinated animals. The vaccinated animals had a
significantly lower (p < 0.05) colonization of the ileal and caecal mucosa as well as the ileocolic lymph nodes than the unvaccinated animals. Østerberg and co-workers demonstrate a successful program which was able to eradicate *Salmonella Yoruba* from an infected integrated SPF sow herd performing an age segregated rearing system. The model presented allows almost full production during the eradication program; only offspring of infected sows are lost. The study also highlights the importance of rearing pigs with different health status separated from each other.

In the session ‘Epidemiology’, Kranker et al. study the risk factors for *Salmonella* infection based on bacteriological and serological herd classification in sow herds and in their related finishing herds. The influence of sow herds and the related risk factors have so far been neglected in the studies of *Salmonella* in pigs. Bacteriological status of the weaners and feed related factors influence the Salmonella status of finishers. McKean and co-workers describe the impact of the commercial pre-harvest processes on the prevalence of *Salmonella* in culled sows. The process of gathering sows in collection points, transporting them over long distances and keep them in lairage before slaughter has a large influence on the *Salmonella* status. Showing a dramatic increase in the number of positive pigs, an increase of isolated serotypes of Salmonella and rapid infection after placing in an contaminated environment. Swanenburg et al. analysed the *Salmonella* isolates cultivated from pig carcasses and compared them to the isolates cultivated from samples of the farm environment, gathered during transport, in the lairage and during the slaughter process. The most amazing result is that 80 or more percent of all *Salmonella* contamination on carcasses originate from the slaughter line and only 15 % derived directly from the herd of origin. Both, Quirke et al. and Boes et al. studied the prevalence of *Salmonella* serotypes on pig carcasses from high- and low-prevalence herds and found that slaughter scheduling is an effective way to reduce cross contamination and carcass contamination of originally *Salmonella* free pigs.

In the session ‘Human Health Implications’, Alban and co-workers make an assessment of the risk for human health when using pork contaminated with *S. Typhimurium DT104* for the production of sausages. Very low numbers of *S. Typhimurium DT104* per serving are estimated: up to 4 colonies per 40 grams of product. It is estimated that about 25 / 100,000 servings will be contaminated.

In the session ‘Pork as Source of Food Borne Infection’, Hald and co-workers describe a sophisticated model for estimating the role of different types of food as source of *Salmonella* infection in people. This model offers an mathematical approach to the uncertainties which are always involved in this process.

In the session ‘Pathogenesis’, Gray and Fedorka-Cray show that pig faeces contaminated with *Salmonella Choleraesuis* can remain infective for pigs for up to 13 months. They demonstrate that the time in which pigs houses are empty is of little importance in preventing *Salmonella*-infections if pig faeces are left in the environment. Seidler and co-workers demonstrate some of the mechanisms behind the rapid dissemination of *Salmonella* through the pig’s body during transport and lairage as a result of the influence of stress. Stress does not only increase the translocation of *Salmonella* across the gut wall and cause an increase in endotoxine levels in the blood stream but also diminishes the immunological defence mechanisms in serum resulting in a
higher contamination rate of internal organs with *Salmonella*. Naughton and Jensen describe a bioreactor system to study the survival of *S.* Typhimurium in pig gut content as a result of different diets and Short Chain Fatty Acid concentrations. This system may simplify the study of the influence of diet composition and may reduce the need for laboratory animals. Hurd et al. demonstrate that slaughter pigs may become infected with *Salmonella* within two hours by placing them in a pen environment contaminated with only $1.5 \times 10^3$ CFU/g faeces. This experiment again demonstrates the importance of cross contamination during lairage. Marg and co-workers studied the course of *S.* Typhimurium DT104 infection in pigs by culture and serologically after experimental infection. They used this model to study the influence of pre-slaughter stress induced by long distance transport on re-activation of clinical disease. Some negative effects of transport stress were observed.

In the session ‘Diagnostics’, van der Heijden describes the first international ring trial for *Salmonella* ELISA’s for the specific detection of antibodies in pigs. The specificity of most ELISAs was satisfactory. Relatively large differences in sensitivity between tests, which varied between laboratories, were shown. It was concluded that international reference samples should be made available to guarantee a minimum level of sensitivity of available tests. Fravalo and co-workers describe the development and improvement in immunofluorescent staining protocol of *S.* Typhimurium and *L. monocytogenes* on pork skin in order to obtain specific and intensive signals able to be detected by electronic cameras (deported microscopy). This method will allow rapid (3 resp. 6 hours) detection of contamination of pig carcasses. Weigel et al. evaluate the use of Pulse Field Gel Electrophoresis (PFGE) and Polymerase Chain Reaction (PCR) techniques to differentiate *Salmonella* isolates. They conclude that REP-PCR should be considered as an acceptable and perhaps preferable alternative to PFGE as a genotyping method for studies of *Salmonella* transmission. Scholz and co-workers demonstrate optimization strategies for the widespread *invA*-PCR in order to detect *S.* Typhimurium in pig tissues. Finally, Bauerfeind et al. describe the prevalence and polymorphism of the virulence factor ‘SpvD’ in *Salmonella* isolates obtained from animal sources. The fact that the gene of this virulence factor is highly conserved in *Salmonella* strains makes it a likely candidate for vaccines and for diagnostics.

As a result of the discussion the symposium decided that the standardisation of the diagnostic methods (including sampling, test material and assessment of the serological results) should be a central point on the agenda of the next symposium. More ring trials are planned.

The 5th Symposium will be organized in 2003 in Greece.

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Born: December 22nd 1959 in Amstelveen, The Netherlands
Studied Veterinary Medicine from September 1979 till graduation in February 1987 (DVM)
Worked in several mixed large and small animal practices in The Netherlands before joining the Animal Health Service in February 1992, working as a veterinarian in the Pig Health Department.

Started working on a PhD-thesis on Salmonella in pigs in March 1995 which was concluded successfully on November 30th 2000 with the defense of the thesis “Salmonella in the pork production chain: feasibility of Salmonella-free pig production”.

Was officially registered by the Royal Dutch Veterinary Association On June 20th 2001 as specialist Pig Health and Disease.