A European longitudinal study in *Salmonella* seronegative-and seropositive classified finishing pig herds

Danilo M.A. Lo Fo Wong¹,², Jan Dahl³, Jens S. Andersen¹, Anne Wingstrand¹,³, Peter J. van der Wolf⁴, Alexandra von Altrock⁵, Britt-Marie Thorberg⁶.

¹: Danish Veterinary Laboratory, 27 Bülowsvej, DK-1790 Copenhagen V, Denmark, Phone: +45 35 30 01 39, Fax: +45 35 30 03 77, E-mail: dwon@svs.dk ²: Royal Veterinary and Agricultural University, 8 Groennegaardsvej, DK-1870 Frederiksberg C., Denmark. ³: Danish Bacon and Meat Council, 3 Axeltorv, DK-1609 Copenhagen V, Denmark. ⁴: Animal Health Service, P.O. Box 4, NL-5280 AA Boxtel, The Netherlands. ⁵: Free University of Berlin, 69 Königsrowg, D-14163, Berlin Germany. ⁶: National Veterinary Institute, P.O. Box 7073, S-75007 Uppsala, Sweden.

Abstract: A study was performed to assess the stability of an assigned *Salmonella* status of finishing pig herds over time, seasonal variation in the incidence of herd infections, the herd incidence of *Salmonella* infections from the grower to the finisher production stage and the correlation between serological and bacteriological herd classification. Finishing pig herds were followed over a two-year period through serological and bacteriological sampling. Sixty-two per cent of herds in this study shifted from their initial status at least once during the observation period. Steady-status periods varied from one month to more than two years. The odds for testing finishers seropositive, given that growers tested seropositive in the previous sampling round were 10 times higher than if growers tested seronegative. When *Salmonella* was isolated from pen faecal samples in the same sampling round, the herd was 4 times more likely to be classified seropositive, compared to if no *Salmonella* was detected. There was no indication of seasonal variation in the incidence of herd infections, measured by serology.

Keywords: epidemiology, serology, bacteriology, herd status, follow-up

Introduction: Since pigs can carry *Salmonella* without obvious symptoms of disease, there is a need for tools that can identify infected animals, which ultimately can lead to contaminated end products. Surveillance and control are important aspects of food safety assurance strategies at the pre-harvest level of pork production. Prior to implementation of a surveillance and control programme, it is important to have knowledge on the dynamics and epidemiology of *Salmonella* infections in pig herds. The study was part of a larger international research project, entitled ‘*Salmonella* in Pork (SALINPORK FAIR1 CT95-0400)’ (Lo Fo Wong and Hald, 2000) and was mainly funded by the European Commission. The objective was to investigate the stability of a *Salmonella* herd status over time, seasonal variation in the incidence of herd infections, the herd incidence of
Salmonella infections from the grower to the finisher production stage and the relation between serological and bacteriological herd classification.

Materials and Methods: The Salmonella status of finishing pig herds at study onset was determined by blood sampling of 50 market weight finishing pigs in Germany, The Netherlands, Denmark and Sweden. Blood samples were analysed with an indirect mix-ELISA (Nielsen et al., 1995; van der Heijden et al., 1998). Samples with an OD% larger than 10 were considered positive. A herd was assigned a seropositive Salmonella status if more than 4% of the blood samples from finishers were positive. The development of the Salmonella status of the selected herds was assessed by 7 subsequent sampling rounds. At each round, 25 blood samples from market weight finishers and 25 blood samples from growers (min. weight of 20 kg) were taken. In addition, 10 pen faecal samples of 25 grams, each representing ≥5 pigs, were collected per visit. A herd was considered bacteriologically positive if Salmonella was isolated from one or more pen faecal samples. Testing was done approximately 3 months apart, so that each herd was to be followed for 2 years (i.e. 2 seasons). Information on herd management factors were available from another study in the same project (Lo Fo Wong, 2001). Descriptive statistics and multivariate logistic regression was performed with standard statistical software.

Results: A total of 32 slaughter pig herds participated in the longitudinal study, 17 of which were initially classified as seropositive and 15 as seronegative. In total, 9,844 blood samples and 1,506 pen faecal samples were collected and analysed. Overall, 12 out of 32 herds (38%) continued to have the same Salmonella status as appointed at the start of the study during the observation period. The number of status shifts per herd varied from 0 to 3. There was no significant difference in the mean duration of the initial status between seropositive and seronegative herds. On average, herds that were classified as seronegative in the initial sampling round, remained negative for 381 days, ranging from 49 to the end of the follow-up of seronegative herds at 695 days. Seropositive herds stayed positive for 419 days on average, ranging from 33 to the end of follow-up of seropositive herds at 861 days. The odds for an initial seropositive herd to be classified as seropositive during follow-up, was approx. 7.5 times the odds for an initially seronegative herd. Feeding wet feed appeared to have a protective effect against seropositive herd classification. No evidence of seasonal variation in the mean duration of the initial status was found.

The odds for testing finishers seropositive, given that growers were seropositive in the previous sampling round were 10 times higher than if growers were seronegative. The positive predictive value of a seropositive sampling round among growers was 0.75, while the negative predictive value was 0.77.
Eighty-four per cent of *Salmonella* isolations were accompanied by a serological response. In 74% of all sampling rounds, serological and bacteriological herd classification were in agreement. When *Salmonella* was isolated from pen faecal samples in the same sampling round the herd was approx. 4 times more likely to be classified seropositive, compared to if no *Salmonella* was detected. Herds feeding with wet feed were approx. 13 times less likely to be classified as seropositive compared to herds feeding dry feed. Herds of which the caretaker(s) did not consistently wash hands before taking care of the animals were more than 4 times more likely to test seropositive compared to herds where the caretaker did.

**Discussion:** The stability of an initially allocated *Salmonella* status, was found to vary noticeably. Sixty-two per cent of herds in this study shifted from their initial status at least once during observation. There are many factors that may lead to a change of *Salmonella* status, such as the introduction of contaminated feed and/or infected animals, a change in feed or management strategy and contact to the surrounding environment. Therefore, a *Salmonella* herd status should not be based on a single sampling round. Regular testing is necessary to monitor any sudden changes in the *Salmonella* status of a herd.

**References**


