Seroprevalence and antibiotic sensitivity of *Salmonella enterica* serotypes in Greek swine herds

L. Leontides¹, E. Grafanakis², C. Genigeorgis²

¹ Laboratory of Epidemiology and Economics of Animal Production, School of Veterinary Medicine, University of Thessaly, P.O. Box 199, 43100 Karditsa, Greece, Tel +30 441 66002, Fax +30 441 66041, Email leoleont@vet.uth.gr., ² Dept. of Food Hygiene and Technology, School of Veterinary Medicine, Aristotelian University, 54006 Thessaloniki, Greece.

**Summary:** Blood samples were taken from 50 pigs in each of 59 farrow-to-finish herds and from 40 gilts in each of 4/5 registered multiplying herds. Samples of feed and faeces were collected from 17 of the production herds and from the multiplying herds. The sera were tested for antibodies by the Danish-mix-ELISA (positive cut-off OD>10 or OD>40 %), and the organisms were isolated, serotyped and sensitivity tested by standard techniques. The average within herd seroprevalence was 15.6 or 3.4 % and at least one pig tested seropositive in 52/59 or 21/59 production herds at the low and the high cut-off values, respectively. All the multiplying herds had seroreactors at the low but only a single seroreactor was detected at the high cut-off. The salmonellae isolated were *S. tennessee*, *S. typhimurium*, *S. bredeney*, *S. london* and an untypable strain. The *S. typhimurium* and *S. london* had low sensitivity to streptomycin, kanamycin and neomycin. The former had low sensitivity also to amoxicillin, ticarcillin, piperacillin, cefalotin and cefoperazone. The other isolates were sensitive to the antimicrobial agents tested.

**Keywords:** Pig-salmonellosis, on-farm epidemiology

**Introduction:** Consumption of contaminated pig-meat and its products has been estimated to account for about 10-15% of total human incidents in Denmark, 14-19% in The Netherlands and 18-23% in Germany (Hald and Wegener, 1999). The most frequent sources of contamination of the pig-meat and its products are the subclinically on-farm infected pigs which will infect penmates and other co-mingling pigs during transportation and lairage (Berends et al., 1997). In Denmark and Sweden human salmonellosis has decreased significantly after the implementation of nation-wide programmes (Mousing et al., 1997; Wierup, 1997) for the control of the infection in the primary production. Across the EU countries, however, there is a need for a battery of different control strategies to be developed because of the multifactorial nature and the variation in the regional prevalence of swine salmonellosis (Berends et al. 1997; Davies and Funk, 1999). In this paper we report the prevalence of serologically positive pigs in finishing sections of farrow-to-finish and of multiplying herds in Greece, and the prevalence
of contaminated faecal pen samples and final feed samples, the serotypes harbored and their sensitivity patterns in a sub-sample of the serologically tested herds.

**Materials and Methods:** Fifty-nine farrow-to-finish and 4/5 registered multiplying pig herds were selected and sampled. From each finishing section of the farrow-to-finish herds, 50 pigs (90-105 kg) were blood sampled. Forty blood samples were collected from ready-to-ship replacement gilts in each of the four multiplying herds. The sera were tested for antibodies to *S. enterica* by the Danish mix-ELISA (Nielsen et al., 1995). The ELISA measures an optical density as a percentage of a known positive control and its results may be interpreted at the OD of >40% or of >10% as positive cut-offs. Final feed was sampled from 19/59 herds and the four multiplying herds. In each herd, 5 samples (consisting of 100 g) were collected from 5 different pens containing either finishers or ready-to-ship gilts. Faecal samples were obtained from the pens in 17/19 feed-sampled herds and from the multiplying herds. From each herd samples were taken from 20 pens occupied by ready-to-ship finishers or gilts; a sample consisted of at least 5 fresh droppings of 5 g each for a total of ≥25 g. The microbiological testing procedure involved enrichment, plating, confirmation and serotyping. The salmonellae isolated were tested for their sensitivity to 35 antimicrobial agents (b-lactamines, aminoglykosides, chloramphenicol, sulphonamides, quinolones, tetracyclines, sulphonamides+trimethoprim, rifampicin, fosfomycin, colistin, nitrofurantoin) by the disk diffusion method, using Mueller-Hinton agar (Bauer et al., 1966). The disks and their antibiotic concentration were identical to those used by several Greek hospitals. To account for the overdispersion in the data, the 95% confidence intervals (CI) for the average within-herd seroprevalences were estimated after calculating the intra-herd correlation coefficients (ICC) and adjusting the binomial variances by the appropriate variance inflation factors (Fleiss, 1981).

**Results:** The average within-herd seroprevalences, at the low and the high cut-off values, in finishing sections of farrow-to-finish herds were 15.6 % and 3.4 %, respectively (ICC and 95 % CI: 0.22 and 11-20 %, 0.32 and 0.7-6.1 %, respectively). In 52/59 (88 %; 80-96 %) and in 21/59 (35.6 %; 23.4-47.8 %) herds at least one finishing pig tested seropositive at the low and at the high cut-off, respectively. In the multiplying herds, 9/40, 19/40, 1/40 and 1/40 seroreactors at the low and a single seroreactor at the high cut-off value were detected. Only 5/95 (5.3 %) samples of final feed were found to harbour *Salmonella* spp; *S. tennessee* was isolated from 4/5 samples from one herd and an untypable strain from another. The prevalence of contaminated samples of faeces was 4/340 (1.2%); *S. typhimurium* was isolated from two herds, *S. bredeney* from one and *S. london* from one herd. The salmonellae were isolated from any of the samples of faeces or feed taken from the multiplying herds. *S. tennessee* and *S. bredeney* isolates were sensitive to all the antimicrobials tested. *S. london* had a low sensitivity to
streptomycin, kanamycin and neomycin and *S. typhimurium* had a low sensitivity to streptomycin, kanamycin and neomycin, amoxicillin, ticarcillin, piperacillin, cefalotin and cefoperazone.

**Discussion:** The estimated average within herd seroprevalences in the Greek production herds were lower than those reported from Denmark at the beginning of its national control programme (Mousing et al., 1997) and that reported from The Netherlands (van der Wolf, 2000). The serotypes isolated from compound feed are rare causes of human disease and were not isolated from faeces samples collected at the same day. The *S. typhimurium* isolates were probably not multiresistant DT104 since they were sensitive to fluoroquinolones, tetracyclines and sulphonamides.

**References**


