Prevalence of *Campylobacter* spp. and *Yersinia enterocolitica* in Fattening Pig Herds in Lower Saxony, Germany

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**Abstract**

The results of a study on the occurrence of two bacteria that cause zoonoses, *Campylobacter* spp. and *Yersinia enterocolitica* were presented and the results of bacteriological and serological methods of detection were compared. The study was carried out on 30 fattening herds in Lower Saxony, Germany. Bacteriological findings of *Campylobacter* spp. in the faeces indicated that 69.7% of the fattening pigs were positive, but 81.2% tested positive serologically. All herds tested here were both bacteriologically and serologically positive for *Campylobacter* spp. Furthermore, only 8.4% tested positive for *Yersinia enterocolitica* in the faecal samples, but 66.8% of the animals were serologically positive for that bacterium. At herd level 43.3% of the herds tested bacteriologically positive for *Yersinia enterocolitica*, whereas serological testing showed that 83.3% of the units had one or more reacting animal.

Although both agents take the same route of infection there was no statistical correlation between bacteriological and serological findings for *Campylobacter* spp. and *Yersinia enterocolitica*.

The great difference between the results of bacteriological and serological testing, especially in the case of *Yersinia enterocolitica*, can be explained by the intermittent intestinal excretion and predominance of this bacterium in the animals' tonsils. Low faecal excretion is also the reason for the low detection rate of 3.4% of *Yersinia enterocolitica* in the environmental samples, while that of *Campylobacter* spp. was 33.3%. These results indicate that the environment plays only a secondary role in the distribution of *Yersinia enterocolitica* in pig herds.

**Introduction**

Infections with *Campylobacter* spp. and *Yersinia enterocolitica* are the two most frequently occurring zoonoses in Europe. Both bacteria are potential pathogens and can cause acute enteritis in humans. In pigs the infection with each of these bacteria is characterised by latent, i.e. clinically unapparent herd infections that do not result in visible tissue changes. Therefore, food products from pigs represent a potential source of human infections. Pigs are an important reservoir for *Yersinia enterocolitica* as well as *Campylobacter* spp. Especially *Campylobacter coli* can be isolated from the intestinal tract of pigs. This agent represents the second most common cause of human campylobacteriosis (TAM et al., 2003) with part of 20% in Germany (SCHULZE et al., 2000, GUERTLER et al., 2005a).

In Germany, the reported prevalence of *Campylobacter* spp. in faeces of slaughter pigs is up to 96% with *Campylobacter coli* strains as the major isolate (V. ALTROCK et al., 2004). According to studies from GUERTLER et al. (2005b), the prevalence of *Yersinia enterocolitica* ranges between 0% and 65.4% in fattening pig herds. The prevalence of anti-*Yersinia*-antibodies in Bavarian slaughter pigs was about 45% (HENSEL et al., 2004). In German blood-donors the prevalence of *Yersinia enterocolitica* O3/O9-specific antibodies has been reported to be 33% and 43% by immunoassay and immunoblotting, respectively (MAEKI-IKOLA et al., 1997).
The purpose of this work was to increase the knowledge of the epidemiology of the occurrence of *Campylobacter* spp. and *Yersinia enterocolitica* in fattening herds with particular emphasis on the comparison of serological and bacteriological findings.

**Material and methods**

Blood and faecal samples were taken from 30 fattening herds in Lower Saxony. From each herd samples from 30 pigs, shortly before being slaughtered, were examined. In addition one swab at a time was taken from drinking and feeding troughs, from the boots of the person in charge of the pigs, and from a water tap near the entrance of the stable.

Swabs and faecal samples were investigated bacteriologically. *Campylobacter* spp. were grown in enriched Bolton bouillon, isolated on modified charcoal ceftazidime deoxycholate agar (mCCDA), and identified by PCR (VAN DOORN et al., 1998; GONZALEZ et al. 1997). *Yersinia enterocolitica* were grown in Irgasan-Ticarcillin-Potassium-Chlorate (ITC) bouillon, isolated on Cefsulodin-Irgasan-Novobiocin (CIN) agar, and identified with the API 20E system.

The serological investigation of antibodies against *Campylobacter* spp. was carried out using a method based on immunoblot analysis developed by the Institute of Animal Hygiene and Veterinary Public Health, University of Leipzig. *Yersinia enterocolitica* infections were detected serologically with an enzyme-linked immunosorbent assay (ELISA) of *Yersinia* outer proteins (YOPs) (Pigtype® YOP-Screen™).

**Results**

A total of 69.7% of the investigated faecal samples and 81.2% of the blood samples were positive for *Campylobacter* spp. (Fig. 1). In the herds, prevalence of *Campylobacter* spp. varied from 10% to 100%. *Yersinia enterocolitica* was found in 8.4% of faecal samples, and antibodies against *Yersinia enterocolitica* in 66.8% of the blood samples (Fig. 1). The results of bacteriological testing indicated prevalence of *Yersinia enterocolitica* in herds between 0% and 53%, and serological testing showed prevalence up to 100%. Five herds tested bacteriologically and serologically negative for *Yersinia enterocolitica*. One herd tested bacteriologically negative, while serological testing showed a prevalence of 100% and *Yersinia enterocolitica* was detected in one of the environment samples for this herd.

While one-third of the environment samples (N = 117) were positive for *Campylobacter* spp., with the troughs in particular showing contamination, only four environmental samples were found to contain *Yersinia enterocolitica* (Fig. 2). All *Yersinia enterocolitica* isolates belong to bioserotype 4/O:3.

There was no statistical correlation between bacteriological and serological findings for *Campylobacter* spp. and *Yersinia enterocolitica*.
Figure 2: part of bacteriological-positive environmental samples

Discussion
The aim of the study was to compare the serological and bacteriological prevalence of *Campylobacter* spp. and *Yersinia enterocolitica* in fattening pig herds in Lower Saxony, Germany. There are strong differences between the serological and bacteriological findings especially for *Yersinia enterocolitica*. Only 8.4% of the investigated fatteners were bacteriologically positive for *Yersinia enterocolitica*, but 66.8% tested serologically positive. As the agent is excreted intermittently the detection of the agent is more or less by chance. In six herds *Yersinia enterocolitica* was not found in the faeces, but in one of these herds we could isolate the agent from the boots of the person in charge of the pigs. That means the bacteriological investigation of the faeces lead to a false negative result. But, although faecal shedding stopped after infection, pigs carry *Yersinia enterocolitica* in the tonsils (KAPPERUD, 1991). During slaughter the rinse water of the tonsils spreads the agent and contaminated offal (FREDRIKSSON-AHOMAA et al., 2001), whereby pork becomes the source of infection for humans. In order to discover subclinically infected pigs it can be concluded that serological testing is more precise than culture methods.

So as to investigate the prevalence of *Campylobacter*-antibodies, the Institute of Animal Hygiene and Veterinary Public Health, University Leipzig, developed an immunoblot method. In comparison to the cultural procedure the sensitivity was about 93% but the specificity only about 46%. One reason is the intermittent shedding of the agent, but also the difficulty in finding pig serum without antibodies. In this examination serum from gnotobiotic pigs was used as a negative control. In our study about 54% of the bacteriologically negative pigs were serologically positive. At present no statement can be made either about the moment of seroconversion or the persistence of antibodies. Further investigations are mandatory.

The contaminated environment can be a source for the infection of the pigs. Therefore, in each herd samples were taken from four different locations. Altogether, *Campylobacter* spp. was found in 33.3%, whereas *Yersinia enterocolitica* was isolated only from 3.4% of the samples. PILON et al. (2001) reported about 0.6% of positive environment samples. The authors concluded that the environment does not represent the main source of contamination of pigs by *Yersinia enterocolitica*, whereas WINGSTRAND and NIelsen (1996) assumed that pigs are infected by the environment rather than by the sow. In contrast to the findings of *Yersinia enterocolitica*, *Campylobacter* spp. was found in a third of the taken samples. The contamination of the environment with faeces seems to have the same importance for the prevalence of *Campylobacter* spp. among the pigs as direct contact.

There was no statistical correlation between bacteriological and serological findings for *Campylobacter* spp. and *Yersinia enterocolitica*, which means that a high prevalence of one agent in a herd did not necessarily mean a high prevalence of the other occurring.

Conclusion
Although *Campylobacter* spp. and *Yersinia enterocolitica* have the same route of infection, differences were found in their distribution. Concerning the status of infection of the herd serological results seem to be more useful than bacteriological results since both agents are not excreted continuously. Nevertheless, further studies on differences and similarities of
Campylobacter spp. and Yersinia enterocolitica are needed in order to create a consistent surveillance programme for both zoonotic agents.

References


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