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# Pathogenic *Yersinia* and *Listeria monocytogenes* in organic pork production

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## Abstract

The microbiological safety of organic food has been under some debate, because knowledge of microbial hazards in organic farming, animal production in particular, is scarce. There is some evidence that differences in pig husbandry, farming and production systems can affect the on farm prevalence of foodborne pathogens such as *Yersinia* and *Listeria* that can cause serious illness in humans. The goal of this study is to determine the prevalence of pathogenic *Yersinia* and *Listeria monocytogenes* in organic pork production and assess risks in different steps of the pork production chain. A total of 1940 faecal, pluck, carcass swab and meat samples were examined for *Listeria monocytogenes*, *Yersinia enterocolitica* and *Yersinia pseudotuberculosis* to assess microbiological safety of organic pork production compared to conventional. Information gained from this study is used to create a more advanced model for the pathogen risks in pork production chain, including special features of organic farming.

**Keywords:** *Listeria monocytogenes*, pathogenic *Yersinia*, pork, prevalence, risk assessment

## Introduction

*Yersinia enterocolitica*, *Yersinia pseudotuberculosis* and *Listeria monocytogenes* are foodborne pathogens that can cause serious illness in humans. *Yersinia* is the third most common enteropathogen reported in humans in Finland, after *Campylobacter* and *Salmonella*. In 2003, the number of reported human yersiniosis cases was 647, of which 174 were caused by *Y. pseudotuberculosis* and 473 by *Y. enterocolitica* (Holmström et al, 2003). *L. monocytogenes* possesses a threat especially for people in high-risk groups such as pregnant women, neonates, immunosuppressed persons and elderly people, but also healthy young people can be infected (Farber & Peterkin, 1991; Miettinen et al, 1999). In 2003, a total of 41 *L. monocytogenes* cases were reported in Finland, of which over 50% were 65 year-olds or older (Holmström et al, 2003).

Pathogenic *Yersinia* and *L. monocytogenes* are commonly found in pig tonsils. In previous papers the prevalence of *Y. enterocolitica*, *Y. pseudotuberculosis* and *L. monocytogenes* in fattening pig tonsils have been 36-65%, 4% and 22%, respectively (Asplund et al, 1990; Fredriksson-Ahomaa et al, 2000; Korte et al, 2002; Niskanen et al, 2002; Autio et al, 2004). Both genera (*Yersinia* and *Listeria*) are able to multiply during cold storage and therefore cause a threat in a modern distribution chain of foods.

The microbiological safety of organic food has been under some debate, because knowledge of microbial hazards in organic farming, animal production in particular, is scarce (Bourn & Prescott, 2002). In general, consumers expect the microbiological quality of organic products to be higher compared to that of conventionally grown (Williams & Hammit, 2001). There is

some evidence that differences in pig husbandry, farming and production systems can affect the prevalence of pathogens such as *Yersinia* and *Listeria*. In previous studies the prevalence of *L. monocytogenes* was found to be higher in pigs raised on silage or wet feed than in pigs fed with dry feed, and lower in specific pathogen free herds (SPF) than non-SPF herds (Skovgaard & Norrung, 1989; Buncic, 1991; Belœil et al, 2003). The prevalence of *Y. enterocolitica* has been shown to be higher in specialized slaughter pig production than in conventional farrow-to-finish production (Skjerve et al, 1998). It is possible that organic and conventional pig production are similar factors causing differences in microbial status between the two systems.

Risk assessment modelling is a novel tool for decision making in complex systems (Nauta et al, 2000). A quantitative model can pool together large amount of data and provide a simulation framework for different scenarios and control measures. Department of Food and Environmental Hygiene of University of Helsinki and National Veterinary and Food Research Institute have started a research project in co-operation with the Finnish Association for Organic Farming to assess the microbial food safety risks concerning organic versus conventional pork production.

### **Progress of the project**

Altogether 15 farms, 5 organic and 10 conventional, from South-Western Finland were selected for the study. Samples were collected during summer 2003 to winter 2005. In every farm, ca 25 pigs were sampled for *L. monocytogenes* and pathogenic *Yersinia* at farm and slaughterhouse. At the farm rectal swabs from pigs and at slaughterhouse samples from intestinal content, pluck, tonsils and carcass were collected. The farm and slaughterhouse samples were taken from the same individuals to allow detailed studies of contamination over production chain. In addition 155 meat samples from meat cutting plants were collected to assess the occurrence of *Yersinia* and *L. monocytogenes* in organically and conventionally produced meat. Meat samples were collected from the batches that included sample pigs. The total of 1940 microbiological samples were examined with conventional cultivation methods using modified ISO protocol (1996) for *L. monocytogenes*, and modified NCFA method (1996) for *Yersinia*. The remaining analyses of samples should be completed in the summer 2005. In addition, data on possible risk factors were gathered from the farms to assess possible routes of contamination of pigs. Statistic methods will be used to analyse the prevalence data and data on possible risk factors. The information on microbiological tests, on-farm questionnaire and observation results are further used to construct a probability model to describe the probability of infection of *L. monocytogenes* and pathogenic *Yersinia* on farm and the transition probability to slaughterhouse. The project should be completed and results reported at the end of the year 2005.

### **Conclusions**

In this project, the information got on the prevalence of *L. monocytogenes* and pathogenic *Yersinia* of organic pig farms, contamination routes of the pigs on farm and contamination of the carcasses and meat in food processing can help to evaluate the microbiological safety of organic pork compared to the conventional system. The risk model constructed in this project can be used for the evaluation of the different interventions available for the reduction of the risk for consumers caused by *L. monocytogenes*, *Y. enterocolitica* or *Y. pseudotuberculosis*.

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