# QUANTITATIVE RISK ASSESSMENT OF PATHOGENIC *YERSINIA* AND *LISTERIA MONOCYTOGENES* CONTAMINATION PROCESS ALONG PRODUCTION STAGES OF ORGANIC AND TRADITIONAL PORK MEAT

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## Background

Consumers are becoming increasingly aware of the quality of meat and meat products as well as animal welfare and production issues. Consequently, interest on organic production where animals have lower animal density and possibilities for expressing normal behaviour has grown. In general, consumers also expect products from this kind of system to be of a higher microbiological quality compared to products from conventional production systems. Unfortunately, only limited amount of information on differences of microbiological food safety risks in organic and conventional farming is available (Muukka *et al*. 2003, Williams & Hammitt 2001). In order to obtain a reliable data for public discussions as well as for farmers planning to start the organic production, a study was launched for pig production. Examples of quantitative risk assessments can be found e.g. in Coleman *et al*. 2003, Hartnett *et al.* 2001, Rasmussen *et al.* 2001 and Nauta *et al.* 2000.

## Objectives

The goal of this study is to create a risk assessment model in order to assess risks in different parts of the pork production chain for three microbiological pathogens (*Yersinia enterocolitica*, *Yersinia pseudotuberculosis* and *Listeria monocytogenes*) in organic vs. conventional production systems (CAC/GL-30 1999).

## Materials and methods

Three groups of pig farms were chosen for the study:

- 5 organic farms,
- 5 conventional farms with similar production capacity as organic farms, and
- 5 conventional large meat producing farms

In every farm, pigs are sampled at farm level as well as in slaughterhouses. In addition, product samples from organic and conventionally produced meat will be taken. In addition to that, other relevant data on production farms, risk factors, behaviour of these three pathogens in environment, meat production volumes etc. are gathered for the risk assessment model. The model will cover the chain from animals intended for slaughter up to the meat cuts sent for retail level.

The infection status of a pig is analysed at two points by microbiological testing: at the farm from living pigs and after slaughter. While the first measurement is a single faecal test, the second measurement consists of several different tests taken at the slaughterhouse. The two tests are taken from the same individuals which allows detailed studies of the change in infection status over production chain.

A probability model is constructed to describe the probability of infection at the first testing and the transition probability from this initial infection status to the second infection status at the slaughterhouse. This model can further extended to describe the third measurement which is taken from meat cut samples. However, the third measurement no longer represents individual specific data. The model then describes the population level only, i.e. the probability of certain meat sample result given the prevalence in certain pig population at the slaughter stage testing. The model can either describe the apparent prevalence at all observation points in two different production systems (Figure 1), or it can be used to estimate the true prevalence by accounting for the test sensitivity for each type of test. It can also be used to simulate the effect of possible interventions, if needed (Gelman *et al.* 2004, Clough *et al.* 2003, Cox 2002, Congdon 2001)

**Preliminary results and discussion**

The results can be used as point estimates or as Bayesian probability distributions of likely parameter values, given data. The joint distribution can be exploited when simulating the production process for making predictions under the current situation and under alternative scenarios concerning changes in the production (proportion of organic vs. conventional can change, small farms quit, all farms will be of the highest/lowest risk index group, etc.) We have already do simple experiment with limited amount of data, so the process is still going on. It will be possible to start final model simulation runs and compare both production systems when all of the data collection is finish. Simulation runs and reporting the result of the model will be done by the end of the year 2005.

**Acknowledgments**

We are gratefully acknowledged to M.Sc. Arja Peltomäki from the Finnish Association for Organic Farming, food industry and farmers. This work was supported by the Agriculture Development Foundation of MAKERA/ Ministry of Agriculture and Forestry.

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**Figure 1**

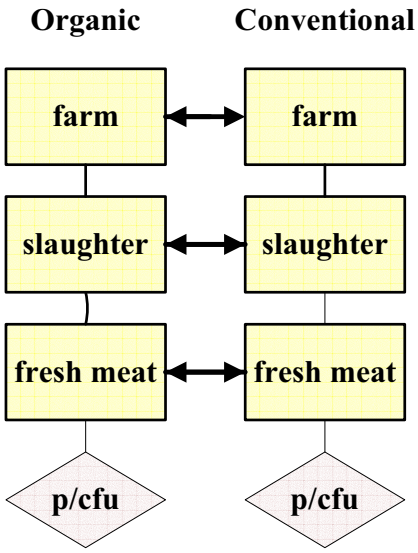


**FIGURE 1.** Skeleton of mathematic model