

PathOrganic* – Risks and Recommendations Regarding Human Pathogens in Organic Vegetable Production Chains

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Abstract

PathOrganic assesses risks associated with the consumption of fresh and minimally processed vegetables due to the prevalence of bacterial human pathogens in plant produce. The project evaluates whether organic production poses a risk on food safety, taking into consideration sources of pathogen transmission (e.g. animal manure). The project also explores whether organic versus conventional production practices may reduce the risk of pathogen manifestation. In Europe, vegetable-linked outbreaks are not well investigated. A conceptual model together with novel sampling strategies and specifically adjusted methods provides the basis for large-scale surveys of organically grown plant produce in five European countries. Critical control points are determined and evaluated and factors contributing to a food safety problem are analyzed in greenhouse and field experiments. The project aims at developing a quantitative risk assessment model and at formulating recommendations for improving food safety in organic vegetable production.

Introduction

A continuous rise in the number of outbreaks of human diseases associated with the consumption of vegetables has been observed during the last few decades. In 2006, *E. coli* O157:H7 was identified as the source of a severe spinach-linked epidemic in the U.S., and in 2007 outbreaks involving lettuce infested with the same pathogen were reported in the Netherlands and in Iceland. As consumers strive to eat healthy diets, the consumption of uncooked and minimally processed vegetables is increasing. In addition, the sources of contamination are increasing, with pathogenic bacteria being increasingly detected in fresh plant produce and their environments. Controversy exists on whether food safety is more at risk in organic versus conventional production of plant produce. The increased use of raw manure for fertilization in organic production may constitute an elevated risk of transferring human pathogens from livestock onto vegetables. On the other hand, it has been argued that the buffering capacity against invading microbes may be significantly improved in organic soils thanks to the more diverse and active microflora. In a repeated field trial with lettuce, numbers of coliform bacteria were not higher in treatments with manure relative to those using mineral fertilizer (Köpke et al. 2006). PathOrganic evaluates potential risks associated with the consumption of organically produced vegetables, taking into account various fertilization practices.

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Methods

Large-scale surveys were performed in Austria, Germany, Switzerland, Sweden and Denmark, with additional expertise coming from research groups in the Netherlands. Information on the use of organic manures as fertilizers in organic vegetable production in the individual countries served as a basis for the development of a sampling strategy for the analysis of animal manures and of organic vegetables subsequently grown on the fertilized fields. Approximately 40 organic vegetable farms were approached in each country and data referring to specific management practices were collected through the use of a questionnaire. Organic manures were analyzed for the prevalence of *E. coli*, *Salmonella*, *Staphylococcus*, *Listeria* and *Campylobacter*. *E. coli* counts were done and standard ISO-methods were applied for detecting food-borne pathogens. Microbial DNA preparations from the samples were distributed among the participating labs, which were each specialized in specific analyses. A corresponding sampling and analysis scheme was applied to the screenings of vegetables. Because of congruency with cultivation-dependent analyses and higher detection sensitivity, only molecular methods were used for analyzing plant produce.

Results and Discussion

While detection of *E. coli* in almost all manure samples was not unexpected, a considerable amount of samples proved positive also for *Campylobacter* and *Staphylococcus*. Few of the *E. coli*-positive cases gave indications for the presence of enterohemorrhagic *E. coli* (EHEC) based on PCR-detection of specific virulence genes. *Salmonella* was detected sporadically in manures from Austria and Switzerland but not from the Nordic countries. Subsequently, vegetables from farms where manures had evidenced a risk of being contaminated with human pathogens were selected to be analyzed for the same pathogens as had been studied in the manures. To allow sound statistical evaluation, a coherent scheme for both sampling and analysis was developed which concentrated on screening spinach and lettuce plants.

The surveys conducted within PathOrganic serve as tools to determine "critical control points", depicting steps at which control can be applied to prevent or eliminate a food safety hazard. Critical factors suggesting a problem concerning food safety will be analyzed in greenhouse and field experiments. Reducing risk factors during production and handling of fresh plant produce has been suggested as the most efficient way to improve the safety of vegetables regarding microbe-mediated contamination. Therefore, a quantitative risk assessment model will be further developed. During a final workshop critical control points and recommendations will be discussed with stakeholders, and project results will be communicated to end-users via a brochure. Thus, guidelines deriving from the project results shall allow producers to better control bacterial contamination of organically grown vegetables.

References

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