Comparing organic and conventional foods

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The market shares for organic food products have increased dramatically during the last 10 years in Denmark (DK). Among organic consumers in DK, 70% indicate that the most important incentive to buy organic food products are related to a lower content of pesticide and pharmaceutical residues; 55% believe that the taste is better and 48% assume that organic products contain more health promoting substances such as vitamins and minerals.

The perception that organic plant products are better for human health than conventional grown products are typically related to the following broad classes of chemical compounds in plants: nitrogen metabolites, minerals, heavy metals, vitamins and a wide array of different dietary phytochemicals related to *e.g.* carcinogensis, heart diseases and the immune system.

In the scientific literature there is currently a strong line of evidence, build up during the last decade, supporting that organic plant products contain significantly less pesticide residues than conventional plant products. However, when it comes to most nitrogen metabolites (nitrite, nitrate, nitrosamines and essential amino acids); minerals (*e.g.* Mg, Fe, Zn, Se); heavy metals (*e.g.* Cd, Hg, Pb); vitamins (C, E, D) and not least the health promoting phytochemicals, the picture is blurred and often contradictory. Thus, there is an urgent need to develop and test theories, which can explain differences between organic and conventional systems in a scientific context, not least in relation to plant nutrition and basic plant metabolism.

Most existing studies comparing organic and conventional plant products are poorly designed and there is rarely any attempt to understand and interpret differences between systems for selected plant metabolites based on knowledge to the fundamental biochemical pathways. This is a serious problem, preventing a scientifically based understanding of agricultural systems at the plant metabolome and ionome levels.

In addition, it is very important to include human intervention studies in order to document that the differences found between cultivation systems are of any significant relevance to human health. It is essential to note that differences in metabolite concentrations observed between agricultural systems, often are smaller than the typical genotypic differences or the differences induced by physiological plant age (*e.g.* harvest time) or differences caused by climatic

fluctuations etc. Thus, it is of prime importance to document that the observed concentration differences in metabolites also translates into an increased retention in the body and influence human health markers significantly when complete diets are consumed.

In 2007 the research project "Content, Bioavailability and Health Effects of Trace Elements and Bioactive Components in Organic and Conventional Agricultural Systems" (OrgTrace) was initiated in order to improve the scientific basis for assessing the health effects of organic and conventional agricultural systems.

The main objective of OrgTrace is to study the impact of different agricultural management practises, relevant for organic farming, on the ability of cereal and vegetable crops to absorb trace elements from the soil and to synthesise selected bioactive compounds with health promoting effects. Based on the nine different plant products produced in OrgTrace, diets are composed and the bioavailability of health promoting substances are analysed in a human intervention study and, moreover, various health effects such as immune system responses are studied using rats as a model. The plant products are produced in four different geographical locations enabling us to analyse if differences between systems are consistent even on different soil types and microclimatic conditions. OrgTrace is one of the first studies, which follows selected bioactive compounds all the way from the plant and soil system to absorption in the human body. The first results from OrgTrace are expected primo 2010, when complete results from two consecutive growing seasons are available.

In this oral presentation, the OrgTrace project will be presented and a number of plant science based key-theories, to explain differences between agricultural systems, will be discussed.

OrgTrace (http://www.orgtrace.elr.dk/uk)