



NJF Seminar 399

Beneficial health substances from berries and minor crops –

- How to increase their concentration in cultivated species, eliminate losses in processing and enhance dietary use

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Antimicrobial properties of berries

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Berries are traditionally an important part of the daily diet in many Nordic countries. In addition of being healthy in general, berries have a long history in folk medicine. Bilberry, for example, has been used as a medicinal herb for treatment of diarrhea, and cranberry for urinary infections. Many positive health effects of berries are believed to be associated to phenolic compounds, which berries are rich in. Phenolic compounds are reported to have a variety of beneficial biological properties. They are potent antioxidants, and exhibit various other physiological activities including anti-inflammatory, antimicrobial, antiallergic, anticarcinogenic and antihypertensive activities in in vitro assays or in cell or animal models. However, there is very little scientific or clinical data available of their efficiency in maintaining health and preventing diseases. Best-defined clinical evidence is most probably associated to cranberry and its preventive effects against urinary tract infections.

Antimicrobial activity of the berry compounds has attracted interest, because recent studies suggest that they may affect the behaviour of human pathogenic bacteria. Pathogenic bacteria or toxins produced by bacteria often enter human body via food or drink causing symptoms or illness. Salmonella enterica sv. Typhimurium, as an example, have caused foodborne and waterborne outbreaks of GI tract infections in human, and Staphylococcus aureus is a causative agent of food poisoning by producing toxin in food, followed by toxic symptoms in human. It has been suggested that the profile of phytochemicals that are present in natural sources, such as berries, confer a broad spectrum of antimicrobial capacity and potentially limit the development of antimicrobial resistance because of their possible differences in modes of action. Several mechanisms of action in the growth inhibition of bacteria are involved, such as destabilization of cytoplasmic membrane, permeabilization of plasma membrane, inhibition of extracellular microbial enzymes, direct actions on microbial metabolism and deprivation of the substrates required for microbial growth. Antimicrobial activity of berries may also be related to antiadherence of bacteria to epithelial cells, which is a prerequisite for colonization and infection of many

pathogens. The antiadherence properties have so far been reported to cranberry phenolics.

Berries, especially their antimicrobial properties, have been intensively studied at VTT over the past ten years in several research projects. In these in vitro studies phenolic berry extracts of common Nordic berries selectively inhibited the growth of harmful bacteria and human intestinal pathogens, without affecting the growth of beneficial lactic acid bacteria. Salmonella and Staphylococcus strains were the most sensitive bacteria, and cloudberry and raspberry the most efficient berries. Campylobacter jejuni and Candida albicans were inhibited only with phenolic extracts of cloudberry, raspberry, and strawberry, which all were rich in ellagitannins. As a consequence of antimicrobial activity, diet rich in berries may affect on composition of intestinal microbiota. So far no in vivo data is available of the effects of berry phenolics on human gastrointestinal microbiota.

In on-going BERRYDRUG project at VTT, phenolic compounds present in berries are studied for utilization in functional foods and in drug development. Selected berry extracts are screened in vitro especially against human pathogens causing gastrointestinal and urinary tract infections. An important aspect in the present study is a human clinical study carried out with volunteers who have consumed a berry rich diet over a certain period of time. The analyses of this trial, which focuses on intestinal microbiota and subsequent microbial conversions, are going on. This research project BERRYDRUG (2005-2008, financially supported by Tekes) is coordinated by VTT, and performed in collaboration with University of Helsinki, University of Tampere and University of Kuopio.