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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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Absorption and metabolism of berry polyphenols

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Diet containing high amounts of vegetables, fruits, berries and cereals is good for the human health, but mechanisms behind their beneficial effects are not yet known. Therefore, studies on absorption, metabolism and bioactivity of compounds present in these foods are needed.

We studied the absorption and metabolism of phenolic compounds present in bilberry-lingonberry purée, which was administered with and without oat cereals. Six subjects were recruited, and they refrained from all vegetable foods (except kernel wheat flour products and cucumber) for five days prior to the both supplementation periods. First berry purée was given with, and then without oat cereals. Urine samples were collected during the preceding 24 hours, and 48 hours after the supplementation at few hour intervals. Blood samples were taken before the supplementation and during the following 48 hours, first in every 30 minutes, and later at few hour intervals. So far, plasma anthocyanins, quercetin, caffeic and ferulic acid, and urinary phenolic acids have been analysed.

Total amount of quantified phenolic compounds from study meals was 767 mg (~1800 μmol) consisting of anthocyanins 590 mg (1113 μmol), flavonols (mainly quercetin) 37 mg (80 μmol), catechins 54 mg (140 μmol), and phenolic acids 86 mg (429 μmol). After the supplementation plasma concentrations of anthocyanins were low (~ 10 - 20 nmol/L), as has been observed in all other studies as well. Peak concentration for plasma quercetin (92±26 nmol/L), and caffeic (788±311 nmol/L) and ferulic (347±143 nmol/L) acids were achieved in 90 min. Half-life for quercetin was 4, for caffeic acid 17, and for ferulic acid 9 hours. Peak concentrations were slightly higher, and half-lives shorter, after the plain purée, but areas under the curve (AUC) were very similar after the both supplementation periods. Thus it seems like that oat

cereals had only a little effect on the absorption and metabolism of berry purée polyphenols.

Urinary excretion of 16 different phenolic acids was determined. Dietary phenolic acids (caffeic, ferulic, isoferulic, p-coumaric, protocatechuic, and syringic acid) presented 10 % of the total excretion prior to supplementation, and supplementation doubled their excretion. Dietary phenolic acids were detected in urine 2 - 4 hours after the supplementation, while the excretion of metabolites continued 36-48 hours. Studied metabolites were different phenylpropionic, phenylacetic, and benzoic acid derivatives and m-coumaric acid (10 compounds). Excreted phenolic acids covered approximately 50 % of their intake. Part of the phenolic acid metabolites was probably produced from quercetin, but only low amounts from anthocyanins.

Regular consumption of vegetable foods keeps the concentrations of phenolic compounds high in the body, but the metabolism of dietary compounds is so intensive and quick that possible health effects might as well be induced by metabolites.