DEUTSCHE GESELLSCHAFT FÜR QUALITÄTSFORSCHUNG
(PFLANZLICHE NAHRUNGSMITTEL) e.V.

50. Vortragstagung, 14./15.März 2016
Julius Kühn-Institut, Berlin

Improving dietary glucosinolate production, processing and characterization of potential health effects for the prevention of colon cancer

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The joint interdisciplinary BMBF-funded project focused on the identification of factors influencing the biosynthesis of glucosinolates (GS) in plants, on the design and optimization of food processing procedures stabilizing GS, and on the characterization of mechanisms underlying the molecular effects of GS and their metabolites in cellular systems and animal models. Results on the crops plants *Brassica italica* (broccoli) and *Brassica chinensis* (pak-choi) provide new insights in nutrition-based strategies for an effective prevention of colon cancer. GS are the characteristic secondary plant metabolites in the order Brassicales. After tissue damage the GS come in contact with the enzyme myrosinase and the hydrolysis products are released with the actual biological activities. UV-B and methyl jasmonate elicited expression of CYP450 monooxygenases belonging to the CYP79 and CYP83 gene family and especially methylthioalkyl or indole GS accumulated in broccoli and pak-choi sprouts respectively. Differently treated sprouts with resulting distinct GS profile were mixed in diets and used in *in vitro* and *in vivo* studies. The bioactivity of GS in control and elicited broccoli (glucoraphanin: GRA) and pak-choi (neoglucobrassicin: nGBS) sprouts was investigated in a model of inflammation-triggered colon carcinogenesis. Both, colitis and tumor number, were drastically reduced after feeding the GS-rich pak-choi diet while the other three diets had no effect. Levels of 1-methoxyindolyl-3-methyl-histidine adducts derived from neoglucobrassicin were highest in the GS-rich pak choi group and were absent in germ-free mices. In the colon, the GS-rich broccoli and the GS-rich pak-choi diet up-regulated the expression of different sets of typical Nrf2 target genes. In regard to food processing, GS have been found to be temperature dependent, whereby this effect was promoted by alkaline conditions. Thereby nitriles as hydrolysis products were dominantly produced and only little amounts of isothiocyanates. Huge quantities of GS can be mined from plant material after myrosinase inactivation by steaming and processing in a decanter centrifuge by using 50% ethanol. Overall the results revealed protective and advers effects of GS.