

Disposition of glucosinolates and sulforaphane in humans after ingestion of steamed and fresh broccoli

Conaway, C. C. //Getahun, S. M. //Liebes, L. L. //Pusateri, D. J. //Topham, D. K. //Botero-Omary, M. //Chung, F. L. American Health Foundation, Valhalla, NY and Nutrilite Division of Amway Corporation, Buena Park, CA.

The cancer --chemopreventive effects of broccoli may be attributed, in part, to isothiocyanates (ITCs), hydrolysis products of glucosinolates. Glucosinolates are hydrolyzed to their respective ITCs by the enzyme myrosinase, which is inactivated by heat. In this study, the metabolic fate of glucosinolates after ingestion of steamed and fresh broccoli was compared in 12 male subjects in a crossover design. During each 48-hour baseline period, no foods containing glucosinolates or ITCs were allowed. The subjects then consumed 200 g of fresh or steamed broccoli; all other dietary sources of ITCs were excluded. Blood and urine samples were collected during the 24-hour period after broccoli consumption. Total ITC equivalents in broccoli and total ITC equivalents in plasma and urine were assayed by high-performance liquid chromatography as the cyclocondensation product of 1,2-benzenedithiol. The content of ITCs in fresh and steamed broccoli

after myrosinase treatment was found to be virtually identical (1.1 vs. 1.0 micromol/g wet wt). The average 24-hour urinary excretion of ITC equivalents amounted to 32.3 +/- 12.7% and 10.2 +/- 5.9% of the amounts ingested for fresh and steamed broccoli, respectively. Approximately 40% of total ITC equivalents in urine, 25.8 +/- 13.9 and 6.9 +/- 2.5 micromol for fresh and steamed broccoli, respectively, occurred as the N-acetyl-L-cysteine conjugate of sulforaphane (SFN-NAC). Total ITC metabolites in plasma peaked between 0 and 8 hours, whereas urinary excretion of total ITC equivalents and SFN-NAC occurred primarily between 2 and 12 hours. Results of this study indicate that the bioavailability of ITCs from fresh broccoli is approximately three times greater than that from cooked broccoli, in which myrosinase is inactivated. Considering the cancer-chemopreventive potential of ITCs, cooking broccoli may markedly reduce its beneficial effects on health.