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CORRESPONDENCE/REBUTTAL

Comment on In Vitro Gastrointestinal Digestion Study of Broccoli Inflorescence Phenolic Compounds, Glucosinolates, and Vitamin C

Sir: In a recent issue of *Journal of Agricultural and Food Chemistry*, Vallejo, Gil-Izquierdo, Pérez-Vicente, and García-Viguera authored the paper "In Vitro Gastrointestinal Digestion Study of Broccoli Inflorescence Phenolic Compounds, Glucosinolates, and Vitamin C" (*1*). The main point that caught our interest is the gastric digestion of broccoli glucosinolates (GLs). The authors reported that whereas flavonoids and vitamin C were less affected during HCl-pepsin digestion, GLs were largely degraded with a total loss of 69% under simulated gastric conditions. Vallejo et al. ascribed this high loss of broccoli GLs, after pepsin treatment at a gastric pH value of ∼3, to their degradation to produce nitriles.

Broccoli, potentially containing sulforaphane in the form of its natural GL precursor glucoraphanin, has gained not only interest in biomedicinal research but also a lot of attention as a food of high dietary value, because of its alleged beneficial effect in cancer prevention. Many studies have focused on the action of sulforaphane at a number of points in the tumor development process (*2*, *3*). Insofar as is known, the enzymatic hydrolysis of GLs is ascribed to myrosinase (EC 3.2.3.1), which is always present in *Brassica* species. Tissue disruption by food processing or chewing brings GLs into contact with endogenous enzymes, causing glucose release and formation of bioactive breakdown products including isothiocyanates and nitriles, depending on physical and chemical conditions (*4*).

However, broccoli is generally eaten after boiling or steaming processes, through which myrosinase is destroyed. Although >50% of the GLs are leached into the cooking water (*5*), ingestion of cooked vegetables provides intact compounds. Through the past decade many studies have been carried out on the fate of GLs after ingestion by humans of either mature broccoli or broccoli sprouts. One of the main findings of those studies was that dietary GLs are converted into isothiocyanates by enzymatic activity of enteric microflora (*6*, *7*). The amount of isothiocyanates released from cooked broccoli was shown to be only one-third as compared with the fresh vegetable (*6*), and the metabolic fate of unhydrolyzed GLs is not yet known. On such bases, it would seem advisable to study the metabolism of the actual compound ingested through diet and for that reason, the authors have simulated the gastric conditions of digestion of fresh broccoli inflorescence. Vallejo et al. determined in vitro the stability under gastric conditions of broccoli GLs, homogenizing fresh broccoli inflorescence in water, then adding pepsin and adjusting the pH value to 2 using hydrochloric acid. In those conditions, however, the endogenous myrosinase of uncooked broccoli is still active, and through autolysis, GLs are enzymat ically transformed into nitriles when the pH drops to acid conditions (*4*). It can be assumed that the loss of GLs during in vitro pepsin digestion of broccoli containing thermally deactivated myrosinase might be very low because of the high stability of those compounds in acidic medium. In fact, Maskell and Smithard (*8*) reported reduced losses of GLs, ranging from 3 to 23%, during in vitro incubation of rapeseed meal with pepsin−hydrochloric acid. Furthermore, Chevolleau et al. (*9*) observed that glucobrassicin, the major indole glucosinolate present in broccoli, is very stable in aqueous media with pH in the 2−11 range and that glucoraphanin, the major aliphatic glucosinolate, is also stable at room temperature for 5 days at pH 3 as reported by Iori et al. (*10*).

We emphasize that the physiological location of GL degradation is a critical piece of information because the acid or neutral−basic pH values, which prevail in the gastric and intestinal digestive tracts, respectively, would allow the release of different compounds. On the basis of a delayed release of isothiocyanates after consumption of cooked cabbage, Rouzaud et al. (*11*) suggested that GLs passed through the upper digestive tract unchanged. In conclusion: as GLs were presumably degraded neither by low pH values nor by pepsin, we thereby consider the high gastric degradation of broccoli GLs reported by Vallejo et al. to be quite ambiguous, mostly because of underestimation of the degradative activity of myrosinase.

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