(Poly)phenolic compounds in teas and their absorption, metabolism and potential bioactivity.

Alan Crozier, School of Medicine, University of Glasgow, UK

Green tea infusions contain very high levels of a diversity of (poly)phenolic compounds with the flavan-3-ols (-)-epicatechin, (-)-epigallocatechin and (-)-epigallocatechin-3-O-gallate being among the major constituents (1) along with smaller amounts of chlorogenic acids and a diversity of quercetin, kaempferol and myricetin-based sugar conjugates (2). During fermentation to produce black tea major changes occur in the flavan-3-ol content of the tea leaves with monomers being converted by polyphenol oxidase activity to dimer-like theaflavins and high molecular weight thearubigins. Little was known about the structure of thearubigins until a recent pioneering, study revealed an exceedingly complex picture with black teas containing ~5000 thearubigin components with mass range between 1000 and 2100 daltons (3).

Human feeding studies with green tea have established that (-)-epicatechin is efficiently absorbed in the small intestine and appear transiently in the circulatory system as sulfated and glucuronidate metabolites. (-)-Epigallocatechin is absorbed much less readily as is (-)-epigallocatechin-3-O-gallate (4). Substantial amounts of a mixture of flavan-3-ol monomers pass from small to the large intestine where they are degraded by the action of the microbiota to a series of valerolactones and valeric acids which undergo side chain shortening producing phenylacetic acids. These products are absorbed into the portal vein and pass through the circulatory system before being excreted in quantities well in excess of sulfated and glucuronidated metabolites absorbed in the upper gastrointestinal tract (5). Recent in vitro studies indicate that colonic catabolites formed in this manner, at physiological doses, have antiglycative and neuroprotective effects (6).

The residual levels of flavan-3-ol monomers in black tea appear to be absorbed in a similar manner (7) while feeds with theaflavins have resulted in only 0.001% of intake being excreted in urine (8). It seems reasonable to assume that following ingestion the vast majority of theaflavins and thearubigins in black teas pass to the colon although, as yet, little is know about the extent to which they are degraded by the microbiota.

In view of its growing popularity, the very limited bioavailability of dihyrochalcone and flavanone C-glycosides in rooibos (red bush) tea will also be discussed (9).

(2) van der Hooft, J.J. et al. (2012). Structural annotation and elucidation of conjugated phenolic compounds in black, green and white tea extracts. J Agric. Food Chem. DOI: 10.1021/jf300297y