Bioavailability and pharmacokinetics of the soy isoflavones in humans

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It has been suggested that the much lower incidence of some cancers in Asian countries compared to Western countries may in part be due to the high intake of soyfoods. In the search for active components in soyfoods that may be responsible for these putative protective effects most attention has focussed on the isoflavones which are found in uniquely high concentration in soybeans.

The isoflavones are present in soybeans predominantly as various forms of glucosidic conjugates. These conjugates undergo bacterial hydrolysis to the corresponding aglycones in the gut. The aglycones may then be further degraded by bacteria to a series of metabolites. The extent to which the ingested isoflavones escape degradation and are absorbed (ie their bioavailabilities) in the human has however not been thoroughly studied. In this study therefore we determined the pharmacokinetics and urinary excretion patterns of the major soy isoflavones daidzein and genistein in humans in order to assess their bioavailabilities.

Six healthy male subjects, mean age 37 y, mean body mass index 24 kg/m^2, consumed a soy meal consisting of debittered soy flour suspended in cows milk on two occasions approximately six days apart. Each meal provided 2.8 μmol daidzein and 3.6 μmol genistein per kg body weight. After each meal, blood samples were taken at intervals and total urine was collected for periods up to 35 h after the meal for the measurement of daidzein and genistein using high performance liquid chromatography.

Daidzein and genistein were present in urine within 2 h after consumption of the meal. The rate of urinary excretion of daidzein was greater than that of genistein throughout the post-meal period, with mean recoveries of 62±6% and 22±4% (P<0.001) for the ingested doses of daidzein and genistein respectively. The isoflavones were detectable in plasma as early as 30 min after the meal, but, overall, concentrations rose slowly and reached maximum values of 3.14±0.36 μM at 7.42±0.74 h for daidzein and 4.09±0.94 μM at 8.42±0.69 h for genistein. The initial rapid appearance of the isoflavones in plasma can be explained by the small fraction of unconjugated forms present in the soy meal. The later slow increase is consistent with the facilitation of absorption by hydrolysis of the glycosidic forms of isoflavones present in soyfoods to corresponding less polar aglycones in the small and large intestines. Elimination half lives were 4.7±1.1 h and 5.7±1.3 h for daidzein and genistein respectively and were not significantly different. Importantly, the ratio of the areas under the plasma concentration vs time curves for genistein and daidzein was equal to the ratio of the concentrations of the respective isoflavones in the soy meal suggesting similar bioavailabilities not withstanding large differences in urinary excretion. This suggests that a greater proportion of genistein was excreted in the bile or that yet to be identified bacterial metabolites of genistein were excreted in urine.