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Citrus boosts tea's antioxidant punch - study

By Stephen Daniells

11/14/2007- **Combining citrus juice or vitamin C with green tea or its extracts could increase the absorption of antioxidants from the tea up to 13-fold, suggests new research.**

The research could have implications for functional food and beverage formulators looking to maximize the antioxidant profile and bioavailability of their products. It is not known if such benefits would be repeatable in supplement formulations.

The study is published in the *Molecular Nutrition and Food Research*.

"Although these results are preliminary, I think it's encouraging that a big part of the puzzle comes down to simple chemistry," said lead author Mario Ferruzzi, from Purdue University.

The researchers used a simulated gastric and small-intestinal digestion system to model the effects of juices, creamers and other additives on the

Tea and tea extracts have been linked to a number of health benefits, ranging from a lower risk of certain cancers to weight loss, and protection against Alzheimer's, have been linked to the polyphenol content of the tea.

Green tea contains between 30 and 40 per cent of water-extractable polyphenols, while black tea (green tea that has been oxidized by fermentation) contains between 3 and 10 per cent. Oolong tea is semi-fermented tea and is somewhere between green and black tea.

The four primary polyphenols found in fresh tealeaves are epigallocatechin gallate (EGCG), epigallocatechin, epicatechin gallate, and epicatechin.

However, according to Ferruzzi, the catechins are relatively unstable in non-acidic environments, such as the intestines, and less than 20 per cent of the total remains after digestion.

"Off the bat you are eliminating a large majority of the catechins from plain green tea," he said. *"We have to address this fact if we want to improve bodily absorption."*

The researchers formulated green tea water extracts in drinks to provide doses of epicatechin (EC), epigallocatechin (EGC), epigallocatechin-gallate (EGCG), and epicatechin-gallate (ECG) of 4.5, 18, 23, and 3.5 mg per 100 mL, respectively.

To these beverages, they added citric acid, BHT, EDTA, ascorbic acid (AA), milk (bovine, soy, and rice), or citrus juice (orange, grapefruit, lemon, and lime), and measured the stability of the catechins under the simulated gastric and small-intestinal conditions.

Adding the citrus juice led to increased stability of the catechins, and resulted in the highest recovery of EGC (81-98%), EGCG (56-76%), EC (86-95%), and ECG (30-55%) for any formulation.

Vitamin C at a dose of 30 mg in 250 mL of tea significantly increased catechin stability of EGC, EGCG, EC, and ECG to 74, 54, 82, and 45 per cent, respectively.

Addition of 50 per cent bovine, soy, and rice milk also produced increased total catechin stability under the simulated gastric and small-intestinal conditions of 52, 55, and 69 per cent, respectively, the authors reported.

"These data provide evidence that tea consumption practices and formulation factors likely impact catechin digestive recovery and may result in diverse physiological profiles," concluded the researchers in the journal.

Ferruzzi confirmed that the study was ongoing, with an *in vivo* study currently underway to quantify

the ability of juices and vitamin C to increase levels of catechins in the intestines and bloodstream of animals and, by extension, in humans.

"This next study is designed to get us past the limitations imposed by our digestive model, which is really just a simple screening process that relies on preset physiology parameters," he said. "Human digestion is a lot more complicated."

The question also remains as to whether the juices and vitamin C actually lead to an increase in bioavailability of the catechins. Ferruzzi added that answers are needed to the question of whether the increased levels of absorbed catechins are not levelled off by metabolic factors.

The study was funded by the National Institutes of Health.

Source: *Molecular Nutrition and Food Research*
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"Common Tea Formulations Modulate In Vitro Digestive Recovery of Green Tea Catechins"

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