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A teacupful of medicine?

Green tea has held a long-standing place in traditional Asian medicine. Scientific research is now beginning to explain why.

We've all heard about the various natural chemical ingredients found in many traditional foods and drinks that may have benefits to health. Antioxidants present in fruits and vegetables, such as pomegranate, may provide protection against cancer. Resveratrol present in red wine is a potent antioxidant that has anti-aging effects, can prevent cancer as well as promote weight loss. We're also seeing more use of guarana, or guaranine, in energy drinks and diet supplements; it has been shown to have the same chemical effects as caffeine. Another item that appears more and more in our consumer consciousness is green tea and its most abundant polyphenol, (–)-epigallocatechin gallate (EGCG).

Green tea has been consumed for hundreds of years in Asia and has only now become popular in Europe and the US, where black tea is predominantly consumed. Green tea has been used in traditional medicine in Japan and China for a variety of purposes, from promoting digestive health to regulating blood sugar and wound healing. Anecdotally, it is believed to stop neurodegenerative diseases, such as Alzheimer's and Parkinson's, lower the level of bad cholesterol, and prevent and treat certain cancers.

Some scientific studies have suggested a valid positive effect for green tea on general health. A large cohort study carried out in Japan and published in *JAMA: The Journal of the American Medical Association* in 2006 concluded that green tea consumption could be associated with reduced mortality due to cardiovascular disease. Another study carried out in Japan and published in *NSMB* in 2004 identified a cell-surface receptor expressed in certain cancer cell lines that binds to EGCG. That study found an EGCG-dependent reduction in cancer cell growth. However, the 2006 *JAMA* study didn't see a correlation between green tea consumption and reduced mortality due to cancer. Several other studies have suggested that increased drinking of green tea can be associated with a lower occurrence of cognitive impairment and can lead to overall improvement of cardiovascular health.

In 2005, the US Food and Drug Administration (FDA) issued a press release after examination of the scientific data available at that

time, concluding that the existing evidence does not yet support the health claims being made for green tea consumption and, specifically, that it is unlikely that green tea can reduce risk of breast or prostate cancer. Since then, the FDA has approved the use of a green tea extract, called Polyphenon E, in the external treatment of genital warts caused by human papilloma virus.

Despite the FDA's verdict that there is no credible evidence supporting the claim that green tea or EGCG can fight cancer, these substances have found their way into our marketplace in the forms of standard beverages, topical creams and lotions, and even body washes. More recent studies have examined how EGCG may positively affect the various signaling pathways that have been shown to be misregulated in certain cancers, and it has been shown to selectively induce apoptosis in some tumor cell lines. Other studies have investigated what effect EGCG may have on some forms of neurodegenerative diseases.

On page 558 of this issue, Erich Wanker and colleagues have looked at the effects EGCG has on the formation of α -synuclein and amyloid- β fibrils, whose formation is associated with Parkinson's and Alzheimer's diseases, respectively. α -synuclein and amyloid- β are known to have mostly random-coil structures in their native state, but in disease states the proteins oligomerize into β sheets that ultimately form toxic amyloid fibrils. The new findings suggest that EGCG may prevent toxic fibril formation by binding to the native unfolded states and promoting formation of off-pathway unstructured oligomers. A News and Views by Blake Roberts and James Shorter, also in this issue, discusses the impact these findings may have on understanding and possibly treating amyloidogenic diseases using small molecules like EGCG.

Although it's unlikely that green tea and EGCG will be able to cure all that ails us—as with most things, too much green tea and EGCG have been suggested by some to be a bad thing—accumulating experimental evidence seems to corroborate or validate the earlier nonscientific findings. A cupful of tea may not always keep the doctor away, but it certainly won't hurt, either. ■

