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## **Antioxidant Activity of Apples is High, says Cornell Food Scientist**

by Linda McCandless

GENEVA, NY: Food scientists at Cornell University didn't set out to prove Mom was right, but new research suggests people should eat more apples and not spit out the skins.

"An apple a day could very well keep the doctor away," says Chang Y. Lee, a food chemist at the New York State Agricultural Experiment Station in Geneva, NY. "The fact is, most Americans barely eat one apple a week."

"Increasing dietary consumption of fresh apples-with the skins on-provides additional phytochemicals that have a long-term health benefit, and may prevent or reduce the risk of some chronic diseases," says Lee.

Apples contain naturally-occurring chemical compounds known as phytochemicals, polyphenols, or flavonoids, some of which have been proven to have antioxidant activity that inhibits, or scavenges, the activity of free radicals in the body. Cell damage from free radicals can be a factor in certain cancers, heart disease, strokes, and other conditions.

The major antioxidant components in apples are polyphenols contained mainly in the skin known as quercetin glycoside, phloretin glycoside, chlorogenic acid, and epicatechin. The names are complex, but their health value is clear: Quercetin has been reported to reduce carcinogenic activity, inhibit enzymatic activities associated with several types of tumor cells, enhance the antiproliferative activity of anticancer agents, and inhibit the growth of transformed tumorigenic cells.

In research funded by the New York Apple Research & Development Board (NYARDB) over the last two years, Lee has shown the average 150 gram apple contains several hundred milligrams of polyphenol.

He also ranked 24 different cultivars according to antioxidant activity. In the three groups, apple varieties such as Northern Spy, Liberty, Crispin, Delicious, and Fuji showed high antioxidant activity; Idared, Jonagold, Gala, Freedom, and McIntosh apples showed medium activity; while Empire, Ginger Gold, NY674, and Golden Delicious apples were relatively low. Lee explains the difference in antioxidant activity among apple varieties in terms of varying composition and concentration of specific phenolic compounds.

In the paper Lee delivered at this summer's annual meeting of the Institute of Food Technologists, and more recently to the NYARDB, he noted that antioxidant activity of apples compares very favorably with other common fruits and vegetables.

Grapes, pears, and peaches exhibit higher antioxidant activity than apples; bananas are similar; oranges and grapefruits are lower, he says. Among vegetables, garlic shows the highest antioxidant activity followed by broccoli and tomatoes, all of which are higher than apples. Other vegetables, such as spinach, carrots, onions and green pepper show some antioxidant activity, but not as much as apples. Per capita consumption of fresh fruit is the other factor in the apple-a-day equation: banana consumption is 28 pounds per year, apples 19.3 pounds, oranges 12.8 pounds, followed by grapes (6.9 pounds), grapefruit (5.8 pounds), strawberries (4.4 pounds), peaches (4.3 pounds), and pears (3.1 pounds).

"If we consider total per capita consumption of fresh and processed apples, and average antioxidant activity, the actual antioxidant contribution of apples exceeds that of other major fruits in the American diet," says Lee.

If you are bringing up baby, here's another little-known fact: Baby-food applesauce is high in quercetin because skins are ground into the sauce. In applesauce for adults, skins are peeled and discarded.

For children and adults, eating more fresh unpeeled apples makes the most sense. Americans currently consume about 20 pounds of fresh apples a year. If we were truly eating an apple a day, we'd each consume 100 pounds a year. Increasing consumption would mean demand for apples would far outstrip supply in states like New York, where the annual crop amounts to 1.12 billion pounds, valued at \$141 million.

A daily antioxidant requirement has yet to be established, and we all know that scientists do not draw conclusions that aren't iron-clad, but

the inference is clear. "Apples are available year round, are relatively inexpensive, and a good source of fiber and Vitamin C," says Lee. "Why shouldn't we eat at least one apple a day?"

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