

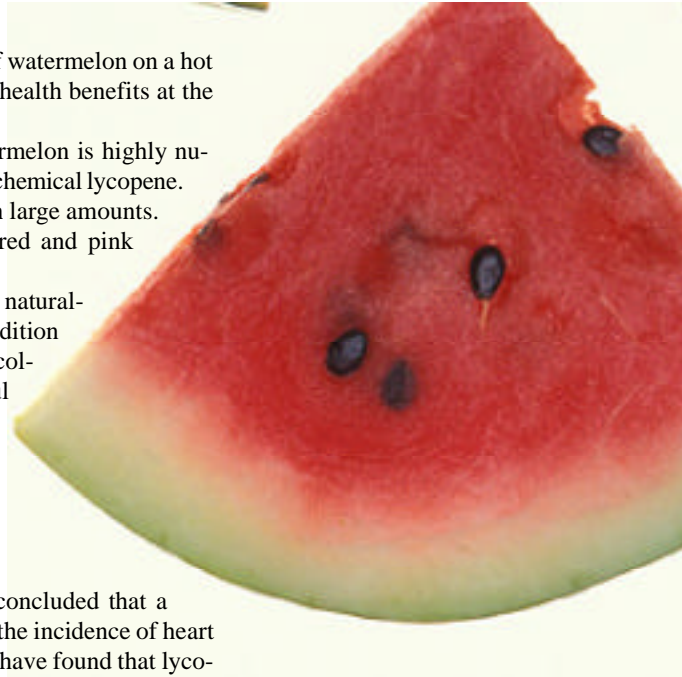
Watermelon Packs a Powerful Lycopene Punch

Imagine eating a crisp, juicy slice of watermelon on a hot summer's day and receiving great health benefits at the same time! Well, you do.

An all-American favorite, watermelon is highly nutritious and packed full of the phytochemical lycopene. It's one of the few foods that contain it in large amounts. Other good sources include tomatoes, red and pink grapefruit, and guava.

Lycopene is a red pigment that occurs naturally in certain plant and algal tissues. In addition to giving watermelon and tomatoes their color, it is also thought to act as a powerful antioxidant. Lycopene scavenges reactive oxygen species, which are aggressive chemicals always ready to react with cell components, causing oxidative damage and loss of proper cell function.

Many epidemiological studies have concluded that a diet rich in fruits and vegetables reduces the incidence of heart disease and cancer in humans. Scientists have found that lycopene in the diet correlates with reduced incidence of certain types of cancer. And lycopene levels in fat tissue—an indicator of lycopene consumption—have been linked with reduced risk of myocardial infarction (heart attack).



PEGGY GREB (K9884-1)



Using high-performance liquid chromatography, nutritionist Beverly Clevidence (left) and chemist Alison Edwards analyze lycopene and other carotenoids in plasma from volunteers who consumed a diet that included watermelon juice.

Most clinical research dealing with lycopene has used tomatoes as the food source. But Agricultural Research Service scientists at the South Central Agricultural Research Laboratory (SCARL) in Lane, Oklahoma, and at the Phytonutrients Laboratory in Beltsville, Maryland, are working to determine lycopene levels in varieties of watermelon. They also want to assess its bioavailability, that is, how well the human body digests and uses it. Funds for the studies were provided in part by the National Watermelon Promotion Board.

A trio of ARS scientists—plant physiologist Penelope Perkins-Veazie, food technologist Julie K. Collins, and entomologist Sam D. Pair, research leader at SCARL—grew, evaluated, and analyzed 13 watermelon cultivars at the Oklahoma laboratory to establish the relative effect of genetic background on lycopene content. The 13 cultivars included 11 red-fleshed and 2 yellow-fleshed types as well as seedless, open-pollinated, and hybrid types representing seasonal production periods.

The researchers used tristimulus colorimeter readings—a relatively inexpensive method to measure visible color in the cut melons—and compared the measurements to the amounts of lycopene extracted from the melons. Lycopene content varied widely among cultivars and types, but the seedless ones tended to have more. Results showed that watermelon has as

much or more lycopene as raw tomatoes and that the amount depends on both variety and growing conditions.

But Can We Digest and Use It?

In late summer of 2000, ARS nutritionist Beverly A. Clevidence and chemist Alison J. Edwards of the Phytonutrients Laboratory began a 19-week study of 23 healthy adults to assess the bioavailability of lycopene from watermelon.

The scientists used tomato juice as the known benchmark for judging the relative bioavailability of lycopene.

Twelve female and 11 male, nonsmoking adults, ages 36-69, participated in the study. All ate a controlled weight-maintenance diet along with watermelon juice at the study facility during the three treatment periods. The watermelon juice was prepared at ARS' Citrus and Subtropical Products Laboratory in Winter Haven, Florida. The juice was bottled and frozen immediately without pasteurization and defrosted just before it was consumed. The scientists then analyzed the lycopene content of the juice.

Blood and fecal samples were collected at the study's onset and then weekly during each treatment period.

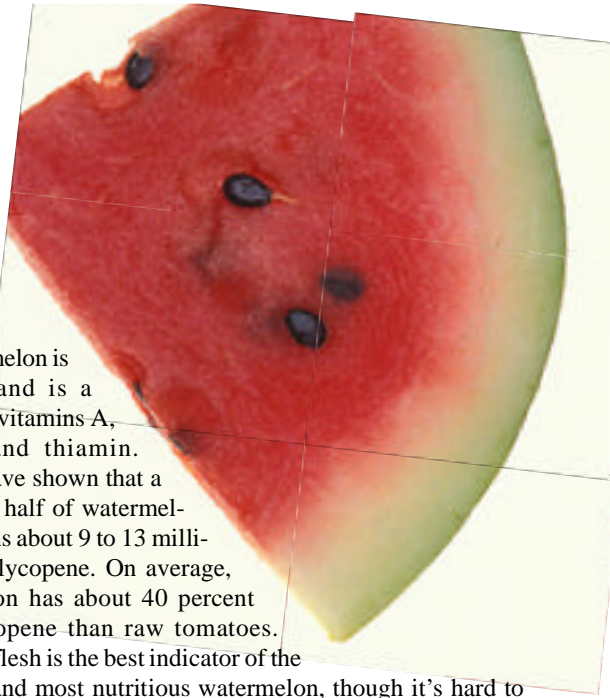
Participants completed three 3-week regimens, each preceded by a washout period during which they received a minimal amount of dietary lycopene. In a random order, all volunteers received the W-20 treatment (20 milligrams of lycopene a day from watermelon juice) and the C-0 treatment (control, no juice). In addition, they received either the W-40 treatment (40 milligrams of lycopene a day from watermelon juice) or the T-20 treatment (20 milligrams of lycopene a day from tomato juice).

The investigators found that all juice treatments increased the plasma concentration of lycopene. Lycopene concentration was similar regardless of whether subjects consumed 20 milligrams of lycopene from tomato juice or from watermelon juice, which was not heat-processed.

The investigators had expected lycopene availability to be greater from tomato juice because it had received heat treatment, which is believed to improve lycopene bioavailability.

"To our knowledge, this is the first study to show that lycopene from watermelon is bioavailable," says Clevidence. "Next, we would like to find out if plasma lycopene levels are higher when people eat watermelon with a meal containing fat than when they eat it by itself."

Hooray for Watermelon!



Watermelon is fat free and is a source of vitamins A, B6, C, and thiamin. Studies have shown that a cup and a half of watermelon contains about 9 to 13 milligrams of lycopene. On average, watermelon has about 40 percent more lycopene than raw tomatoes. Red, ripe flesh is the best indicator of the sweetest and most nutritious watermelon, though it's hard to choose the ripest melon when it's uncut.

"We think there are a lot of potential uses for watermelon that are just beginning to be explored," says Perkins-Veazie. "It can be a so-called functional food—one that can help prevent certain diseases."

There is commercial interest in producing watermelon juice. A company in California has perfected a great-tasting, all-natural version that is already selling in California and Oregon.—
By **Jennifer Arnold**, formerly with ARS.

This research is part of Human Nutrition (#107) and New Uses of Plant Products (#106), two ARS National Programs described on the World Wide Web at <http://www.nps.ars.usda.gov>.

Penelope Perkins-Veazie, Julie K. Collins, and Sam D. Pair are with the USDA-ARS South Central Agricultural Research Laboratory, Hwy. 3 West, Lane, OK; phone (580) 889-7395, fax (580) 889-5783, e-mail perkins-USDA@lane-ag.org, jcollins-USDA@lane-ag.org, spair-USDA@lane-ag.org.

Beverly A. Clevidence and Alison J. Edwards are with the USDA-ARS Phytonutrients Laboratory, 10300 Baltimore Blvd., Bldg. 308, Room 114, Beltsville, MD 20705-2350; phone (301) 504-8396 [Clevidence], (301) 504-8430 [Edwards], fax (301) 504-9456, e-mail clevideb@ba.ars.usda.gov, edwards@bhnrc.ars.usda.gov. ♦

On average,
watermelon
has about
40 percent
more
lycopene
than raw
tomatoes.