

## Sip Your Fat Away

- EGCG (Green Tea Extract)

We humans drink more tea than any other liquid, except for plain old H<sub>2</sub>O. And Bill Gottlieb does his part to keep tea number two.

Every morning before work, he makes himself a big pot of green tea (we'll talk in a minute about the differences among the three main types of tea—black, green, and oolong), and whether the variety he chooses is gunpowder, dragon well, or sencha, his daily ritual is always the same.

He fills a kettle with water and puts it on the stove to boil . . . spoons tea leaves into a mesh tea ball . . . places the tea ball in a ceramic teapot . . . fills the pot when the water boils . . . puts the pot on a tray . . . and carries the tray to his office, where he blissfully sips away while reading the morning paper.

And here are a few more tea-dious details about Gottlieb: he's fifty-three, five foot ten, and weighs 154 pounds—the same weight as when he graduated from high school.

Does drinking green tea every day for so many years have something to do with the fact that he's not suffering from middle-aged spread? A bunch of scientists in Taiwan might think so.

## TEA DRINKERS ARE 20 PERCENT TRIMMER

This was the startling news published in the September 2003 issue of *Obesity Research* by Dr. Chih-Hsing Wu and a team of Taiwanese scientists at the National Cheng Kung University Hospital. They had studied more than one thousand men and women, with an average age of forty-eight, querying them about numerous “lifestyle characteristics.”

Did they smoke? Drink alcohol? Coffee? What were their favorite foods and how often did they eat them? How much did they exercise? How much money did they make? And . . . how much tea did they drink a day, and for how many years had they been doing so?

But the researchers didn't only investigate habits. They also looked into hips. Specifically, they measured each person's percentage of body fat, and their waist-to-hip ratio, or WTHR. (WTHR is your waist measurement in inches, divided by your hip measurement. It not only shows the size of your belly, but also indicates how healthy you are: people who have a higher WTHR, storing more fat in their tummies, are at a greater risk for heart disease than people who store more fat in their hips and thighs.) The results from the Taiwanese study were remarkable.

Of those studied, 43 percent had been “habitual” tea drinkers for ten years or more, drinking about 15 ounces of tea a day.

*The habitual tea drinkers had, on average, 19.6 percent less body fat than people who didn't drink tea regularly.*

They also had slimmer waists, with a 2.1 percent lower WTHR.

No other lifestyle factor—whether or not they were smokers, snackers, sedentary, or high-salaried—correlated with a lower percentage of body fat. Tea was the likely ticket to leanness.

And only a few of those trimmer tea drinkers were regularly drinking Earl Grey, English Breakfast, or another variety of black tea. *Eighteen* of the habitual tea drinkers drank black tea. *Four hundred fifty-five* drank green or oolong. What's so special about those two varieties? To find out, let's take a quick trip to a tea plantation.

## GREEN TEA: LEAVING THE GOODNESS IN THE LEAVES

Black, green, and oolong tea all start the same way: as leaves on *Camellia sinensis*, an evergreen shrub that can grow to the height of a tree but is cultivated as a bush on tea plantations. A few times a year, the buds and the tender, young leaves at the top of the bush are picked and then dried on racks. But those dried tea leaves aren't ready for the teapot.

The next step is fermentation, as enzymes begin to break down other natural chemicals in the leaf. In black tea, fermentation is allowed to do its thing, producing a darkly colored, robustly flavored tea. But in green tea, fermentation is brought to a halt by heating: after drying, the leaves are lightly steamed or gently pan-fried in huge woks. Oolong tea is midway between black and green: a degree of fermentation is allowed to occur before the leaves are heated.

This seemingly slight difference in processing creates an enormous difference in the chemical composition—and the potential impact on your health—of green tea as compared to black. That's because the natural chemicals preserved in green tea leaves are a group of *polyphenols* containing *flavonoids* called *catechins*.

Let's define that trio of terms.

### **Polyphenols: Super-Protective Plant Chemicals**

*Polyphenols* are polypopular—they get a lot of press. When you read about the health-giving power of the red in wine, the dark in chocolate, or the green in tea, you're reading about polyphenols. Plants produce polyphenols not because they want human beings to be healthier, but for their own protection: polyphenols are *antioxidants*, shielding plants from environmental harm.

A *flavonoid* is a type of polyphenol. There are five thousand of them, like the *quercetin* in kale, the *anthocyanins* in blueberries, and the *genistein* in soy.

*Catechins* (pronounced CAT-uh-kins) are a type of flavonoid found in high levels in green tea. (Green tea consists of 30 to 42 percent catechins, while black tea has 3 to 10 percent, with oolong in between.) Catechins aren't your everyday antioxidant: they're more powerful than antioxidant vitamins like A, C, and E in stopping the "free radical" damage to cells that can trigger chronic disease and speed aging. But that's not all catechins do.

In study after study in cell cultures, animals, and humans, they have been shown to help prevent, slow, or kill cancer cells—colon, breast, prostate, lung, skin, and others.

They can lower cholesterol, perhaps helping prevent heart disease. Ditto for high blood pressure.

They can lower blood sugar, perhaps helping prevent diabetes.

They can strengthen the immune system, helping to defuse viruses.

They can reduce inflammation, a harmful process linked to a host of diseases, from Alzheimer's to ulcers.

And—most important for this book—they can help burn calories and defuse fat making.

Scientists have isolated several catechins in green tea. But it's *epigallocatechin gallate*, or EGCG—the most abundant catechin in green tea—that we fat fighters are particularly interested in. An extract of green tea that contains high levels of EGCG may help you lose weight. And keep it off.

### EXTRACT = EX-FAT

Let's move our green tea party from Taiwan to Switzerland. There, in 1999, Dr. Abdul Dulloo and his team of researchers at the University of Fribourg conducted an experiment on ten healthy men, publishing their results in the *American Journal of Clinical Nutrition*.

On three occasions, the men stayed for twenty-four hours in a "respiratory chamber"—an airtight room with all the comforts of a hotel (bed, armchair, table, TV, VCR, telephone, sink, and toilet). But this "hotel room" was inside a laboratory, where equipment measured differences be-

tween the air pumped into the respiratory chamber and the air pumped out, allowing researchers to calculate the exact amount of calories and fat the men burned while living in the chamber. During each of the three twenty-four-hour periods the men spent in the respiratory chamber, they took a particular set of pills with their breakfast, lunch, and dinner: (1) 50 milligrams (mg) of caffeine, (2) a combination of 90 mg of EGCG and 50 mg of caffeine, the amount of EGCG and caffeine in a cup of green tea, or (3) a placebo. The results?

The men burned a lot more calories when they took the EGCG/caffeine combo, compared to either the caffeine pill or the placebo—an average of 78 more calories over the twenty-four hours they spent in the chamber. The men also burned about 20 percent more fat on the EGCG/caffeine combo. How did the green tea extract incinerate extra calories and fat?

Dr. Dulloo theorizes that EGCG blocks the action of an enzyme that breaks down *noradrenaline* (NA), a hormone manufactured by the adrenal gland. NA functions as a neurotransmitter in the brain, stimulating the sympathetic nervous system, which controls heart rate, muscle tension, and the release of energy from fat. So when you take EGCG, the body's dominoes may fall like this:

EGCG keeps more NA in your brain . . . that extra NA triggers your metabolism to stay more active, thereby burning more calories . . . and the boost in NA also triggers extra fat burning.

Caffeine lends this process a helping hand, says Dr. Dulloo, blocking other enzymes that affect NA.

To add more evidence to their theory, Dr. Dulloo and his team measured the men's urinary levels of NA during each of the twenty-four hours they were in the respiratory chamber. And, sure enough, when the men took EGCG/caffeine supplements, their NA levels were higher than when they took either caffeine alone or the placebo.

Dr. Dulloo's conclusion: a green tea extract consisting of EGCG and caffeine has the potential to help people lose weight and fat. And he has another important opinion.

It's theorized that people who *eat* extra fat but don't *burn* extra fat (through increased exercise or some other means) develop a disordered appetite, craving and overeating fatty and other high-calorie foods. By burning fat, says Dr. Dulloo, a green tea extract may also help control the appetite of a person who typically eats a high-fat, high-calorie diet.

### How Much EGCG Is Best?

The scientists in Switzerland aren't the only ones to have found that green tea extracts can burn extra calories and fat. A similar study was conducted by Dr. Sonia Berube-Parent and her team of researchers at Laval University in Canada and published in the *British Journal of Nutrition* in 2005.

The Canadian scientists wanted to answer two questions: Could they produce the same results as those from Switzerland—would an extract of EGCG/caffeine burn extra calories and fat? And if it did, what *dose* of EGCG/caffeine would work best?

To find out, the researchers studied fourteen healthy men, aged twenty to fifty, testing them on five separate days in a metabolic chamber (similar to a respiratory chamber). While in the chamber, the men took supplements three times a day that contained 200 mg of caffeine (from the herb guarana) and one of four different levels of EGCG: 90, 200, 300, or 400 mg. A few of the men took a placebo.

The answer to the first question was a qualified yes: the EGCG/caffeine extract increased calorie burning by an average of about 180 calories a day, compared to the placebo. But (unlike what happened in most of the other studies discussed in this chapter) it didn't boost fat burning. (Hey, one out of two ain't bad, especially when it's 180 calories a day—an amount of calories that could help you shed twenty-two extra pounds a year. Plus, many other studies *have* shown fat burning.)

The surprising answer to the question about dosage: 200, 300, and 400 mg doses did *not* burn any more calories than the 90 mg dose. Therefore,

## EGCG: SAFER THAN ANTI-OBESITY DRUGS?

Dr. Sonia Berube-Parent and her Canadian colleagues at Laval University, as well as other researchers, theorize that EGCG works by stimulating the *sympathetic nervous system*, which controls heart rate, blood pressure, muscle tension, and fat burning. Dr. Berube-Parent points out that a green tea/caffeine combo might be *safer* than some of the anti-obesity drugs on the market, like Meridia (sibutramine), which also work in part by stimulating the sympathetic nervous system.

The problem with those drugs, she says, is not only can they increase calorie and fat burning—they can also boost heart rate and blood pressure. And in overweight folks, who are at a greater risk for developing heart problems, that boost, she says, “is a matter of concern for health professionals.” (Not to mention the overweight folks themselves!)

“In this context,” says Dr. Berube-Parent, the green tea/caffeine mixture (which studies show doesn’t speed your pulse or raise your blood pressure) “seems to have potential as an effective alternative to these anti-obesity drugs.”

Talk to your doctor about the possibility of using a green tea/caffeine extract as a natural alternative to prescription anti-obesity drugs.

says Dr. Berube-Parent, it’s likely that 270 mg a day of EGCG is the “optimal concentration” to produce calorie burning.

She also points out that the EGCG/caffeine mixture didn’t speed heart rate or significantly boost blood pressure levels—the cardiovascular symptoms experienced by some users of the now-banned ephedra, which also works by stimulating the sympathetic nervous system. (In fact, average blood pressure went up by only *one point*, from 122/74 to 123/75.)

Her final thoughts: An EGCG/caffeine mixture should be considered as a good addition to a weight-loss program, particularly one that includes nutritional smarts and regular exercise.

We couldn’t agree more.

## French Women Do Lose Weight

The studies in the respiratory and metabolic chambers were conducted over several twenty-four-hour periods. But what would happen if someone took a green tea extract for weeks or even months?

To find out, scientists in France studied sixty-three overweight women and seven overweight men for three months, giving them a green tea extract. Their results, published in the journal *Phytomedicine*, were very positive.

After three months on the extract, the group's average weight loss was 4.6 percent. And their waistlines shrunk by 4.5 percent.

Like the Canadian researchers, the French scientists note the people taking the supplement had no average increase in heart rate or blood pressure. A green tea extract, they conclude, might be a suitable natural supplement for people who are overweight, supporting their attempt to lose weight.

You won't hear us arguing with them.

## Green Tea Extract and Exercise: Double Trouble for Fat

What happens when you take a green tea extract *and* you exercise? If you're a mouse that's been eating a high-fat diet, you lose a lot of weight. That was the finding of a team of Japanese scientists, reported in the journal *Medicine and Science in Sports and Exercise* in November 2005.

First, the researchers fed mice a high-fat diet. Next, they put the animals on one of three different regimens: exercise; green tea extract (GTE); or GTE and exercise.

The group of exercising mice lost 24 percent of that added weight.

The group of mice given GTE lost 47 percent of the weight they had gained.

But the group of mice that got GTE *and* exercised lost 89 percent of their extra pounds. (Okay, ounces.)

A similar study, reported in the October 25, 2005 issue of the *International Journal of Obesity*, produced the same results.

The researchers' conclusion: "The intake of tea catechins, together with regular exercise, helps to reduce diet-induced obesity."

It's great to know that a supplement you're taking to help you with weight loss may also boost the positive, pound-shedding effect of exercise.

### **Not Just Losing Weight but *Keeping It Off***

Another study shows that a green tea/caffeine extract may have an important role *after* you've lost weight—in helping keep the weight off. The experiment, conducted by Dr. Margriet S. Westerterp and her colleagues at Maastricht University in Holland, was published in the scientific journal *Obesity Research*. She studied seventy-six overweight men and women for four months. For the first month, they ate a very low-calorie diet, losing an average of 13 pounds. For the next three months, they ate a diet aimed at maintaining their weight loss. During that time, a group of the former dieters took an EGCG/caffeine supplement three times a day, before meals, for a total intake of 270 mg of EGCG and 150 mg of caffeine. Another group got a placebo. They were the unlucky group.

The group that took the green tea/caffeine extract *continued* to lose weight during the three months of weight maintenance, compared to the placebo group, which gained back an average of 40 percent of the weight they had lost.

But EGCG might not work to maintain weight loss . . . if you drink a lot of coffee. Oddly enough, people who took the EGCG/caffeine supplement but also got *more* than 300 mg a day of caffeine from their diet *didn't* maintain their weight loss as effectively as people who took EGCG/caffeine and had a dietary intake of caffeine *under* 300 mg. So if you drink two or more cups of coffee a day, an EGCG/caffeine supplement might not help you keep your weight off. (The researchers don't know why.)

## NATURAL FAT-LOSS PHARMACY SUCCESS STORY

### Green Tea—The First Step in Losing 170 Pounds

She was featured for years in television and print ads for a low-calorie meal replacement system: an attractive, dark-haired woman in her forties, standing proudly behind an outstretched pair of jeans like a toreador. A size 56 pair of jeans.

The woman was Mary Jane Medlock—and they were her jeans. When she weighed 320 pounds.

Now, Mary Jane weighs 148 pounds and wears size 8 jeans. She lost more than 170 pounds. And she's kept it off for the last five years.

Green tea may have played a significant role in the first chapter of that remarkable success story, Mary Jane told us. Before she started to lose weight, she started to drink 32 ounces a day of green tea—an amount that would have delivered about the same dose of EGCG found in a weight-loss supplement with green tea extract (200 to 400 mg).

"I couldn't even *walk* five years ago," she says. "My doctors told me that if I didn't lose weight, I might die, because of a fatty liver and other severe medical and weight-related problems. I had already spent \$20,000 trying to lose weight—trying practically every fad diet and diet drug and weight-loss program out there.

"One day, I was listening to *Get the Edge*, a CD by motivational expert Tony

But for those who don't have too much caffeine in their diet, a green tea extract might be a good choice, says Dr. Westerterp. "I recommend an EGCG/caffeine supplement to support weight maintenance after weight loss," she told us. "Of course," she added, "one must also eat healthy food at an intake matched to one's daily requirement for calories."

## EGCG: SLAYER OF FAT CELLS

Researchers call them *adipocytes*, and you call them . . . well, what you call them might not be printable here.

We're talking about *fat cells*.

Robbins. He recommended green tea for weight loss, just like Oprah. I went out and bought some—a powdered variety that I mixed with hot water. I drank about 32 ounces of that green tea for a month. I didn't lose a pound, but the tea seemed to give me the mental clarity to stick with my weight-loss program—to begin eating the way I needed to eat to lose weight.”

Using a customized meal replacement program, and under the strict supervision of her doctor, Mary Jane quickly lost weight: 152 pounds in less than a year. “But I believe the spark could have been green tea,” she says. “They say it's an amazing mental tonic. And it certainly seemed to give me the clarity to stay focused on losing weight. A clarity I'd never had before.”

After losing her weight, Mary Jane maintained her weight *and* lost an additional 20 pounds—simply by making healthier food choices and changing her lifestyle. She continued to use meal replacements. With foods she loved and wanted to eat, like cupcakes and pizza, she followed a “two-bite” rule, so she could enjoy but not overdo. She sought out and added new and delicious fruits to her diet. She exercised regularly. (Today, she's an aerobics teacher.) And, in many other innovative ways, she learned how to think, feel, and live as a thin person—or, as she told us, a *passionate* person, challenged and fulfilled by life. In fact, she plans to write a book about her experience, so she can help others achieve their weight-loss goals. Mary Jane offers her perspective and advice about weight loss at [www.maryjanemedlock.com](http://www.maryjanemedlock.com).

Once upon a thinner time (twenty years ago, when 74 percent fewer Americans were overweight), scientists thought people were born with a set number of fat cells, which stayed constant throughout life. Fat cells might grow larger but you couldn't grow more of them.

Now, however, it's understood that two things can happen when you get fatter: fat cells can get bigger *and* you can develop new ones. Conversely, when you lose weight, fat cells can shrink *and* you can get rid of them—which means that anything that can kill fat cells might help you lose weight. EGCG does just that.

In an experiment conducted by Dr. Clifton Baile and other researchers at the University of Georgia, fat cells exposed for twenty-four hours to EGCG died at a much higher rate than fat cells exposed to a “control”

chemical. And the longer the exposure to EGCG, the more fat cells died. After three or four days of exposure, more than 50 percent of the cells were dead. (In fact, so many cells died that the researchers couldn't get an accurate count.)

Dr. Baile also found that EGCG stopped *adipogenesis*—the creation of new fat cells. Again, the higher the levels of EGCG the newly forming cells were exposed to, the less likely they were to reach maturity. “EGCG may prove to be a valuable natural product in the treatment of obesity,” writes Dr. Baile, in the June 2005 issue of *Obesity Research*.

## OOLONG, TOO

Scientists have also looked at the fat-beating power of oolong tea, which contains less EGCG than green but more than black.

A study on oolong tea was conducted by Dr. William Rumpler, at the USDA Human Nutrition Research Center in the U.S. and his colleagues at the Department of Nutrition at the University of Tokushima in Japan, and published in the *Journal of Nutrition*.

Twelve men, twenty-five to sixty years old, were given one of three different beverages on three separate days: full-strength oolong tea; half-strength oolong tea; and water with 270 mg of caffeine. On each of those days, the men (like those in the Swiss and Canadian studies) lived in a laboratory, where the researchers measured the amount of calories and fat they burned.

And, sure enough, the men drinking the full-strength tea burned 67 percent more calories a day than when they were drinking just water. They also burned 12 percent more fat.

Oolong tea consumption, concludes Dr. Rumpler, could help people maintain lower levels of body fat.

### Fighting Fat

A study on oolong tea *and* a green tea extract was conducted by Dr. Ichiro Tokimitsu and his colleagues at the Health Care Products Research Labo-

ratories of the Kao Corporation, and published in the *American Journal of Clinical Nutrition* in 2005.

For their twelve-week study, the researchers divided thirty-five men into two groups, giving one group a daily bottle of oolong tea enriched with 690 mg of green tea catechins, while a second group got oolong tea containing only an extra 22 mg of green tea catechins. At the beginning and the end of the study, the researchers weighed all the men and also measured a number of indicators of body fat. It was a lot leaner being green.

Compared to the 22 mg group, the 690 mg group lost 1.5 percent more weight; had a 1.5 percent greater decrease in BMI (body mass index, a measure of fatness); lost 2 percent more from their waists; had a 3.7 percent greater drop in body fat mass; had a 7.9 percent greater decrease in total fat area . . . and had a 7.5 percent greater reduction in subcutaneous fat (fat right underneath the skin).

*Important:* This was a three-month study, which means it took a little bit of time for the fat-reducing effects of EGCG to become obvious. “It takes time for body fat reduction to become apparent with EGCG,” Dr. Tokimitsu told us. “Therefore, it is important to *continue* to ingest tea catechins, and not expect instant results.”

## Less LDL

There was another measurement of body fat the researchers found intriguing: lower levels of the blood fat LDL, or low-density lipoprotein.

LDL is the “bad” cholesterol that forms the clumps of arterial plaque that narrow arteries, increasing your risk of a heart attack or stroke. Specifically, the researchers measured MDA-LDL, a particularly nasty type of LDL that is a common component of arterial plaque.

The men getting the higher levels of tea catechins had lower levels of MDA-LDL.

These results, says Dr. Tokimitsu, suggest that catechins can help lower not only a person’s level of body fat, but also their risk for heart disease and “various lifestyle-related diseases.”

Let's take a look at some of those "lifestyle-related diseases" like heart disease, cancer, and diabetes (and some other diseases that are just plain bad luck) and see how EGCG might help.

### EGCG TO THE RESCUE?

We don't want to tout EGCG as some kind of snake oil, able to cure whatever ails you. It can't do that. *No* pill—natural supplement or prescription drug—can do that. However, scientists have conducted hundreds of experiments investigating EGCG, and many of them demonstrate its proven or potential power to prevent and treat disease. Here's an A-to-Z recap of some recent research highlighting the health-giving goodness of EGCG.

***Aging.*** Maybe the biggest fear about aging is the fear of literally losing your mind—the gradual fading of memory, clarity, and concentration, the looming possibility of developing Alzheimer's or suffering a stroke. Good news for our aging population: researchers in Israel have found that EGCG can prevent the death of neurons, or brain cells. And in a study published in the *Journal of Neurochemistry* in June 2005, they found EGCG can actually help "rescue" neurons *after* they've been damaged. Their findings, they say, "suggest that EGCG may have a positive impact on aging and neurogenerative diseases to retard or perhaps even reverse the accelerated rate of neuronal degeneration."

***Allergies.*** In laboratory tests on human cells, EGCG blocked the production of histamine and immunoglobulin E (Ige), two compounds that trigger allergic responses. The study was conducted by researchers in Japan and reported in the *Journal of Agricultural and Food Chemistry*.

***Alzheimer's disease.*** Researchers at the University of Southern Florida gave EGCG to mice genetically programmed to develop Alzheimer's-like brain changes. The extract prevented much of the brain injury associated with

## NATURAL FAT-LOSS PHARMACY SUCCESS STORY

### Four Women Who Lost 25 Pounds Each

Elizabeth Jones is a certified clinical nutritionist in Vermont. When she counsels overweight clients, she works with them to break food addictions, lower stress, eat more fruits and vegetables and low-fat protein foods, exercise, chew thoroughly, drink more water, take antioxidant and fish oil supplements—and use green tea extract.

“EGCG is not a stand-alone therapy for weight control, but it is a very valuable adjunct, helping control appetite and burn fat,” she told us. “I give it to all of my overweight clients. One client said she’d rather drink the tea—but that’s an awful lot of tea, and she gave up and started using the supplement.”

In the last year, Jones has advised four women to take EGCG, and each of them lost at least 25 pounds.

“These clients were women aged forty-seven, sixty-five, fifty, and fifty-five,” she says. “The sixty-five-year-old had gone through an enormous amount of stress. Her husband had a heart bypass operation and she was a caretaker for her dying parents. She started to eat a lot of comfort foods and stopped exercising. Over five years, she gained 50 pounds. But once she was eating right and exercising and taking her supplements—including green tea extract—the pounds just dropped off and she returned to her normal weight.”

Jones says that even if EGCG didn’t help with weight loss she would probably advise her clients to take it. “It’s anticancer, lowers cholesterol, and is a powerful antioxidant,” she told us. “It’s just a wonderful substance.”

Alzheimer’s disease, including a 54 percent decrease in the formation of the beta-amyloid plaques that are the primary indication of Alzheimer’s. “These data,” wrote the researchers in the *Journal of Neuroscience* in 2005, “raise the possibility that EGCG dietary supplementation may provide effective prophylaxis [prevention] for Alzheimer’s disease.”

**Bladder cancer.** In laboratory research from scientists at UCLA, EGCG induced “cell adhesion” in bladder cancer cells, making them less mobile and therefore less likely to grow and spread. The researchers are currently

conducting a clinical study with EGCG on patients with bladder cancer to see if it can help prevent a recurrence of the disease.

**Breast cancer.** When scientists at Boston University School of Medicine combined EGCG with breast cancer cells, the substance changed the “gene expression profile” of the cells, making them much less virulent. Their research was reported in the December 2005 issue of the *Journal of Nutrition*.

In other research in 2005, scientists at the University of Alabama at Birmingham found that EGCG could stop the development of “estrogen receptor negative” breast cancer cells—a type of breast cancer that spreads fast and is hard to treat. In their positive assessment of the power of EGCG, the researchers assert: “EGCG possesses anticarcinogenic effects against ER-negative breast cancer cells” and could be developed as “a novel and pharmacologically safe chemopreventive agent for breast cancer prevention.”

**Cervical cancer.** Researchers studied eighty-eight women with chronic cervical inflammation (cervicitis) or cervical dysplasia (a precancerous condition), giving some of them EGCG and some other treatments. Of the women receiving the extract, 69 percent improved—human papillomavirus (HPV), which is linked to cervical cancer, was reduced or eliminated; the size of cervical lesions decreased; and the abnormal cells of dysplasia vanished. Of the women not receiving EGCG, 10 percent improved. The research was reported in the *European Journal of Cancer Prevention* in 2003.

**Cholesterol problems.** Researchers divided 220 adults with high cholesterol into two groups. For twelve weeks, one group received a green tea extract enriched with theaflavins, a potent polyphenol formed during the fermentation of black tea. The other received a placebo. In the extract group, total cholesterol decreased by 11 percent and “bad” LDL cholesterol by 16 percent. There was little change in the placebo group. The research was conducted by scientists at the Vanderbilt University Medical Center in Tennessee (Dr. Preuss’s training grounds) and reported in the *Archives of Internal Medicine* in 2003.

**Colon cancer.** Researchers at Columbia University in New York found that EGCG inhibits a number of key processes involved in the proliferation, or spread, of human colon cancer cells. “EGCG may be useful in the chemoprevention or treatment of colorectal cancer,” they wrote in the September 2005 issue of *Biochemical and Biophysical Research Communications*.

**Diabetes.** In type 2 diabetes, blood sugar isn’t effectively absorbed by the cells and circulates in the bloodstream, creating metabolic havoc. The most common complications of type 2 are a nightmare: heart disease; stroke; nerve damage leading to foot or leg amputation; blindness; and kidney disease. In research in India, scientists found that EGCG protected the red blood cells of diabetics from the types of changes that can cause complications. “We hypothesize” that catechins like EGCG “may provide some protection against the development of long-term complications of diabetes,” they write in a 2005 issue of *Clinical and Experimental Pharmacology and Physiology*.

**Flu.** In cell cultures, EGCG stopped three different types of influenza virus from replicating. The research was conducted in South Korea and reported in the November 2005 issue of *Antiviral Research*.

**Fungal infections.** Researchers in Japan tested EGCG against the common fungal infection *Candida albicans*—and it cut fungal growth by 91 percent. And when the researchers used EGCG *with* standard antifungal drugs, it improved the performance of the drugs. Combined treatment with catechin “allows the use of lower doses of antimycotics [antifungal medication],” they write in the February 2004 issue of the *Journal of Antimicrobial Chemotherapy*. “It is hoped,” they continue, “that this may help avoid the side effects of antimycotics.”

**Heart attack.** In laboratory studies, researchers in the UK found that EGCG can reduce the number of heart cells that die after a heart attack and also speed up the postattack recovery of heart cells. The research was

published in the FASEB (Federation of American Societies for Experimental Biology) journal in 2005. Other research shows that EGCG can inhibit *platelet aggregation*—the clumping of blood cells that can lead to the formation of blood clots that cause heart attacks and strokes.

*More evidence on green tea and heart disease:* Researchers in Japan analyzed the green tea intake of 109 people with heart disease and 94 people without the problem. Those without heart disease drank an average of 5.3 cups of green tea a day; those with heart disease, 3.5 cups. “The more green tea patients consume, the less likely they are to have cardiovascular disease,” conclude the researchers, in the July 2004 issue of the *Japanese Circulation Journal*.

***Helicobacter pylori.*** This stomach-based bacterial infection can cause ulcers. Scientists in Japan took strains of *H. pylori* that had been resistant to certain antibiotics and put them in cell cultures with EGCG and previously unused antibiotics. EGCG *and* the new antibiotics were more powerful in killing *H. pylori* than the new antibiotics alone. “These results indicated that EGCG may be a valuable therapeutic agent against *H. pylori* infection,” the scientists wrote in 2003 in the journal *Current Microbiology*.

***Immune weakness.*** Researchers in the Department of Medical Microbiology and Immunology at the University of South Florida College of Medicine exposed *macrophages* (infection-fighting white blood cells) to a particularly nasty substance: cigarette smoke condensate. The macrophages became a lot weaker, unable to produce certain infection-fighting chemicals like interleukin-6, and unable to stop a pneumonia virus. But when the macrophages were treated with EGCG, they were able to produce those infection-fighting chemicals *and* resist the virus. The study was reported in 2002 in the journal *Clinical and Diagnostic Laboratory Immunology*.

***Leukemia.*** Scientists at the Mayo Clinic took cancer cells from patients with chronic lymphocytic leukemia (CLL) and put them in a test tube with EGCG—and a lot of the cancer cells died. When some leukemia patients

at the clinic found out about these results, they started taking over-the-counter EGCG supplements, without telling their doctors. But a few of those patients couldn't keep their self-care therapy under wraps for long—because their worsening leukemia started to get better! The doctors reported these cases in the December 2005 issue of *Leukemia Research*. As this book was being written, the Mayo Clinic had started a clinical trial to test EGCG on patients with early-stage CLL.

***Lou Gehrig's disease (amyotrophic lateral sclerosis).*** This neuromuscular disease progressively weakens and destroys motor neurons, the cells that connect the brain and skeletal muscles. Korean researchers gave EGCG to mice genetically altered to develop ALS. Compared to similar mice not getting EGCG, the EGCG mice got symptoms later in life and also lived longer. "EGCG could be a potential therapeutic candidate for ALS as a disease-modifying agent," the researchers wrote in the December 12, 2005 issue of *Neuroscience Letters*.

***Lung cancer.*** When Chinese researchers combined lung cancer cells with EGCG, the extract decreased the power of the cells to invade noncancerous areas. Their study was reported in the April 2005 issue of *Biomedicine and Pharmacotherapy*.

*Possible anticancer mechanism:* Researchers from the UK and Spain showed that EGCG binds to and inhibits the enzyme DHFR, which plays a role in the growth of both normal and cancer cells and is an established target for the anticancer drug methotrexate. They reported their study in *Cancer Research* in 2005.

***Metabolic syndrome.*** This disorder—also called syndrome X and insulin resistance—afflicts one in four Americans. It's a deadly combination of overweight, high blood pressure, high triglycerides (a blood fat), low levels of HDL ("good" cholesterol), and insulin resistance (a prediabetic condition of abnormal blood sugar metabolism, with higher than normal blood levels of insulin

and blood sugar). When laboratory animals bred to have excess weight and insulin resistance were fed EGCG, the animals lost weight and had lower blood levels of blood sugar and insulin. The study was conducted by researchers in Japan and reported at a meeting of the American Physiological Society.

***Pancreatic cancer.*** Researchers at Case Western Reserve University in Ohio found that EGCG fights pancreatic cancer by damaging the *mitochondria*, or energy-generating cores, of cancer cells, and thereby causing *apoptosis*, or “programmed cell death.” Their research was reported in the May 2005 issue of *Carcinogenesis*.

***Prostate cancer.*** Italian researchers studied sixty-two men, aged forty-five to seventy-five, with high-grade prostatic intraepithelial neoplasia (PIN), a premalignant condition that leads to prostate cancer in about 30 percent of cases. For one year, thirty-two of the men received a green tea extract, while thirty received a placebo. At the end of the year, only one man in the green tea group was diagnosed with prostate cancer. Nine in the placebo group—the predicted 30 percent—got the disease. The doctor who led the study says that his data suggests that nine out of ten cases of prostate cancer in high-risk men, such as African-Americans and those with a family history of the disease, might be prevented by EGCG. The research was presented at the annual meeting of the American Association for Cancer Research in 2005.

***Skin cancer.*** In a laboratory study, dermatologists in the UK found that EGCG could prevent UVA-caused damage in skin cells—the same kind of sun damage that may contribute to the development of skin cancer. As part of the same study, the scientists asked ten people to drink green tea, subjecting samples of their cultured cells to twelve minutes of UVA radiation before and after the tea drinking. There was much less DNA damage to the cells *after* the tea was consumed. This research was reported in the February 2005 issue of *Photodermatology, Photoimmunology and Photomedicine*.

**Stomach cancer.** Researchers in Japan combined EGCG with four “cell lines” of stomach cancer cells. In each case, EGCG stopped the cells from multiplying. The more EGCG, the stronger the effect. The study was published in the April 2005 issue of the *Biological and Pharmaceutical Bulletin*.

**Stroke.** Japanese researchers induced strokes in two groups of experimental animals, one given EGCG and one not. EGCG reduced the extent, intensity, and negative effects of the stroke. The researchers’ conclusion: “Daily intake of green tea catechins efficiently protects the penumbra [the area of the brain affected by the stroke] from irreversible damage due to cerebral ischemia [stroke] and consequent neurological deficits.” This research was reported in the June 2004 issue of *Medical Science Monitor*.

## HOW TO USE EGCG

Okay: enough about problems *other* than overweight. Let’s talk about the best way to use EGCG to lose weight and fat, and keep it off.

**Take EGCG right before meals.** In most of the studies on EGCG/caffeine and weight loss, the participants took the supplement three times a day, before meals. That makes sense, because EGCG/caffeine supplements work, in part, by telling your body to burn more calories and fat—and you might as well start with the calories and fat you just ate!

(However, if you take EGCG for other therapeutic effects—such as cancer prevention—your best bet might be taking it first thing in the morning, before you eat. That was the finding of researchers at the Arizona Cancer Center at the University of Arizona in Tucson, who studied EGCG absorption in thirty healthy people. They found that the EGCG in green tea extracts was absorbed 3.5 times better when taken first thing in the morning, before eating, than when taken with breakfast.)

**Take the right amount.** Based on her research on weight maintenance with EGCG, Dr. Westerterp recommends a supplement that provides a daily

## SUPPLEMENT SUPPORTER

**STEVEN PRATT, MD**[www.superfoodsrx.com](http://www.superfoodsrx.com)

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**Author, *SuperFoods RX* and *SuperFoods Healthstyle*; senior staff ophthalmologist at Scripps Memorial Hospital, California**

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The SuperFoods philosophy is simple and positive. Emphasize whole foods in your diet (beans, blueberries, and broccoli; salmon, soy, and spinach; tea, tomatoes, and turkey; and many more) and you'll be a whole lot healthier.

But whole foods aren't only about health. They're also about weight loss. "Whole foods are the key to weight loss," Dr. Pratt told us. "You don't have to *think* about losing weight, or about a lot of do's and don'ts." Just eat whole foods over the course of several months, he says, and you'll naturally and easily lose weight. He also advises those who want to lose weight to exercise regularly, control portions, reduce stress, and get plenty of sleep.

In conjunction with that program, he also supports the possible use of EGCG, or green tea extract. "Tea is part of the SuperFoods approach," he says. "And EGCG seems to have sufficient calorie-burning attributes to also play an important role in weight loss."

intake of 575 mg of tea catechins, with 325 from EGCG, and 100 mg of caffeine.

***Don't rely on tea.*** Why not just drink three or four cups of green tea a day to get that amount of EGCG and caffeine? Well, there's nothing wrong with drinking green or oolong tea regularly—just ask Gottlieb. It's relatively inexpensive, tasty, and probably really good for you. But most of the studies on weight loss and weight maintenance were conducted with green tea *extracts*. So that's the proven and reliable way to get plenty of EGCG into your system—and to get the calorie-burning, fat-busting results you want. Plus, in a study comparing the antioxidant power of green tea extracts versus green tea—extracts won.

Researchers at UCLA gave thirty people either a green tea extract, green

tea, or black tea, with each source standardized to deliver the same amount of EGCG. Eight hours later, they tested the blood of the tea drinkers for antioxidant activity. Compared to the people drinking green or black tea, those getting the green tea extract had a “significant increase in plasma antioxidant activity,” said the researchers in the December 2004 issue of the *American Journal of Clinical Nutrition*.

***Pick a product with the right amount of EGCG and caffeine.*** Look for a product that meets Dr. Westerterp’s recommendations for EGCG and caffeine. There are many on the market. A few possible choices among widely distributed brands include:

*Teavigo 300 with Guarana*, from GNC. This product includes a highly purified green tea extract (Teavigo) that has been successfully used in experiments on laboratory animals to prevent weight gain and reduce body fat, and also has been extensively tested for safety. Two pills a day provide 270 mg of EGCG and 180 mg of caffeine.

*Schiff Green Tea Diet*. Each pill provides 225 mg of green tea extract, 90 mg of EGCG, and 50 mg of caffeine, amounts that are quite close to Dr. Westerterp’s recommendations.

*Thermo Green Tea Caps* by Universal Nutrition, which provide 90 mg of EGCG and 50 mg of caffeine per pill.

## IS EGCG SAFE?

Human beings have been drinking green tea for thousands of years. If there were any side effects, we’d probably know by now.

But human beings *haven’t* been taking EGCG—a highly purified extract of green tea—for thousands of years. That’s a recent development. Is EGCG safe?

According to two studies published in the journal *Food and Chemical Toxicology*, in December 2005—the answer is yes.

Researchers tested EGCG (Teavigo), feeding extremely high levels to laboratory animals and then examining their cells for genetic damage. There was

### ENVIGA: THE REAL THING?

Can Coke help you lose weight? Okay, not Coke exactly—but a new product from Coca-Cola: Enviga, a 5-calorie beverage that contains EGCG and caffeine.

In a scientific study conducted at the University of Lausanne in Switzerland, researchers gave three 12-ounce cans of Enviga a day to thirty-two normal-weight adults. The thirty-two people drank Enviga between meals for three days—and burned 60 to 100 calories more per day than when they weren't drinking the beverage.

Should you consider Enviga a smart way to get your daily dose of EGCG and caffeine? Well, if you like the flavors (green tea, berry, and peach) enough to think that you'll reliably drink three cans a day, day after day (at a cost of about \$4.00 a day), why not? Three cans of the drink deliver 270 milligrams of EGCG and 300 milligrams of caffeine—similar to the amount that studies show is optimal for burning calories and maintaining weight loss.

none. In another study, conducted by the same researchers, laboratory animals were fed large doses of EGCG for thirteen weeks, with no adverse effects.

What about us humans?

For four weeks, researchers at the University of Arizona gave up to 800 mg a day of EGCG (in single or divided doses) to thirty-two healthy people. A similar group received placebos. There were no more “adverse events” like headaches or nausea in the EGCG group than there were in the placebo group, and there was no significant change in blood chemistry in the EGCG group.

“We conclude,” write the researchers, in the August 2003 issue of *Clinical Cancer Research*, “that it is safe for healthy individuals to take green tea polyphenols in amounts equivalent to the EGCG content in 8–16 cups of green tea once a day or in divided doses twice a day for 4 weeks.”

Another study on people was conducted in Switzerland and reported in the July 2004 issue of the *International Journal of Vitamin and Nutrition Research*. EGCG (Teavigo) was given daily for ten days to thirty-six healthy

men—either 200, 400, or 800 mg. The researchers write that every level of EGCG was “safe and very well tolerated.”

Add to these safety studies the fact that EGCG has been on the market for quite a while without any hue or cry over side effects, and it appears to be a very safe supplement.

### **Pregnancy Precautions**

As with *all* natural supplements, however, EGCG shouldn't be taken by pregnant or lactating women (except with the approval and supervision of a gynecologist). In fact, the scientists who discovered one possible mechanism for the anticancer powers of EGCG—binding to and inhibiting the action of the enzyme DHFR—say that same mechanism might also reduce folate absorption. And a lack of folate has been linked to birth defects.

This caution is completely speculative: there is no proven link between EGCG and birth defects. But even a speculative link is reason enough for pregnant women not to use the extract.

### **Is the Caffeine Okay?**

Most doctors don't forbid their patients with heart problems to drink coffee or tea. But, to be extra safe, if you've experienced heart difficulties of any kind, you should talk to your doctor before taking an EGCG/caffeine combination.

### **A Product Not to Take**

Although it's not available in America (and even hard to find on the Internet), stay away from Exolise, a green tea extract from a French company that was sold as an over-the-counter weight-loss drug. Writing in the French journal *Gastroentérologie Clinique et Biologique*, a team of researchers reported that thirteen people who took Exolise developed elevated liver enzymes (a sign of liver problems). In twelve people, the enzymes returned to

normal when they stopped taking the extract, but one person went on to develop liver toxicity, a much more serious problem.

Does this result indicate that *all* over-the-counter EGCG products are potentially harmful? No, says Dr. Preuss, who thinks the preponderance of evidence points to the safety of products containing EGCG.