Food Science

Grapefruit pectin reduces cholesterol

Researchers at the University of Florida in Gainesville report that about three tablespoons of grapefruit pectin a day—either in capsule form or as a nontoxic dietary additive—can lower blood-cholesterol levels an average of almost 8 percent. This reduction "is quite significant," explains James Cerda, who directed the study, since "a 1 percent drop in cholesterol causes about a 2 percent drop in the risk of heart disease."

Pectins are the main structural substances binding adjacent cell walls in plants. Especially prevalent in the rinds and fleshy parts of citrus and other fruits, they are often used as binders in jams and jellies. For 16 weeks, volunteers with high serum-cholesterol levels consumed unidentified capsules with each of their three major meals daily. Roughly half the 27 subjects got capsules containing a placebo; the others got capsules containing pure grapefruit pectin. Eight weeks into the experiment, each group was switched to the opposite capsule.

Although the average blood-cholesterol reduction for those on the pectin was 7.6 percent, levels in some dropped by as much as 19 percent. Moreover, 13 participants experienced a drop of more than 10 percent in low-density lipoprotein (LDL) levels while taking the pectin-capsule supplements. No one is sure what a reduction in LDLs—sometimes called the "bad" lipoproteins—heralds, Cerda says, "but this kind of drop can't hurt you, and most scientists would interpret such a drop as very favorable."

Recently, Agriculture Department scientists reported that vegetable pectins, like those in carrots, appear capable of comparable cholesterol lowering (SN: 6/27/87, p.409). However, Peter D. Hoagland, one of that study's authors, told SCIENCE NEWS it is unlikely that the pectins in these two studies would lower cholesterol in the same way. First, carrot and grapefruit pectins differ. Cerda's previous work suggests that the different effects may be due in part to the fact that grapefuit pectins contain more methyl (CH_4) groups than do carrot pectins. Second, in Hoagland's study, the pectins used calcium to bind with bile acids as a route to lower cholesterol. Cerda's study, however, involved pure pectins and required no calcium to achieve similar ends.

Promising sulfite alternatives

As antioxidants, sulfites help control wilting and discoloring of fresh produce. Last year, however, the Food and Drug Administration banned their use on produce because of concern about their ability to trigger life-threatening reactions in some asthmatics (SN: 8/17/85, p.100). Right now, the best stand-ins are ascorbic acid (vitamin C) and erythorbic acid, says Gerald M. Sapers, a food technologist with the Agriculture Department's Eastern Regional Research Center in Philadelphia. However, he says, these substitutes are easily oxidized by reactions with both food and air. The result: They disappear quickly, leaving treated foods vulnerable.

In an 18-month study, however, Sapers and his co-workers have turned up two related classes of compounds—ascorbic acid-2-phosphate and ascorbic acid-6-fatty acid esters—that avoid these pitfalls and remain effective at room temperature for at least one or two days.

The phosphate version works much like a controlled-release antioxidant, Sapers says. It doesn't begin acting—and therefore doesn't become oxidized—until acted upon by an enzyme (acid phosphatase) in produce. The fatty-esters version is just oxidized much more slowly, making it available for a longer time. Both compounds work even longer when combined with cinnamic acid or an inorganic polyphosphate (made in Korea and not yet commercially available in the United States). To date, all have been successfully tested as a dip for fresh apples and a browning inhibitor for apple juice.

Technology

Putting on a robotic balancing act

Even among basketball players, Manute Bol of the Washington Bullets stands out as being exceptionally tall and thin. Now, researchers at Carnegie-Mellon University in Pittsburgh have designed and built a kind of Manute Bol of robots—a tall, slender machine poised precariously on a roller-skate base. Remarkably, the robot balances itself. Anyone who has held the lower end of a 6-foot pole and tried to keep the pole vertical can appreciate the difficulty of accomplishing this feat.

In fact, the robot manages to keep its balance in much the same way a person would keep a pole vertical. The robot moves its base in the direction in which the robot happens to be leaning at any given moment. Constant adjustments back and forth keep the robot upright.

But civil engineer Irving J. Oppenheim and graduate student Lyman Petrosky have gone one step further. They've added to the challenge by putting in a joint halfway up the robot's trunk. Thus, the robot can bend down at its waist, going, as if it were doing calisthenics, from a vertical stance to touching its toes. Even through this additional movement, it maintains its balance.

Oppenheim's 6-foot-tall robot consists of two 3-foot sections of perforated aluminum mounted on a pivoted base carrying a set of motor-driven wheels. Another motor controls movement at the waist. The aluminum trunk, with a square cross section, is about 3 inches wide. One sensor—a "floor feeler"—measures the angle between the ankle-height pivot link and the floor. Another counts motor rotations so that it's possible to sense how far along its path the robot has moved. A third device allows the researchers to determine the waist angle.

All of the data are fed by cable to a computer, which analyzes the data and sends appropriate control signals back to the robot. The cable also transmits the power needed to run the robot's motors. The researchers use a joystick connected to the computer for commanding the robot to move from place to place and to bend.

The key component enabling the robot to keep its balance is the computer program governing its operation. Although the idea of balancing a rod (an inverted pendulum) has long been a standard laboratory exercise in control theory, Petrosky developed a new, innovative mathematical approach that improves on older methods and greatly increases the robot's stability.

"When this robot stands undisturbed, you're not really aware that it's doing active balancing," says Oppenheim. "It looks as if it were planted in the ground." And the machine isn't delicate. "It's very difficult to knock it over," he says. When struck, the robot may briefly skitter away or swing wildly, but, unless its wheels slip or the motors need more power than they can deliver, it returns to its former position.

Oppenheim and Petrosky are using their robot to study how a machine may be designed to use its own weight to help it do a particular job. For instance, human beings, by tugging and pulling instead of relying just on the strength of their arms, can move relatively heavy objects. A lightweight robot with a similar capability may someday be able to accomplish what now requires a much heavier machine.

Although Oppenheim's robot can hold a camera about as steadily as a human being, it isn't equipped yet for turning a valve, stuffing a basketball into a basket or other chores where a long, vertical reach is handy. The Department of Energy, which is funding the research, is interested in tall, light robots that could work within tightly confined spaces in nuclear power plants and other hazardous environments (SN: 7/12/86, p.28). It may even be possible to use the principles applied in a self-balancing robot to improve the stability of construction machinery such as cranes.