Nutrition

From New Orleans at the Experimental Biology '97 meeting

The cost of too little magnesium

Most people work harder than they really need to, a new study suggests. There's a simple solution, though: Eat more magnesium-rich greens and grains.

Magnesium plays an important role in regulating how well the body converts food into energy, notes physiologist Henry Lukaski of the Department of Agriculture's Human Nutrition Research Center in Grand Forks, N.D. Since the majority of adults don't eat the recommended daily allowance (RDA) of this mineral—about 280 milligrams for women and 350 mg for men—he wondered whether the general U.S. population might be using energy inefficiently.

To test the idea, Lukaski recruited eight women, age 55 to 70, to live on the metabolic ward of a local hospital for 5 months. There, his team could oversee the preparation and consumption of the women's food, measure their excretion of magnesium, and periodically biopsy muscle to verify diet-related changes in the amount of magnesium their bodies incorporated.

For the first month, the women received a magnesium-enriched diet (about 390 mg per day). For the next 3 months, the magnesium content of their otherwise balanced diet was only about two-thirds of the RDA. Magnesium intake was boosted again—to 420 mg per day—for the remainder of the study.

At the end of each dietary phase, the women rode stationary bicycles to keep their hearts pumping at 70 to 80 percent of an age-adjusted maximum rate. "Regardless of the diet, they were able to do the same amount of work," Lukaski says. "However, their oxygen consumption was about 15 percent higher when the diet was low in magnesium than when it was adequate." The women's average heart rate was nine beats per minute faster throughout the low-magnesium phase of the study—an increase "that was biologically significant," he says.

"These two indicators tell us that the women were under more physiological stress when they had low magnesium in the diet." He compared the low-magnesium effect to the extra effort required of a person carrying a backpack equivalent to 15 percent of his or her weight while climbing stairs: "You're going to use more energy to do that work." —*J.R.*

Fussy baby? Maybe it's the juice

Feeding babies too much juice can stunt their growth, according to a provocative study in the January Pediatrics. The authors of that report speculated that letting infants fill up on empty calories in juices would leave no appetite for more nutritious offerings. A new study suggests another explanation: Babies can't efficiently absorb the sugar in many popular juices.

Conrad R. Cole and his colleagues at Maimonides Medical Center in New York placed 10 healthy 5- to 7-month-old infants on a padded platform in a glass-walled chamber for 3 hours. The platform measured all movements, and the enclosed chamber allowed the researchers to measure expelled hydrogen—a gauge of sugar malabsorption. After 1 hour, each baby drank 4 ounces of pear or white grape juice.

Exhaled hydrogen measured less than 10 parts per million (ppm) prior to feeding and climbed to only 11 ppm after the babies had drunk white grape juice. However, hydrogen spiked to 35 ppm in the breath of babies who had drunk pear juice. Another major difference: Babies who got the grape juice soon settled down and slept, whereas those who got pear juice fussed and fidgeted continuously, Cole says, suggesting some minor discomfort.

Nutritionally, the juices differ in the type and proportion of sugars they contain. The major difference, Cole says, is that pear juice contains large amounts of sorbitol and grape juice doesn't. Concludes Cole, don't give fruit juices—especially those high in sorbitol, like pear and apple—to young children, "at least until after they're a year old." —*J.R.*

Physics

From a meeting in Washington, D.C., of the American Physical Society

First data from new neutrino detector

Nuclear fusion reactions in the sun's core produce huge quantities of neutrinos, elusive subatomic particles that interact only weakly with ordinary matter. Japan's new Super-Kamiokande neutrino detector has been monitoring the sun's output since April 1996 (SN: 9/7/96, p. 149), and researchers have analyzed the first 102 days of data. Preliminary results confirm previous experimental findings that the number of solar neutrinos detected on Earth falls significantly short of the number predicted by conventional theory (SN: 12/21&28/91, p. 406).

The data also contain tantalizing hints that more neutrinos are detected at night than during the day and that they appear more plentiful during certain times of the year, says Kenneth K. Young of the University of Washington in Seattle, who is a member of the Super-Kamiokande collaboration.

The standard model of particle physics posits that neutrinos come in three varieties: the electron, muon, and tau neutrino. Super-Kamiokande detects just electron neutrinos. One possible explanation for the shortfall is that neutrinos may change back and forth between the detectable variety and one that isn't. This oscillation process may also occur more readily when neutrinos pass through Earth, possibly creating a difference between night and day neutrino detection rates. The seasonal fluctuations may depend on the distance between the sun and Earth, which varies by about 5 percent during the year.

At least another year of results from Super-Kamiokande is needed to establish the difference, if any, between the day and night rates, Young says. —*I.P.*

Subatomic scrutiny from Jefferson lab

One hundred years after the discovery of the electron—the first known subatomic particle—physicists are using the particles to reveal the quirks of quarks, which constitute protons and neutrons. Now, scientists have obtained the first results from high-speed collisions between electrons and other particles at the Thomas Jefferson National Accelerator Facility in Newport News, Va.

Physicists first identified quarks in 1968 by bouncing isolated bursts of high-energy particles off protons, providing a brief snapshot of the quarks inside. The Jefferson accelerator, which began operating last year, sends continuous beams of electrons with an energy of 4 billion electronvolts along its nearly mile-long tunnel and into atomic targets, providing an improved picture of quarks as they interact and combine to create other particles.

The new pictures reveal some novel phenomena. In one experiment, protons were bumped out of the nucleus more easily than expected. In other instances, however, increasing amounts of energy failed to kick more protons out of the nucleus, hinting that quarks somehow absorbed the extra energy. A clear conception of quarks and their interactions will require more experiments, says Jefferson lab's Larry Cardman. —*P.S.*

Speed of sound in frigid sodium cloud

Researchers have now measured the rate at which sound travels in a cloud of sodium atoms cooled to temperatures near absolute zero. At such low temperatures, the sodium atoms collectively enter the same quantum state and act as a coherent unit, producing a Bose-Einstein condensate (SN: 4/26/97, p. 255).

A Bose-Einstein condensate "is a fascinating kind of matter," says Wolfgang Ketterle of the Massachusetts Institute of Technology. One way to study its characteristics is to disturb the atomic cloud, making it ring like a bell (SN: 5/25/96, p. 327). Ketterle's team has now gone one step further, measuring how quickly a sound pulse propagates through the cloud. —*I.P.*