Nutrition

Janet Raloff reports from a reporters' briefing in Beltsville, Md., at the Agricultural Research Service's Human Nutrition Research Center

How fat are you?

Joan Conway and her colleagues are pioneering a new method for measuring total body fat. They shine near-infrared light on the skin at selected body sites, and then, using a spectrophotometer, measure the degree to which that light is absorbed or modified by irradiated tissue within 1 or 2 centimeters of the skin surface. Since fat, water and protein each absorb most efficiently different spectral frequencies, one can focus on fat's peak interacting wavelengths to gauge total body fat, explains Conway.

These "infrared interactance" measurements are made at 1-nanometer intervals between about 750 and 1,100 nm. It takes less than a minute to scan the range of frequencies at each body site, using a 2-centimeter-diameter fiber-optic cable, which also transmits the tissue-altered frequencies back for analysis. Although Conway now averages readings from five sites to calculate total body fat, her data — based on a survey of more than 200 people aged 19 to 65 — show these five-site averages to be virtually identical to biceps-fat readings alone.

Conway says her data show the technique is more accurate than the commonly used calipered measurement of pinched skin folds, and is more reliable than the electrical-impedence technique (which, because it measures the body's electrical conductivity, can be affected by such factors as blood flow, body water content and body salts content). In fact, Conway's studies show that her technique gives fat calculations within 3 percent of the best techniques — deuterium oxide dilution and underwater weighing. Moreover, where deuterium oxide dilution requires drawing blood and underwater weighing requires immersion in a calibrated pool, the infrared technique can be completed in three minutes and may ultimately require no more than the rolling up of one's sleeve.

Conway's system, the only one of its kind in existence, now sprawls across a desktop. But she expects that within two or three years a commercial version, perhaps only the size of a thick paperback book, could be available.

Butter lovers: The news isn't all bad

For years, studies conducted at the Human Nutrition Research Center have been showing that reducing dietary fat will lower blood pressure. And, says Joseph Judd, supervisory research chemist at the center's Lipid Nutrition Laboratory, that should be good news for the estimated 25 million people in the United States whose mildly elevated blood pressure appears to predispose them to clinical hypertension (high blood pressure) — a risk factor in heart disease, kidney disease and stroke. But most of those people seem to have resisted making the dietary change this research would recommend. And no wonder, notes Walter Mertz, the center's director: "The problem with fat is that it tastes so good." So Judd and his colleagues decided to investigate whether, in order to lower blood pressure, fat-lovers had to cut down on *all* forms, or might instead get by with substituting more polyunsaturated fats, like safflower oils, for the butter they loved.

The bad news is that the new research continues to show "a very strong effect of dietary fat on blood pressure," Judd says. The good news for butter lovers is that saturated fats appear to be no worse than polyunsaturates — at least as far as blood pressure is concerned. The data come from a series of studies involving 16 to 30 volunteers who, while living at home and working as usual, for 12 weeks ate only meals and snacks provided by the lipid lab.

The most conclusive data, explains nutritionist Mary Marshall, came from a study where all the participants ate two low-fat diets — each having only 25 percent of its calories derived from fat. For six weeks, half ate a diet in which the polyunsaturated-to-saturated fat ratio was 1:1, the others a diet in which the ratio was approximately 1:3 — meaning it was higher in saturated fats (mainly butterfat) but not in cholesterol. After six weeks, the groups swapped diets.

Both low-fat diets brought equivalent declines in blood pressure — on average, a 6 percent decline from baseline readings recorded in the participants during the five weeks immediately preceding and succeeding the 12-week test period.

"While those may seem like small changes," Marshall told SCIENCE NEWS, "to drop like that and remain stable over a period of 12 weeks, and then climb back up [once participants returned to their normal diets], is significant."

Watching those calories

Why is it that one person can gain weight and another lose weight while both seem to be eating the same amount of food and getting comparable exercise? Although the question has plagued nutritionists for years, an answer may be in sight. A room-sized calorie-meter, or calorimeter, is being completed at the center's Energy and Protein Nutrition Laboratory to study whether humans really differ in the efficiency with which they metabolize their food energy — and, if so, why.

Some 80,000 thermocouples in the floor, walls and ceiling of the 8-by-9-by-10-foot room will measure heat radiated by volunteers who spend 48 hours or more at a time in the enclosed structure. As their energy intake (food) and expenditures (exercise) are monitored closely, the calorimeter will also analyze gases given off by the body — including oxygen, carbon dioxide, argon, nitrogen, sulfur gases and water vapor — for an indirect calculation of metabolism. The calorimeter, according to scientists at the center, is the first large-scale chamber in the United States to combine direct and indirect measurements of calorie expenditures. Moreover, says C.E. Bodwell, who heads the project and the energy lab, "It will provide the most complete gas measurement of any in the world."

On diet and cancer risks

Death rates from cancer among Seventh Day Adventists in the Los Angeles area are only about half those of the general population, according to Padmanabhan Nair, a chemist at the Lipid Nutrition Laboratory. Nair, who collaborated with a team of researchers headed by Roland Phillips, who is at Loma Linda (Calif.) University, studied dietary factors that differentiated these Seventh Day Adventists from the general population. Most of the Adventists were teetotalers, the study found, and roughly 70 percent were either strict vegetarians or ovalacto vegetarians, whose diets include milk and eggs.

This vegetarianism contributed to the Adventists' low consumption of fat; Nair says only 25 to 35 percent of their calories were fat-derived, as opposed to 41 percent in the standard U.S. diet. Vegetarianism also contributed to the Adventists' low cholesterol intake; Nair says the 100 to 150 milligrams they consumed daily was less than half the national average.

Studies have shown that colon-cancer death rates are higher among meat eaters than among ovalacto vegetarians. Data on strict vegetarians also suggest lower rates but are preliminary, Nair says. Fat may be one reason for the lower rates, he says, pointing out that several studies have shown "a close association between both colon- and breast-cancer mortality and the amount of fat consumed."

Spurred in part by these data on Adventists, Nair and his colleagues in Beltsville have begun a series of year-long studies to explore how diets that differ in the proportion of fat-derived calories alter human body chemistry — such as cholesterol metabolism or hormone cycles — in ways that might change the risk of cancer.