

Looking for the Perfect Brew

Recent reports illustrate the limitations of coffee, tea and caffeine studies and raise questions about assessing health risks

Photo: World Coffee & Tea Magazine

By STEVE EISENBERG

In 1985, psychologists at Carleton University in Ottawa, Ontario, wanted to know if caffeine consumed by a group of pregnant women would affect their newborns. So they asked research scientist Bozidar Stavric to determine how much caffeine the women were getting daily from coffee and tea.

After each woman prepared a typical cup of household coffee or tea, Stavric and his colleagues at Canada's Health Protection Branch in Ottawa analyzed all 58 cups. They found considerable variation in caffeine, with coffee ranging from 21 to 148 milligrams per cup and the tea showing similar differences.

Stavric wondered whether caffeine samples from other sources of coffee and tea would show such great variation. So he literally took his study to the streets. At 11 local restaurants, the researchers found not only different caffeine levels among coffee samples, but also considerable day-to-day variation at some restaurants. In addition, decaffeinated coffee at some restaurants contained substantial amounts of caffeine.

When he and his colleagues prepared 17 samples of five instant brands using the same amounts of coffee and water, they found significant caffeine differences among the brands. Yet caffeine content within the same brand remained virtually identical over a two-year period.

Finally, Stavric and his colleagues measured teas brewed with loose tea and with tea bags. They found significant differences only when they used 2- and 5-minute steeping times. They also discovered considerable amounts of caffeine in two herbal teas. Their results, reported in the March *FOOD AND CHEMICAL TOXICOLOGY*, may have considerable significance for epidemiologists trying to determine the relationship between caffeine and human health.

During the past decade, the media have barraged the public with conflicting reports on the ill-effects of caffeine-containing products, particularly coffee. Animal and human studies have associated coffee drinking with more than 100 diseases and disorders, including pancreatic cancer and heart disease. Yet studies have failed to confirm a cause-and-effect relationship between high coffee intake and health, except for aggravation of certain gastrointestinal problems and jitteriness.

The new Canadian study suggests one reason some researchers say epidemiologists may never successfully establish a direct link between the popular beverage and a number of suspected

health hazards. Weak coffee or tea may not have the same health effects as strong coffee or tea. And few studies measure the precise caffeine content of a person's average cup, Stavric said in an interview.

Stavric and his coauthors believe researchers studying caffeine consumption should determine much more accurately the actual amounts of caffeine consumed by their subjects. Most epidemiologists assume that each cup of coffee contains 80 mg of caffeine, they say, but "if all the subjects [in their study] consumed three cups of coffee, only 25 percent of the subjects would have been categorized as having daily caffeine intakes between 200 and 280 mg. Of the remaining 75 percent of subjects, the caffeine intakes would have been overestimated for 39 percent and underestimated for 36 percent."

Yet epidemiologist Walter C. Willett, of the Harvard School of Public Health in Boston, thinks measuring exact amounts of caffeine would not be necessary. "The amount of error is small because you're dealing with people who drink no coffee or great amounts. The slope of the curve

will be underestimated, but the slope should still be there," Willett told *SCIENCE NEWS*.

Beyond the issue of relative strength, epidemiologists say other problems exist in studies seeking connections between disease and caffeine consumption. These include improperly selecting controls, failing to measure consumption periodically in long-term studies, and the possibility that coffee drinking may be simply a marker for an unhealthy lifestyle. In animal studies, the question remains whether these mammals metabolize caffeine differently than humans.

Even when clear health risks are indicated, researchers may have difficulty determining whether those problems result from caffeine itself or from some other substance. In several studies, for example, coffee but not tea has been linked to disease. Moreover, some studies don't consider all possible caffeine sources, Stavric notes. Cocoa products, some soft drinks and some medications, such as analgesics and appetite suppressants, contain caffeine.

So, before scientists can resolve often-inconsistent findings, they must resolve the methodological shortcomings in the different designs of epidemiologic studies focusing on caffeine, coffee or tea.

A paper published in 1981 in the *NEW ENGLAND JOURNAL OF MEDICINE* illustrates the problem. Researchers led by Brian MacMahon of the Harvard School of Public Health in Boston linked pancreatic cancer with coffee drinking. The study's initial purpose was to examine the roles of smoking and alcohol in pancreatic cancer. The researchers asked a group of pancreatic cancer patients how much coffee or tea they consumed before being diagnosed and compared them with a group of hospital patients without the disease. MacMahon and his colleagues were surprised to find a significantly increased risk of pancreatic cancer among coffee drinkers — but not among tea drinkers. Caffeine, therefore, may not have been the culprit.

Some epidemiologists criticized MacMahon's selection of controls because about 40 percent of them had gastrointestinal conditions that may have led them to stop drinking coffee. Thus, the controls may not have been representative of the general population.

MacMahon defended his control selection, arguing that even when he excluded controls with gastrointestinal conditions, the risk of pancreatic cancer was only slightly lower. A few years later, he tried to duplicate his results and found a weaker relationship than in his first study.

Although MacMahon says "there's nothing wrong with using hospital patients as controls [to represent the general population]," several epidemiologists disagree. Lynn Rosenberg of Boston

University's School of Public Health used a different approach in a retrospective study to be published in an upcoming *AMERICAN JOURNAL OF EPIDEMIOLOGY*. In it, she found an association between coffee drinking and heart attacks in men. To avoid any problems due to restricted diets or other such factors, she chose only patients with acute problems, such as a broken leg or appendicitis.

Rosenberg did not include any diet elements in her study, although she acknowledges a history of high cholesterol is an important factor in heart disease. It is difficult to measure diet, she says; moreover, most U.S. adults eat a high-fat diet. But, she adds, diet should be considered in the future.

A prospective study involving 1,130 men, enrolled when they were medical students, raises this same diet issue. Andrea Z. LaCroix and her colleagues at Johns Hopkins School of Medicine in Baltimore reported a strong association between heavy coffee drinking and coronary artery disease in a 1986 article in the *NEW ENGLAND JOURNAL OF MEDICINE*. The study controlled for cigarette smoking, but not for some other lifestyle or personality factors that may be associated with both heavy coffee consumption and the development of coronary disease. Those include a diet high in total and saturated fats and cholesterol, a sedentary lifestyle and high levels of occupational stress.

The researchers said they could have improved coffee measurement by considering such factors as the number of ounces consumed daily, the brewing method used and the amounts of caffeinated and decaffeinated coffee consumed. They measured only the number of cups consumed.

But LaCroix's group did something few prospective studies examining an association between coffee drinking and coronary artery disease have done. It looked at coffee consumption every five years and noted any changes, rather than inquiring about consumption only at the beginning of the study.

Some studies support the notion that high coffee consumption merely reflects an unhealthy lifestyle. On the basis of a telephone survey of a representative sample of U.S. adults, Alan Leviton and his colleagues at Harvard Medical School in Boston reported last year at the annual meeting of the Association Scientifique Internationale du Cafe in Switzerland that heavy consumers of coffee — those drinking daily more than 3 cups prepared by the drip method or 5.5 cups prepared with a percolator — are more likely to perceive themselves as healthy than are low coffee consumers.

Maybe that is why, Leviton suggests, his group found that high coffee consumers are more likely to engage in such unhealthy activities as smoking cigarettes and drinking alcohol. They also are less likely to take vitamins and to eat a

low-fat, high-fiber diet.

"The major implication of our findings is that consumers of coffee and caffeine might be at increased risk for a number of diseases, not because of coffee and caffeine consumption per se, but because of other aspects of their lives," Leviton says. "Future epidemiologic studies should take these into account when coffee consumption is evaluated as a risk factor of any disease."

Some epidemiologists already have. In the Tromsø Heart Study — a cross-sectional study of 14,581 Norwegians — Dag S. Thelle and his colleagues at the University of Tromsø found a strong dose relationship between coffee consumption and serum cholesterol. Their findings, which appeared in the *NEW ENGLAND JOURNAL OF MEDICINE* in 1983, were adjusted for body weight, age, physical activity, cigarette smoking and alcohol consumption, but not for food habits.

In a follow-up article in the April 1987 *AMERICAN JOURNAL OF EPIDEMIOLOGY*, the group made the additional adjustments. After considering such food habits as the use of low-fat milk, butter and bread, they still found a relationship.

They cautioned, however, that unknown factors might be important. One possibility, Thelle told *SCIENCE NEWS*, is that coffee consumption is much easier to recall than most other foods, stress and physical activity.

In an article in the October 1987 *ATHEROSCLEROSIS*, Thelle (now at the Nordic School of Public Health in Göteborg, Sweden) notes that three of seven clinical studies done by others examining the cholesterol-raising potential of coffee didn't find an association. He speculates that this may be in part because two of the three studies examined instant coffee, which contains lower levels of caffeine and other substances than brewed or percolated coffee.

He also maintains that brewing method, which wasn't considered in any of the seven studies, may have influenced their findings. In some European countries, including Norway, people drink mostly boiled coffee, which exposes coffee grounds to water for an extended period and involves higher temperatures than do other methods of preparation. The finished product, which isn't filtered, may contain more active substances.

Until scientists resolve the medical questions about coffee, tea and caffeine, what do researchers recommend? "In the absence of conclusive studies, it's difficult to give *any* advice," says Roy Fried at Johns Hopkins. But Rosenberg, noting that studies linking coffee drinking to disease generally show the adverse response is dose-related, suggests it may be wisest to "do everything in moderation." □

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