Food Sciences

Fat poses dual threat of breast cancer

Dozens of studies suggest that fatty foods may predispose women to breast cancer. Others suggest that the large number of calories typically consumed in a high-fat diet may represent the real underlying risk. In an attempt to settle the controversy, three National Cancer Institute researchers have reanalyzed 100 animal experiments, in many cases pooling data from various studies before hunting for statistical trends. In the Sept. 15 CANCER RESEARCH, they conclude that both fat and calories pose independent breast cancer risks.

"The calorie effect was stronger than the fat effect," says biostatistician Laurence S. Freedman, who led the study. The data suggest that every excess calorie raises breast cancer risk, with each excess fat-derived calorie posing about 67 percent more risk than calories from other sources, he says.

A study of Finnish women, described in the November AMERICAN JOURNAL OF CLINICAL NUTRITION, appears to support a fat-related risk. The researchers analyzed dietary questionnaires filled out at least 20 years ago by 3,988 healthy women aged 20 to 69, and found that the 54 participants who later developed breast cancer showed a "consistently higher" average percentage of fat-derived calories. Dividing the entire sample into thirds based on the proportion of fat in the women's diets, they calculated that the subgroup eating the most fat had a breast cancer risk about 70 percent higher than the subgroup eating the least fat.

Demetrius Albanes of the National Cancer Institute, who coauthored the Finnish study, says he wasn't surprised that no independent risk from calories showed up, since the study involved relatively few cancer cases and lacked exercise data, and since the cancer and noncancer groups had similar height-to-weight ratios. However, he says, the results did turn up hints that diets high in carbohydrates or milk might *lower* breast cancer risk by as much as 60 percent.

Cooking up colon cancer

While human studies seem to finger fatty diets as a risk for colon cancer, animal studies haven't strongly supported that link. Noting that humans' high-fat diets usually include foods cooked at high temperatures, cancer biologist W. Robert Bruce decided to investigate cooking's possible role in colon cancer. In the Nov. 1 CANCER RESEARCH, he and his co-workers report that cooking indeed appears to transform benign ingredients into ones that spur the growth of microadenomas – common colon abnormalities that can develop into malignancies.

Working at the Ontario Cancer Institute in Toronto, the researchers chemically induced small microadenomas in the colons of 152 mice and 83 rats. Then they fed the animals diets differing only in whether some component – 20 percent by weight of the sugar (sucrose), protein (casein), fat (beef tallow) or some combination of these – had been cooked (to 324°F). After 100 days, animals whose diets contained either cooked sugar or protein cooked in fat showed three to five times as many large, precancerous microadenomas as any of the other groups. Further investigation revealed that the protein/fat result was due not to the beef tallow *per se* but to a more complete heating of the protein when cooked in tallow.

The findings suggest by-products of the cooked sucrose and casein can promote colon cancer development, Bruce says. Fat by itself also poses a risk, he notes, pointing to previous work in which his group found that animals on diets with 20 percent fat showed a 50 percent increase in microadenoma development compared with animals receiving 5 percent fat. However, he says, the fat risk clearly was much smaller than that associated with cooked casein or sucrose. The Toronto team is now trying to identify the cancer-promoting by-products in the cooked sugar and protein.

Space Sciences

Jonathon Eberhart reports from Charlottesville, Va., at a meeting of the American Astronomical Society's Division for Planetary Sciences

The mystery behind Triton's plumes

The dark, geyser-like plumes photographed by Voyager 2 last year, rising about 8 kilometers above Neptune's moon Triton, are far less spectacular than the towering volcanic eruptions witnessed by Voyager 1 on Jupiter's moon Io a decade earlier. Yet Triton's outbursts puzzle scientists more.

Researchers had predicted Io's eruptions – which rose hundreds of kilometers and provided the first examples of active volcanism seen beyond Earth. Moreover, a now widely accepted explanation accompanied the prediction, suggesting that a tidal tug-of-war between Jupiter and its other big moons might drive Io's volcanic fury.

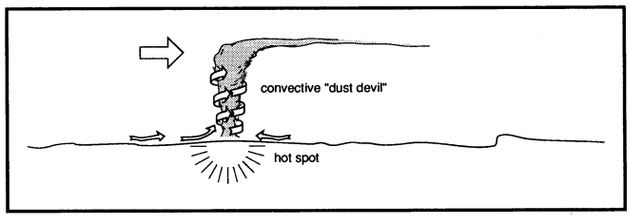
Triton's plumes, by contrast, were wholly unexpected (SN: 10/14/89, p.247). And the question of what propels them high into Triton's atmosphere still furrows many brows. Are Triton's plumes due to some version of the "greenhouse" effect, or to some extraterrestrial analog of the dust devils that whirl sand across desert landscapes on Earth?

Triton's mystery plumes consist primarily of nitrogen gas that has burst through a layer of frozen nitrogen covering Triton's extremely cold surface. Some Voyager researchers proposed last year that the sun's warming of dark particles trapped in the ice may ultimately heat the gas underneath. The resulting expansion of this gas could create a pressure buildup that eventually relieves itself in eruptions through weak spots in the ice. It's also possible, though less likely, that radioactive elements in Triton's core might generate enough heat to expand and pressurize the gas, according to Laurence Soderblom of the U.S. Geological Survey in Flagstaff, Ariz.

Whatever the source, warming the plume material by as little as 4°C could "drive it out of the ground" with enough momentum to spew it 8 km into Triton's atmosphere, says Robert H. Brown of NASA's Jet Propulsion Laboratory in Pasadena, Calif. And two kinds of "greenhouse" effects occurring within Triton's frozen surface could store enough heat to power such plumes, Brown reports.

Under one possible scenario – which he terms a "super-greenhouse" effect – dark, absorbing matter trapped with the nitrogen gas might capture and hold heat from the sun beneath a thin covering of icy nitrogen. Under a more "classical" greenhouse scenario, the sun's heat might merely build up throughout a pile of ice more than 60 meters deep. Either way, the heated gas would eventually escape.

Kimberly A. Tryka and Andrew P. Ingersoll of the California Institute of Technology in Pasadena counter that the curious plumes might instead represent a Tritonian version of dust devils – swirling atmospheric vortices. Though the mean temperature at Triton's surface is a frigid -235°C, dust devils might arise if the sun created a relatively hot spot on Triton's surface. The temperature differential between that surface ice and the surrounding, colder terrain might create enough turbulence in the nitrogen atmosphere to drive formation of the plumes, the Caltech team concludes.



Timothy Dowling

Dust devils on Earth can occur in environments well above 50°C, but there is evidence that they also arise in much colder climes. Besides Voyager's intriguing Triton images, photos taken in the late 1970s by the Viking craft recorded 6-km-high dust devils on Mars.