Soft Drinks, Hard Facts

Research suggests kids who drink a lot of soft drinks risk becoming fat, weak-boned, cavity-prone and caffeine-addicted.

By Sally Squires

Americans drink more soda pop than ever before. These popular beverages account for more than a quarter of all drinks consumed in the United States. More than 15 billion gallons were sold in 2000. That works out to at least one 12-ounce can per day for every man, woman and child.

Kids are heavy consumers of soft drinks, according to the U.S. Department of Agriculture, and they are guzzling soda pop at unprecedented rates. Carbonated soda pop provides more added sugar in a typical 2-year-old toddler's diet than cookies, candies and ice cream combined. Fifty-six percent of 8-year-olds down soft drinks daily, and a third of teenage boys drink at least three cans of soda pop per day.

Not only are soft drinks widely available everywhere from fast food restaurants to video stores, they're now sold in 60 percent of all public and private middle schools and high schools nationwide, according to the National Soft Drink Association. A few schools are even giving away soft drinks to students who buy school lunches.

As soda pop becomes the beverage of choice among the nation's young -- and as soda marketers focus on brand-building among younger and younger consumers -- public health officials, school boards, parents, consumer groups and even the soft drink industry are faced with nagging questions: How healthful are these beverages, which provide a lot calories, sugars and caffeine but no significant nutritional value? And what happens if you drink a lot of them at a very young age?

Beginning tomorrow, representatives of the soft drink industry, concerned that public opinion and public policy may turn against them, will stage a three-day "fly-in" to lobby Congress to maintain soft drinks sales in schools; and to educate lawmakers on the "proper perspective" on soft drink use. The industry plans to counter a U.S. Department of Agriculture proposal, announced in January, that would require all foods sold in schools to meet federal nutrition standards. That would mean that snack foods and soft drinks would have to meet the same standards as school lunches.

Some state legislators are already taking steps to limit soft drink sales to youngsters. In Maryland, a bill introduced by Sen. Paul G. Pinsky (D-Prince George's) would prohibit sales of soft drinks and other non-nutritious foods in schools until after 3 p.m. Current law says vending machines can't be turned on until after the final lunch period.

Nearly everyone by now has heard the litany on the presumed health effects of soft drinks: Obesity. Tooth decay. Caffeine dependence. Weakened bones. But does drinking soda pop really cause those things?

Even the staunchest critics of soft drinks say finding the scientific bottom line on soda pop can be maddeningly tricky. "It's hard to pull out the health effects of soft drinks from the whole diet," says Michael Jacobson, executive director of the Center for Science in the Public Interest and author of a critical report on soft drinks called "Liquid Candy: How Soft Drinks Are Harming Americans' Health." "There are relatively few studies on sugars. And some studies don't distinguish between naturally occurring sugars and refined sugars."

To help separate fact from fiction, the Health section reviewed the latest scientific findings and asked an array of experts on both sides of the debate to weigh in on the topic. Be forewarned, however: Compared with the data available on tobacco and even dietary fat, the scientific evidence on soft drinks is less developed. The results can be a lot like soft drinks themselves, both sweet and sticky.

Obesity

One very recent, independent, peer-reviewed study demonstrates a strong link between soda consumption and childhood obesity. One previous industry-supported, unpublished study showed no link. Explanations of the mechanism by which soda may lead to obesity have not yet been proved, though the evidence for them is strong.

Many people have long assumed that soda-- high in calories and sugar, low in nutrients -- can make kids fat. But until this month there was no solid, scientific evidence demonstrating this.

Reporting in The Lancet, a British medical journal, a team of Harvard researchers presented the first evidence linking soft drink consumption to childhood obesity. They found that 12-year-olds who drank soft drinks regularly were more likely to be overweight than those who didn't. For each additional daily serving of sugar-sweetened soft drink consumed during the nearly two-year study, the risk of obesity increased 1.6 times.

Could it be that the soda pop drinkers were simply living extremely sedentary lives? Or that they ate more than the kids who didn't drink soft drinks regularly? When lead author David Ludwig and his colleagues parsed the data to examine those possibilities, neither explanation panned out. Drinking soda proved to be "an independent risk factor for obesity," says Ludwig.

The soft drink industry quickly took steps to dispute the findings. Although the study included 548 ethnically diverse youngsters attending four public schools in Massachusetts, the NSDA knocked the research for including too few Caucasian kids: About two-thirds of participants were white, compared with 75 percent of the total U.S. population and 88 percent of Massachusetts residents.

The industry response also cited an earlier study conducted by Georgetown University's Center for Food & Nutrition Policy that showed overweight children consumed about 14 ounces of carbonated beverages per day -- only about two ounces more than kids of normal body weight. The Sugar Association paid for part of the Georgetown study, which was presented last April at the Experimental Biology 2000 meeting, but it has not been published in a peer-reviewed journal.

Obesity experts, on the other hand, called the Harvard findings important and praised the study for being prospective. In other words, the Harvard researchers spent 19 months following the children, rather than capturing a snapshot of data from just one day. It's considered statistically more valuable to conduct a study over a long period of time.

But even those who lauded the Harvard report still underscored the usual caveats. "It's only a single study, and it needs to be repeated," says William H. Dietz, director of the division of nutrition and physical activity at the U.S. Centers for Disease Control and Prevention (CDC) in Atlanta.

If soft drinks do prove to contribute to obesity, how might this happen? Is it simply a matter of drinking in too many calories?

Again, the jury is out, and there are several competing theories. But there are some tantalizing clues suggesting that excess calories alone can't explain the problem. The Harvard team also conducted a meta-analysis -- a number-crunching examination of similar research conducted over the past 25 years -- to explore this question. They concluded that drinking sugary calories doesn't register with the brain the same way that eating calories does. In other words, the brain seems to get confused by these sugary liquid calories that pass quickly through the stomach; they do not seem to trigger feelings of satiety in the same way calories from foods do. Absent a signal that calories have been consumed via soft drinks or sweetened fruit juices, the stomach does not tell the brain to quit eating at the current meal or to eat less at the next meal. In this way, the thinking goes, excess pounds are added.

Ludwig found that schoolchildren who drank soft drinks consumed almost 200 more calories per day than their counterparts who didn't down soft drinks. That finding helps support the notion, he says, that "we don't compensate well for calories in liquid form."

The soft drink industry doesn't buy that conclusion. "Childhood obesity is the result of many factors. Blaming it on a single factor, including soft drinks, is nutritional nonsense," noted Richard Adamson, NSDA's vice president for scientific and technical affairs.

On this point, the obesity experts tend to agree: "There are no data from the Harvard study that allow us to make an estimate of what proportion of obesity might be accounted for by changes in soft drink consumption," says the CDC's Dietz. "It's unlikely that we will be able to tie the obesity epidemic to any single change in the way we live. It is much more complex than that."

Tooth Decay

Though the soft drink industry admits that soda contributes to tooth decay, most data suggest it is just one of several contributors, and a less important one in developed countries than elsewhere in the world. In the United States, cavities have decreased while soda consumption has increased.

Here's one health effect that even the soft drink industry admits, grudgingly, has merit. In a carefully worded statement, the NSDA says that "there's no scientific evidence that consumption of sugars per se has any negative effect other than

dental caries." But the association also correctly notes that soft drinks aren't the sole cause of tooth decay.

In fact, a lot of sugary foods, from fruit juices to candy and even raisins and other dried fruit, have what dentists refer to as "carcinogenic properties," which is to say they can cause tooth decay.

Okay, so how many more cavities are soft drink consumers likely to get compared with people who don't drink soda? This is where it gets complicated.

A federally funded study of nearly 3,200 Americans 9 to 29 years old conducted between 1971 and 1974 showed a direct link between tooth decay and soft drinks. (Numerous other studies have shown the same link throughout the world, from Sweden to Iraq.) But here's the rub: In the last 25 years, tooth decay in the United States and other developed countries has actually declined -- at the same time that soft drink use and obesity have risen dramatically.

The scientific explanation for this phenomenon appears to come from a number of studies. One of the most illustrative is a 1994 British study of tooth decay among 12-year-olds in 90 countries. Conducted by statisticians at the University of Reading, the study found that throughout the world, dental decay rises proportionally with sugar consumption. But when researchers examined data from 29 industrialized nations, there was no evidence of a link between sugar and tooth decay.

"These results suggest," the researchers reported in the British Dental Journal, "that in addition to sugar, other factors" -- including improved diet, fluoridated water and even genetics -- play an important role in reducing tooth decay.

But sugar isn't the only ingredient in soft drinks that causes tooth problems. The acids in soda pop are also notorious for etching tooth enamel in ways that can lead to cavities. "Acid begins to dissolve tooth enamel in only 20 minutes," notes the Ohio Dental Association in a release issued earlier this month.

Caffeine Dependence

The stimulant properties and dependence potential of caffeine in soda are well documented, as are their effects on children. While health advocates argue that childhood use of caffeine can lead to dependence later in life -- and that regular doses of caffeine can have negative effects on brain development -- there is no conclusive science to demonstrate this.

Ever tried going without your usual cup of java on the weekend? If so, you may have experienced a splitting headache, a slight rise in blood pressure, irritability and maybe even some stomach problems. These well-documented symptoms describe the typical withdrawal process suffered by about half of regular caffeine consumers who go without their usual dose, according to Kenneth S. Kendler, professor of psychiatry and human genetics at Virginia Commonwealth University (VCU) in Richmond.

Research on caffeine's effects in children is more limited, but it suggests that kids also experience caffeine dependence and withdrawal. At the University of Minnesota, child psychiatrist Gail Bernstein and her colleagues gave 8- to 12-year-old children

the equivalent of two to three cans of Diet Coke daily for 13 days. Then they substituted caffeine-free soft drinks without telling the children and measured withdrawal symptoms.

During a computerized test 24 hours later, the children showed signficantly decreased attention, a classic symptom of withdrawal, Bernstein says.

The soft drink industry agrees that caffeine causes the same effects in children as adults, but officials also note that there is wide variation in how people respond to caffeine. The simple solution, the industry says, is to choose a soda pop that is caffeine-free. All big soda makers offer products with either low or no caffeine.

That may be a good idea, though it raises the question of whether soda machines in schools should be permitted to offer caffeinated beverages or at least be obligated to offer a significant proportion of caffeine-free products. It also raises the question of how one determines a product's caffeine content. Nutrition labels are not required to divulge that information. If a beverage contains caffeine, it must be included in the ingredient list, but there's no way to tell how much a beverage has, and there's little logic or predictability to the way caffeine is deployed throughout a product line.

Okay, so most enlightened consumers already know that colas contain a fair amount of caffeine. It turns out to be 35 to 38 milligrams per 12-ounce can, or roughly 28 percent of the amount found in an 8-ounce cup of coffee. But few know that diet colas -- usually chosen by those who are trying to dodge calories and/or sugar -- often pack a lot more caffeine. A 12-ounce can of Diet Coke, for example, has about 42 milligrams of caffeine -- seven more than the same amount of Coke Classic. A can of Pepsi One has about 56 milligrams of caffeine -- 18 milligrams more than both regular Pepsi and Diet Pepsi.

Even harder to figure out is the caffeine distribution in other flavors of soda pop. Many brands of root beer contain no caffeine. An exception is Barq's, made by the Coca-Cola Co., which has has 23 milligrams per 12-ounce can. Sprite, 7-Up and ginger ale are caffeine-free. But Mountain Dew, the curiously named Mello Yellow, Sun Drop Regular, Jolt and diet as well as regular Sunkist orange soda all pack caffeine.

So does Kick (58 milligrams) and Surge (53 milligrams).

Confused? You're not alone. "There is no way for a parent to know how much caffeine their kids are getting," said Avram Goldstein, professor emeritus of pharmacology at Stanford University and a petitioner, along with the Center for Science in the Public Interest, to the Food and Drug Administration to require soft drink manufacturers to label caffeine content.

Caffeine occurs naturally in kola nuts, an ingredient of cola soft drinks. But why is this drug, which is known to create physical dependence, added to other soft drinks?

The industry line is that small amounts are added for taste, not for the drug's power to sustain demand for the products that contain it. Caffeine's bitter taste, they say, enhances other flavors. "It has been a part of almost every cola -- and pepper-type

beverage -- since they were first formulated more than 100 years ago," according to the National Soft Drink Association.

But recent blind taste tests conducted by Roland Griffiths at Johns Hopkins Medical Institutions in Baltimore found that only 8 percent of regular soft drink consumers could identify the difference between regular and caffeine-free soft drinks. The study included only subjects who reported that they drank soft drinks mainly for their caffeine content. In other words, more than 90 percent of the self-diagnosed caffeine cravers in this small sample could not detect the presence of caffeine.

That's why Griffiths says the "great popularity of caffeinated soft drinks is driven not so much by subtle taste effects as by the mood-altering and physical dependence of caffeine that drives the daily self-administration," he says.

The soft drink industry counters that "the long history of caffeine's use confirms that it is safe when consumed in moderation."

That is true. "Were you to compare with alcohol or nicotine, there's no question that caffeine is far less deleterious to health," says VCU's Kendler. "But consuming a substantial amount of any psychoactive substance is not generally a good idea. It produces physiological changes in the brain. We don't know what that means."

And the unknown could be especially troublesome for the developing brains of children and adolescents. As Stanford's Goldstein sees it, logic dictates that "when you are dependent on a drug, you are really upsetting the normal balances of neurochemistry in the brain. The fact that kids have withdrawal signs and symptoms when the caffeine is stopped is a good indication that something has been profoundly disturbed in the brain."

Exactly where that leads is anybody's guess -- which is to say there is little good research on the effects of caffeine on kids' developing brains.

Bone Weakening

Animal studies demonstrate that phosphorus, a common ingredient in soda, can deplete bones of calcium. And two recent human studies suggest that girls who drink more soda are more prone to broken bones. The industry denies that soda plays a role in bone weakening.

Animal studies -- mostly involving rats -- point to clear and consistent bone loss with the use of cola beverages. But as scientists like to point out, humans and rats are not exactly the same.

Even so, there's been concern among the research community, public health officials and government agencies over the high phosphorus content in the U.S. diet. Phosphorus -- which occurs naturally in some foods and is used as an additive in many others -- appears to weaken bones by promoting the loss of calcium. With less calcium available, the bones become more porous and prone to fracture.

The soft drink industry argues that the phosphoric acid in soda pop contributes only about 2 percent of the phosphorus in the typical U.S. diet, with a 12-ounce can of soda pop averaging about 30 milligrams.The National Academy of Sciences has set 3

grams (or 3,000 milligrams) per day as the tolerable upper limit of phosphorus for children ages 1 to 8 years, and 4 grams per day for those 9 years and older.

To reach that amount would require drinking at least 100 cans of soda pop per day. But there's growing concern that even a few cans of soda today can be damaging when they are consumed during the peak bone-building years of childhood and adolescence. A 1996 study published in the Journal of Nutrition by the FDA's Office of Special Nutritionals noted that a pattern of high phosphorus/low calcium consumption, common in the American diet, is not "conducive to optimizing peak bone mass in young women."

The scientific literature is scant on this topic, and the soft drink industry says the few studies that have been done are flawed. But the studies seem to consistently link soft drink use with the kind of bone weakening that can raise the risk of fractures. Most troubling is that the studies suggest the increased risk of fractures occurs as early as adolescence.

A 1994 study of bone fractures in teenage athletes by Grace Wyshak, then a researcher at Harvard's Center for Population Studies, found a strong association between cola beverage consumption and bone fractures in 14-year-old girls. A follow-up study of 468 9th- and 10th-grade girls, also conducted by Wyshak, who is now at the Harvard School of Public Health, concluded that girls who drank cola were about five times more likely to suffer bone fractures than girls who didn't consume soda pop. She also found that girls who drank only non-cola carbonated drinks were three times more likely to develop bone fractures than those who didn't consume soda pop.

Exactly how soft drinks may contribute to bone weakening is not yet known. But Pennsylvania State University researcher Leeann Birch has found that soft drinks often displace more nutritious beverages, including milk. And just how much soda are teens -- whose bones are growing at peak levels -- drinking? Shanty Bowman, a researcher at USDA's Agricultural Research Service in Beltsville, finds that Americans 12 to 19 years old consume an average of 503 grams of carbonated beverages each day, the equivalent of about half a quart. About 61 percent of teens report drinking carbonated beverages on any given day, compared with just half who drink milk. Bowman says that only one in every five meets the current milk requirement.

It's that combination of increased consumption of soda, decreased consumption of milk and other beverages, and the possible link between phosphorus and bone health that researchers such as Wyshak believe is enough to justify a "national concern and alarm about the health impact of carbonated beverage consumption on teenage girls."

Besides, to many researchers, the combination of rising obesity and bone weakening has the potential to synergistically undermine future health. "Adolescents and kids don't think long-term," says Jamie Stang, professor of epidemiology at the University of Minnesota. "But what happens when these soft-drinking people become young or middle-aged adults and they have osteoporosis, sedentary living and obesity?"

By that time, switching to water, milk or fruit juice may be too little, too late.