

**NEW &  
IMPROVED**

*Liquid Candy*

**How Soft Drinks  
Are Harming  
Americans' Health**

**Center for Science in the Public Interest**



# **Liquid Candy**

## **How Soft Drinks Are Harming Americans' Health**

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—Michael F. Jacobson

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## Liquid Candy Supplement

### Soft Drink Consumption: 1999–2002

Teenagers are consuming ever-greater volumes of soft drinks, according to new analyses of the latest national food-consumption surveys.<sup>1</sup>

In 1999–2002, the average 13- to 18-year-old boy consumed the equivalent of 2 12-ounce cans of soda pop a day; the average girl consumed 1½ cans per day. (See **table 1**.) Soda pop provided about one-fourth more of teens' calories in 1999–2002 than in 1994–96 (10.7 percent compared to 8.5 percent of calories).

Adding in fruit drinks, which are basically noncarbonated soft drinks, the totals rise to 2½ cans for boys and 1¾ cans for girls (and 13 percent of their calories). That compares to a paltry 11 ounces of milk for boys and 7 ounces for girls.

When those youths who did not drink any carbonated soft drinks or fruit drinks are excluded, the consumption figures rise to 3 12-ounce cans per day for the average boy and more than 2 cans for the average girl. (See **table 2**.) Those teens were getting

**Table 1**  
Daily beverage consumption by all 13- to 18-year-olds (1999–2002)

Beverage	Boys		Girls		All	
	Ounces	Calories	Ounces	Calories	Ounces	Calories
<b>Carbonated soft drinks, total</b>	<b>25</b>	<b>303</b>	<b>17</b>	<b>194</b>	<b>21</b>	<b>250</b>
Caloric	25	303	16	193	20	249
Diet	1	0	1	0	1	0
Fruit drinks	5	60	5	61	5	60
Caloric carbonated + fruit drinks	29	363	21	254	25	310
<b>All carbonated + fruit drinks</b>	<b>30</b>	<b>363</b>	<b>22</b>	<b>254</b>	<b>26</b>	<b>310</b>
Milk	11	160	7	98	9	130

**Table 2**  
Daily beverage consumption by 13- to 18-year-olds, excluding non-consumers (1999–2002)

Beverage	Boys		Girls		All	
	Ounces	Calories	Ounces	Calories	Ounces	Calories
<b>Carbonated soft drinks, total</b>	<b>32</b>	<b>379</b>	<b>23</b>	<b>267</b>	<b>28</b>	<b>326</b>
Caloric	32	390	23	286	28	343
Diet	20	4	19	5	19	4
Fruit drinks	22	267	17	215	19	238
Caloric carbonated + fruit drinks	35	427	26	318	30	375
<b>All carbonated + fruit drinks</b>	<b>35</b>	<b>416</b>	<b>26</b>	<b>302</b>	<b>31</b>	<b>361</b>
Milk	19	277	14	205	17	245

15 percent of their calories from soda pop and fruit drinks. The boys in the 90th percentile of consumption were drinking the equivalent of over 5 cans a day, and the girls 4 cans. (See **table 3**.) In the 95th percentile of consumption, the boys drank 7 cans a day, and the girls 5 cans.

Notwithstanding high rates of overweight and obesity, distressingly few boys and girls have switched to diet soft drinks: Only 4 percent of boys and girls reported drinking diet sodas, while 85 percent reported drinking non-diet soft drinks or fruit

drinks. Teenagers drank 22 times as much regular soda and fruit drinks as diet soda.

**Note**

1. Calculated from the 1999–2002 National Health and Nutrition Examination Survey for the Center for Science in the Public Interest by Barry Popkin and Dan Blanchette, University of North Carolina School of Public Health, July 2005. Totals may not equal the sum of their parts because of rounding. Due to methodological differences, these new data may not be directly comparable to the 1994–96 data (based on the U.S. Department of Agriculture’s Continuing Survey of Food Intakes of Individuals) presented in *Liquid Candy*.

**Table 3**  
**Percentile distribution of consumption of non-diet carbonated soft drinks and fruit drinks by 13- to 18-year-olds, excluding non-consumers (oz./day)**

Sex	Percentile					
	10th	30th	50th	80th	90th	95th
Boys	12	19	27	49	66	83
Girls	9	13	21	38	48	61
All	9	15	25	44	59	74

Statistical clarification:

In table 2, total carbonated soft-drink consumption (for example, 32 ounces per day for boys) is not the simple sum of caloric- (32 ounces) and diet- (20 ounces) soda consumption. That is because so few boys consume diet soda that the diet soda barely affects overall consumption per soda drinker.

In table 3, the bottom row is not the simple average of the upper two rows, because girls are more highly represented in the lower percentiles of consumption, while boys are more represented in the higher percentiles.

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## EXECUTIVE SUMMARY

Americans consume gargantuan quantities of carbonated soft drinks and suffer untoward health consequences. Companies annually produce enough soda pop to provide 557 12-ounce cans—52.4 gallons—to every man, woman, and child. Adding in noncarbonated soft drinks (including fruit drinks, ades, iced teas, and the like) adds thousands of more empty calories to the diet each year.

Carbonated soft drinks are the single biggest source of calories in the American diet, providing about 7 percent of calories; adding in noncarbonated drinks brings the figure to 9 percent. Teenagers get 13 percent of their calories from carbonated and noncarbonated soft drinks.

Consumption of carbonated soft drinks peaked in 1998, when consumption was 56.1 gallons per person. In a historic turnaround, consumption was 7 percent lower in 2004. And because some people have switched to diet sodas, the consumption of caloric soft drinks declined by 12 percent.

Soft drinks provide large amounts of sugars (mostly high-fructose corn syrup) to many individuals' diets. Soda pop provides the average 12- to 19-year-old boy with about 15 teaspoons of refined sugars a day and the average girl with about 10 teaspoons a day. Those amounts roughly equal the government's recommended limits for teens' sugar consumption from *all* foods.

Soft drinks are a problem not only for what they contain, but for what they push out of the diet. In 1977–78, boys consumed more than twice as much milk as soft drinks, and girls consumed 50 percent more milk than soft drinks. By 1994–96, both boys and girls consumed twice as much soda pop as milk. Heavy soft drink consumption is associated with lower intake of numerous vitamins, minerals, and dietary fiber.

The empty calories of soft drinks are likely contributing to health problems, particularly overweight and obesity. Those conditions have become far more prevalent during the period in which soft drink consumption has soared. Several scientific studies have provided experimental evidence that soft drinks are directly related to weight gain. That weight gain, in turn, is a prime risk factor for type 2 diabetes, which, for the first time, is becoming a problem for teens as well as adults. As people get older, excess weight also contributes to heart attacks, strokes, and cancer.

Frequent consumption of soft drinks may also increase the risk of osteoporosis—especially in people who drink soft drinks instead of calcium-rich milk. Dental experts continue to urge that people drink less soda pop, especially between meals, to prevent tooth decay (due to the sugars) and dental erosion (due to the acids).



Frequent consumers of soft drinks may also be at a higher risk of kidney stones and a slightly higher risk of heart disease. More research is needed in both of those areas.

Besides the sugars and acids, other soft drink ingredients are of concern. Caffeine, which is added to many of the most popular soft drinks, is a mildly addictive, stimulant drug. It also increases slightly the excretion of calcium. Artificial colorings, especially Yellow No. 5, promote attention-deficit hyperactivity disorder in some children. Yellow No. 5 also causes hives, asthma, and other allergic reactions in a small number of individuals.

Soft drinks are heavily consumed in part because companies promote them vigorously and market them everywhere—in stores, restaurants, gas stations, museums, vending machines, and even schools. Companies spend roughly \$700 million on media advertising each year, and hundreds of millions more on other promotional activities, which may involve musicians, actors, contracts with schools, and price discounting.

A number of parents and educators have—in response to the obesity epidemic among youths—begun successful efforts to curb the sale of soft drinks in schools. Currently, many middle schools and most high schools sell soda, with many schools having exclusive marketing contracts with companies. California, Tennessee, Arizona, Philadelphia, New York City, and other jurisdictions have barred non-diet soft drinks from some or all schools.

To help reduce the consumption of soft drinks, especially non-diet varieties, the Center for Science in the Public Interest makes these and other recommendations:

- \*National and local governments should require chain restaurants to declare the calorie content of soft drinks and all other items on menus and menu boards.
- \*The Food and Drug Administration should require labels on non-diet soft drinks to state that frequent consumption of those drinks promotes obesity, diabetes, tooth decay, osteoporosis, and other health problems.
- \*Local, state, and federal governments should provide water fountains in schools, government buildings, parks, and other public spaces.
- \*School systems and other organizations catering to children should stop selling soft drinks (as well as candy and other junk foods) in hallways, shops, and cafeterias.
- \*State and local governments should consider levying small taxes on soft drinks, with the revenues earmarked for promoting health and fitness. A national 2-cent tax on a can of soda pop would raise \$3 billion annually.



**In 1942,** U.S. annual production of carbonated soft drinks was about 60 12-ounce servings per person. At that time, the American Medical Association's Council on Foods and Nutrition warned:

From the health point of view it is desirable especially to have restriction of such use of sugar as is represented by consumption of sweetened carbonated beverages and forms of candy which are of low nutritional value. The Council believes it would be in the interest of the public health for all practical means to be taken to limit consumption of sugar in any form in which it fails to be combined with significant proportions of other foods of high nutritive quality.<sup>1</sup>

By 2005, soft drink production had increased almost 10-fold and provides more than one-third of all refined sugars in the diet. This review discusses the impact on nutrition and health of carbonated soft drinks, the nation's single largest source of calories, particularly among teenagers.

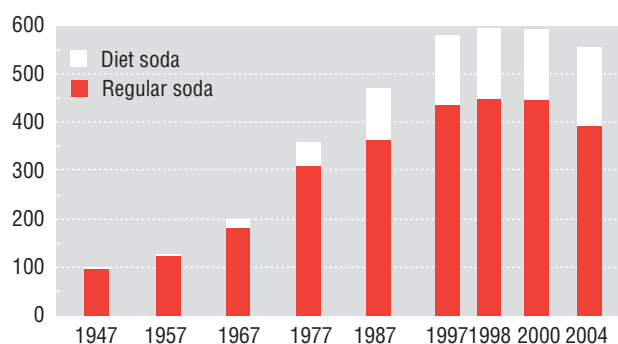
## Soaring Consumption of Soft Drinks

Consumption of carbonated soft drinks in the United States exploded over the past 40 years and has more than doubled since 1971. (See **figure 1**.) Those drinks now account for more than one out of every four beverages consumed in America.<sup>2</sup> In 2004, Americans spent \$66 billion<sup>3</sup> on carbonated drinks—and billions more on noncarbonated soft drinks. That works out to about \$850 per household—enough to buy a computer and year's worth of Internet access.<sup>4</sup>

The industry produced enough soda pop that year to provide the average person with 52 gallons—the equivalent of 557 12-ounce servings per year, or 1½ 12-ounce cans per day, for every man, woman, and child.<sup>5</sup> Carbonated soft drinks are the single most-consumed food in the American diet, providing about 7 percent of all calories, according to the government-sponsored 1999–2000 National Health and Nutrition Examination Survey.<sup>6</sup>

The good news is that soft drink consumption has been decreasing. Sales declined by 7 percent from a high of 56.1 gallons per person in 1998 to 52.4 gallons in 2004.<sup>7</sup> Consumption of non-diet sodas

**Figure 1**  
Annual soft drink production in the United States  
(12-oz. cans/person)



Sources: USDA Economic Research Service (1947–87); Beverage Digest (1997–2004).

declined a remarkable 12 percent. In the first nine months of 2004, the volume of Coca-Cola's products declined by 5 percent.<sup>8</sup> Also, reflecting the increased concern about obesity and consumer interest in low-carb diets, artificially sweetened diet sodas are grabbing a larger share of the market. Diet sodas accounted for 29 percent of total carbonated soft drink sales in 2004, up several percentage points in the last few years and up from just 9 percent in 1970.<sup>9,10,11</sup> Given current trends in our overweight nation, in another 10 years diet soda may outsell regular soda.

Most of the data in *Liquid Candy* do not cover sweetened *non*carbonated beverages—everything from Gatorade to Kool-Aid to Arizona Iced Tea—which are nutritionally equivalent to carbonated beverages. Most of those products contain between 0 and 10 percent fruit juice. If they were included, many of the consumption and sales figures would be significantly higher.<sup>12</sup>

**Table 1**  
**Consumption of non-diet soft drinks by all 12- to 19-year-olds**

Year	Ounces per day		% of daily calories	
	Boys	Girls	Boys	Girls
1977–78	7	6	3	4
1987–88	12	7	6	5
1994–96	19	12	9	8

**Source:** Calculated from USDA Nationwide Food Consumption Survey, 1977–78; and Continuing Survey of Food Intakes by Individuals, 1987–88, 1994–96.

Children start drinking soda pop at a remarkably young age, and consumption increases through young adulthood. One-fifth of one- and two-year-old children consume soft drinks.<sup>13</sup> Those toddlers drink an average of seven ounces—nearly one cup—per day. Toddlers' consumption changed little between the late 1970s and mid-1990s.

Almost half of all children between the ages of 6 and 11 drink soda pop, with the average drinker consuming 15 ounces per day. That 1994–96 figure was up slightly from 12 ounces in 1977–78.

The most avid consumers of all are 12- to 29-year-old males. Among teens aged 12 to 19, boys who imbibe soda pop drink an average of almost 2½ 12-ounce sodas (28.5 ounces) per day. (See **tables 1** and **2**.) One-fourth of 13- to 18-year-old male pop-drinkers drink 2½ or more cans per day, and 1 out of 20 drinks 5 cans or more.<sup>14</sup> (See **table 3**.) (Actual intakes probably are higher, because dietary surveys underestimate the quantities of foods people consume, and people may be particularly likely to underestimate foods perceived as being bad for them.)

**Table 2**  
**Consumption of regular and diet soft drinks by 12- to 19-year-olds, excluding nondrinkers (oz./day)**

Year	Boys	Girls
1977–78	16	15
1987–88	23	18
1994–96	28	21

**Source:** USDA Nationwide Food Consumption Survey, 1977–78; and Continuing Survey of Food Intakes by Individuals, 1987–88, 1994–96.

Teenage girls also drink large amounts of soda pop. Girls who drink soft drinks consume about 1.7 12-ounce sodas per day. One-fourth of 13- to 18-year-old female pop-drinkers drink two or more cans per day, and 1 out of 20 drinks three cans or more.<sup>15</sup> (Women in their 20s average slightly more: two 12-ounce sodas per day.)

By contrast, 20 years earlier, the typical (50th percentile) 13- to 18-year-old consumer (boys and girls together) of soft drinks drank three-quarters of a can per day, while the 95th percentile teen drank 2¼ cans. That's slightly more than one-half of current consumption.

One reason for that increased consumption is that the industry has steadily increased container sizes. In the 1950s, Coca-Cola's 6½-ounce bottle was the standard serving. That grew into the 12-ounce can, and now *that* is being supplanted by 20-ounce bottles (and such gargantuan products as the 64-ounce Double Gulp at 7-Eleven stores). (See **figure 2**.) The larger the container, the more soda people are likely to drink, especially when they assume they are buying single-serving containers.

Pricing practices also encourage people to drink large servings. For instance, at McDonald's restaurants a 16-ounce ("small") drink costs about \$1.05, while a drink 100 percent larger (a 32-ounce "large") costs only 50 percent more (about \$1.57).<sup>16</sup> At a multiplex theater in Maryland, a 16-ounce drink costs \$3.25, while the 44-ounce drink, which is 175 percent larger, costs only 30 percent more (\$4.25).<sup>17</sup>

## Nutritional Impact of Soft Drinks

Regular soft drinks provide youths and young adults with hefty amounts of refined sugars, usually in the form of high-fructose corn syrup,<sup>18</sup> and calories. Even diet sodas may replace more nutritious foods and beverages and decrease consumption of various nutrients.

### Sugars Intake

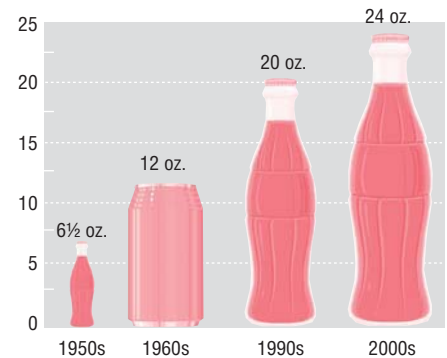
Carbonated drinks are the single biggest source of refined sugars in the American diet.<sup>19</sup> According to dietary surveys,<sup>20</sup> soda pop provides the average American with 7 teaspoons of sugars per day, out of a total of about 20 teaspoons. Teenage boys get 44 percent of their 34 teaspoons of refined sugars a day from soft drinks.<sup>21</sup> Teenage girls get 40 percent of their 24 teaspoons of sugars from soft drinks. Because some people drink little or no soda pop, the percentage of refined sugars provided by pop is higher among actual drinkers.

**Table 3**  
Consumption of regular and diet soft drinks by 13- to 18-year-olds, excluding nondrinkers (oz./day)

Year/sex	Percentile					
	5th	25th	50th	75th	90th	95th
1994–96: boys	6	12	20	30	44	57
1994–96: girls	4	6	14	23	32	40
1977–78: boys and girls	3	5	9	15	—	27

**Source:** Percentile calculations by Environ, Inc., for Center for Science in the Public Interest; data from USDA, Continuing Survey of Food Intakes by Individuals, 1994–96. Figures for 1977–78 calculated from P.M. Guenther, *J Am Diet Assoc* 1986;86:493–9.

**Figure 2**  
Growth in soda container size (oz.)



### Putting the USDA Recommendations in Perspective

To better grasp the USDA sugar recommendations, consider that the average 12- to 19-year-old boy consumes about 2,750 calories and 1½ cans of soda with 15 teaspoons of sugars a day; the average girl consumes about 1,850 calories and one can with 10 teaspoons of sugars. Thus, typical teens just about hit their recommended refined-sugars limit from soft drinks alone. Adding in fruit drinks, candy, cookies, cake, ice cream, and other sugary foods, most teenagers exceed those recommendations by a large margin.

The U.S. Department of Agriculture (USDA) has recommended that people eating 1,600 calories a day eat no more than 6 teaspoons a day of refined sugars, 12 teaspoons for those eating 2,200 calories, and 18 teaspoons for those eating 2,800 calories. Thus, refined sugars should provide no more than 6 to 10 percent of people's total daily calories.<sup>22</sup> USDA made those estimates after considering how many more calories could fit into a diet after a person consumed all the recommended servings of fruits, vegetables, grains, and lean animal products (plus enough oil so that fat equals 30 percent of daily calories). Among 12- to 19-year-olds, soft drinks provide the average boy with about 15 teaspoons of refined sugars a day and the average girl with about 10 teaspoons a day.<sup>23</sup> (Using a line of reasoning similar to USDA's, the 2005 edition of

*Dietary Guidelines for Americans*, which is published jointly by USDA and the U.S. Department of Health and Human Services, notes that someone who is eating a healthy 2,000-calorie diet plus 1½ tablespoons of butter or margarine has room for only eight teaspoons of added sugars per day—or 6 percent of calories; a 2,800-calorie diet could contain 15 teaspoons of sugars—or 9 percent of calories.<sup>24</sup>)

### Calorie Intake

Consuming large amounts of non-diet soda pop means consuming a lot of sugars (in the form of high-fructose corn syrup) and a lot of calories. Among all Americans, carbonated soft drinks provided 7 percent of calories in 1999–2001.<sup>25</sup> Adding in noncarbonated soft drinks brings that figure up to 9 percent. Among children 2 to 18 years old, the percentage of calories provided by carbonated and noncarbonated soft drinks more than doubled (from 4.8 to 10.3) between 1977–78 and 1999–2001.<sup>26</sup>

Among 12- to 19-year-olds, carbonated soft drinks provided 9 percent of boys' calories and 8 percent of girls' calories.<sup>27</sup> Those percentages are triple (boys) or double (girls) what they were in 1977–78 (see table 1) and include children who consume little or no soda pop. Among 13- to 18-year-olds who drink soft drinks, boys and girls in the 75th percentile of consumption obtain 12 percent of their calories from soft drinks. Those in the 90th percentile obtain about 18 percent of their calories from soft drinks.<sup>28</sup> In 1999–2000, carbonated soft drinks and fruit drinks/ades provided 13 percent of teenagers' calories.<sup>29</sup>

## Nutrient Intake

Some nutritionists in and outside of the soft drink industry emphasize that soft drinks and other nutrient-poor foods can fit into a healthful diet. They may be correct in theory, but they ignore the fact that many people consume great quantities of soft drinks—along with chips, candy, pastries, hot dogs, French fries, and other low-nutrition foods—and meager quantities of the nutrient-rich foods that should constitute the bulk of the diet. One government study found that only 2 percent of 2- to 19-year-olds met all five federal recommendations for a healthy diet.<sup>30</sup> USDA’s Healthy Eating Index found that, on a scale of 0 to 100, teenagers had scores in the low 60s (as did most other age/sex groups). Scores between 51 and 80 indicate that a diet “needs improvement.”<sup>31</sup>

Dietary surveys<sup>32</sup> of teenagers found that in 1994:

- Only 39 percent of boys and 31 percent of girls consumed the number of servings of vegetables recommended by USDA’s Food Pyramid.
- Only 13 percent of boys and 15 percent of girls consumed the recommended amount of fruit.
- Only 29 percent of boys and 12 percent of girls consumed the recommended amount of dairy foods.

Those surveys<sup>33</sup> also found that few 12- to 19-year-olds consumed the recommended amounts of certain nutrients, including:

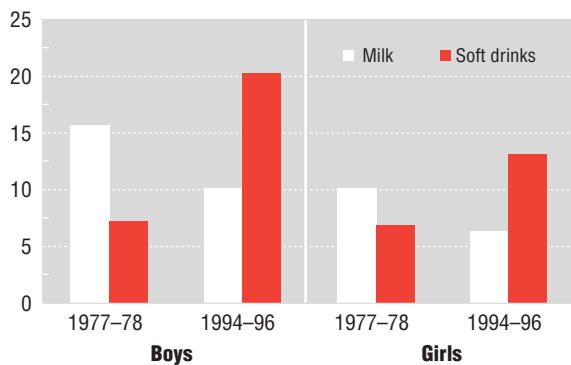
- **Calcium:** Only 36 percent of boys and 14 percent of girls consumed 100 percent of the Recommended Dietary Allowance (RDA).
- **Vitamin A:** Only 36 percent of boys and 31 percent of girls consumed 100 percent of the RDA.
- **Magnesium:** Only 34 percent of boys and 18 percent of girls consumed 100 percent of the RDA.

As teens have doubled or tripled their consumption of soft drinks, they have cut their consumption of milk by more than 40 percent. In 1977–78, boys consumed more than twice as much milk as soft drinks, and girls consumed 50 percent more milk than soft drinks. By 1994–96,



Many people consume great quantities of soft drinks, but only meager amounts of the nutrient-rich foods that should make up the bulk of their diet.

**Figure 3**  
Boys' and girls', aged 12–19, average daily consumption of milk and soft drinks (oz.)



Source: USDA Continuing Surveys of Food Intakes of Individuals, 1977–78, 1994–96.

both boys and girls consumed twice as much soda pop as milk (and 20- to 29-year-olds consumed three times as much). (See **figure 3**.) Teenage boys consumed about 2<sup>2/3</sup> cups of carbonated soft drinks per day but only 1<sup>1/4</sup> cups of milk. Girls consumed about 1<sup>1/2</sup> cups per day of soft drinks but less than 1 cup of milk. Compared to teens who don't drink sodas, heavy drinkers of soda pop (those who consume 26 ounces a day or more) are almost four times more likely to drink less than one glass of milk a day.<sup>34</sup>

In 1977–78, teenage boys and girls who frequently drank soft drinks consumed about 20 percent less calcium than those who didn't drink soft drinks. Heavy soft-drink consumption also correlated with low intake of magnesium, ascorbic acid, riboflavin, and vitamin A, as well as high intake of calories, fat, and carbohydrate.<sup>35</sup>

In 1994–96, calcium sufficiency continued to be a particular problem for girls who consumed soft drinks.<sup>36</sup> (Boys likely were getting more calcium from pizza and cheeseburgers.) A 1996 USDA study of a large sample of nonpregnant, nonlactating women found that high intakes of soft drinks were associated with low calcium intakes.<sup>37</sup> The study's author stated: "Women who failed to meet their calcium RDA consumed less milk and milk products than those who did meet their RDA....They also consumed more regular soda."

Women who met their calcium RDA consumed an average of 99 grams (3 fluid ounces) of regular soda per day; those who did not meet their calcium RDA consumed 47 percent more regular soda, 146 grams (5 fluid ounces) per day.

Drinking more soda pop was correlated with children of all ages consuming too little vitamin A, children younger than 12 consuming too little calcium, and children 6 and older consuming too little magnesium.<sup>38</sup> The authors concluded: "A decrease of one glass of carbonated soda coupled with an increase of one glass of milk or juice could have a substantial effect on a child's daily nutrient intake."

USDA's Agricultural Research Service analyzed 1994–96 dietary-intake data to understand the relationship between intake of added sugars (much of which comes from soft drinks) and other nutrients.<sup>39</sup> That study provides strong evidence that foods and beverages high in added sugars are displacing more nutrient-rich foods in the American diet.



The researcher, Shanthy Bowman, divided individuals into three groups based on their added-sugars intake: light consumers (under 10 percent of calories), medium (10 to 18 percent of calories), and heavy (more than 18 percent of calories). She found that the medium and heavy groups consumed 10 percent more calories than the light. There was no difference in fat intake (measured in grams) between light and heavy consumers of added sugars. The surprising finding was that heavy consumers, despite their higher caloric intake, consumed:

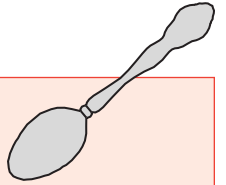
- 24 percent *less* fiber than light consumers
- *less* of 15 different vitamins and minerals than light consumers
- 15 percent to 20 percent *less* vitamin A, vitamin C, folate, vitamin B-12, and magnesium than light consumers
- 6 percent *less* calcium than light consumers

The study concluded: “A remarkably lower percentage of [heavy consumers of added sugars] met their RDA for many micronutrients.” It also found that disproportionately high percentages of lower-income Americans (40 percent) and African Americans (44 percent) were heavy consumers of added sugars. (Those figures compare to 33 percent of all individuals.)

Bowman added: “Because of the increasing prevalence of obesity, consumers will be benefited by limiting intake of ‘empty’ calories, especially during childhood and adolescence....It is important for consumers to recognize that they get large amounts of added sugars through processed foods and beverages.” Further, she cited the need for better food labeling: “Food labels contain information on total sugars per serving but do not distinguish between sugars naturally present in foods and added sugars. Better information on the food label is needed to help consumers make informed choices regarding added sugars.”

Another study reviewed adolescents’ food consumption based on USDA national dietary surveys conducted between 1965 and 1996.<sup>40</sup> The study found that decreases in raw fruits, non-potato vegetables, and calcium-rich dairy foods coincided with “greatly increased” soft drink consumption. Calcium consumption by children 11 to 18 years old dropped from 1,100 mg to 960 mg per day between 1965 and 1994–96. The paper noted that those trends “are of most concern for females, who may be at greater risk of developing osteoporosis later in life.”

### Activity for Kids



Spoon out 10 level teaspoons of sugar to see about how much sugar (actually high-fructose corn syrup) is in a 12-ounce can of regular soda pop. Spoon out 17 teaspoons for a 20-ounce bottle. Can anyone imagine consuming that much sugar at one time?

“Sugar-loaded beverages are really just empty calories that block out healthy foods. I would tell parents to restrict their kids’ soft drink and fruit drink consumption.”

— BARRY POPKIN, UNIVERSITY OF NORTH CAROLINA—CHAPEL HILL

Barry Popkin, one of the authors of that study, said that the dietary changes over the past several decades may leave teenagers at higher risk of chronic ailments later in life, including heart disease, osteoporosis, and diabetes. He said that people who indulge in too many soft drinks either get fewer nutrients or eat more food than they should. A spokesperson for the American Dietetic Association expressed concern: “Soda is no longer considered a treat. Soda is now considered a given at a lot of people’s tables. You’re replacing nutritious calories with empty calories.”<sup>41</sup>

In a small study of 6- to 13-year-old children, researchers found that kids who drank more sweetened beverages (fruit-flavored drinks, soft drinks, iced teas, and the like) drank less milk.<sup>42</sup> Children who consumed more than 16 ounces of sweetened beverages per day had lower intakes of calcium, magnesium, zinc, vitamin A, and other nutrients.

A study of children in grades 4 to 6 (aged 10 to 12 years old) also found reason for concern.<sup>43</sup> Compared to children who did not drink soft drinks, children who consumed an average of 20 ounces of soft drinks per day consumed substantially less fruit and more high-fat vegetables (such as French fries).

The 2005 edition of *Dietary Guidelines for Americans* summarizes the effects of sugary foods, such as soft drinks, on nutritional status:

Individuals who consume food or beverages high in added sugars tend to consume more calories than those who consume food or beverages low in added sugars; they also tend to consume lower amounts of micronutrients. Although more research is needed, available prospective studies show a positive association between the consumption of calorically sweetened beverages and weight gain. For this reason, decreased intake of such foods, especially beverages with caloric sweeteners, is recommended to reduce calorie intake and help achieve recommended nutrient intakes and weight control.<sup>44</sup>

## Health Impact of Soft Drinks

The soft drink industry has consistently portrayed its products as being positively healthful, saying they are 90 percent water and contain sugars found in nature. A poster that the National Soft Drink Association (now the American Beverage Association) once provided to teachers stated: “As refreshing sources of needed liquids and energy, soft drinks represent a positive addition to a well-balanced diet.... These same three sugars also occur naturally, for example, in fruits.... In your body it makes no difference whether the sugar is from a soft drink or a peach.”<sup>45</sup>

Currently, in a desperate attempt to link soft drinks to good health, the industry emphasizes that soda contains water, an essential nutrient: “Drink plenty of fluids: consume at least eight glasses of fluids daily, even more when you exercise. A variety of beverages, including soft drinks, can contribute to proper hydration.”<sup>46</sup> A similar claim was made in 1998 by M. Douglas Ivester, then Coca-Cola’s chairman and CEO, when he defended the marketing of soft drinks in Africa. He said, “Actually, our product is quite healthy. Fluid replenishment is a key to health...Coca-Cola does a great service because it encourages people to take in more and more liquids.”<sup>47</sup>

In fact, soft drinks pose health risks both because of what they *contain* (extra calories, sugar, and various additives) and what they *replace in the diet* (beverages and foods that provide vitamins, minerals, and other nutrients).<sup>48</sup>

## Obesity

Being overweight or obese increases the risk of diabetes, heart disease, stroke, cancer, and other diseases and causes severe social and psychological problems in millions of Americans.<sup>49</sup> Between 1971–74 and 1999–2002, overweight rates in teenagers soared from 6 percent to 16 percent.<sup>50</sup> (See **table 4**.) What used to be called adult-onset diabetes is now called type 2 diabetes, because the disease is being seen increasingly in teens.

Among adults, between 1976–80 and 1999–2002, the rate of obesity more than doubled, rising from 15 to 31 percent.<sup>51</sup> (See **table 5**.) The overall rates of obesity plus overweight were 47 percent in 1976–80 and 65 percent in 1999–2002.

Numerous factors—from lack of exercise to eating too many calories to genetics—contribute to obesity. Soda pop adds unnecessary, non-nutritious calories to the diet. Nutritionists and weight-loss experts routinely advise overweight individuals to consume fewer calories, especially from such nutrient-free foods as soft drinks. The National Institutes of Health recommends that people who are trying to lose weight or control their weight should drink water instead of sugar-containing soft drinks.<sup>52</sup>

**Table 4**  
Prevalence of overweight and obesity among American children (%)

	1971–74	1976–80	1988–94	1999–2002
6–11	4	7	11	16
12–19	6	5	11	16

**Sources:** Ogden CL, Flegal KM, Carroll MD, et al. Prevalence and trends in overweight among U.S. children and adolescents, 1999–2000. *JAMA*. 2002;288:1728–32. Hedley AA, Ogden CL, Johnson CL, et al. Prevalence of overweight and obesity among U.S. children, adolescents, and adults, 1999–2002. *JAMA*. 2004;291:2847–59.

**Table 5**  
Prevalence of overweight and obesity among American adults, age 20–74 (%)

	1976–80	1988–94	1999–2002
Overweight	32	33	34
Obese	15	23	31
Overweight or obese	47	56	65

**Source:** National Center for Health Statistics, Health E-Stats, “Prevalence of Overweight and Obesity among Adults: United States, 1999–2002”; [www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm](http://www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm).

Researchers have begun to find statistical and experimental evidence that soft drinks do, in fact, promote obesity.

In 2004, 37 gallons—60,000 calories—of carbonated, non-diet soft drinks were produced for each and every American.. Adding in several more gallons of fruit drinks and ades and iced teas adds thousands of more calories. All those calories from empty-calorie beverages certainly could contribute to significant weight gain.<sup>53</sup> Moreover, as some Americans do not consume sugar-sweetened soft drinks, the impact on the weight of those who do may be much larger than indicated by average consumption.

It is only in the last 10 years that researchers have begun to find statistical and experimental evidence that soft drinks do, in fact, promote obesity. An analysis of USDA 1994–96 dietary-intake data found that obesity rates have risen in tandem with soft drink consumption, and that heavy consumers of soda pop have higher calorie intakes.<sup>54</sup> A study of middle-school children in Santa Barbara County, California, found a strong association between obesity and consumption of both regular and diet soft drinks.<sup>55</sup> (The link between diet soda and obesity may reflect that some overweight children have made dietary changes or that children may consume large amounts of snack foods along with the sodas.)

National Cancer Institute scientists found that soft drinks provide a larger percentage of calories to overweight youths than to other youths. The difference was most striking among teenage boys: soft drinks provided 10.3 percent of the calories consumed by overweight boys, but only 7.6 percent of the calories consumed by other boys. No difference was observed in the overall caloric intake of the two groups.<sup>56</sup>

David Ludwig and his colleagues at Children’s Hospital in Boston conducted an observational study on the relationship between soft drinks and obesity in children.<sup>57</sup> The 19-month study involved 548 children whose average age was just under 12 years. It found that the chances of becoming obese increased significantly with each additional daily serving of sugar-sweetened drink. It also found that, at the beginning of the study, children’s consumption of sugar-sweetened drinks was associated with increased body mass index (BMI, a measure of overweight and obesity). Though the study was relatively small (37 children became obese over the course of 19 months), it adds to the evidence that soft drinks are contributing to the obesity epidemic.

A much larger observational study, the Growing Up Today Study, was conducted by Catherine Berkey and other researchers at Brigham and Women’s Hospital and Harvard Medical School. They studied more than 12,000 children between 9 and 14 years old and found that greater consumption of soft drinks was associated with small increases in BMI

over a two-year period. The authors concluded that “consumption of sugar-added beverages may contribute to weight gain among adolescents, probably due to their contribution to total energy intake.”<sup>58</sup>

That soft drinks contribute to obesity in adults, and not just children, was indicated by a Harvard School of Public Health study of tens of thousands of nurses over an eight-year period.<sup>59</sup> Women who increased their consumption of soft drinks from less than one a week to one or more per day gained an average of 18 pounds. Women who originally drank one or more soft drinks per day but then cut back to no more than one drink per week gained the least weight (about six pounds). The study also found that women who drank soft drinks daily had almost twice the risk of diabetes as women who drank little or no soda pop. Fruit drinks also promoted weight gain and diabetes.

Caroline Apovian, a researcher at Boston University School of Medicine, commented that the study “provides strong, scientifically sound evidence that excess calories from soft drinks are directly contributing to the epidemics of obesity and type 2 diabetes” and that “reducing sugar-sweetened beverage consumption may be the best single opportunity to curb the obesity epidemic.”<sup>60</sup>

Intervention studies can identify cause-and-effect relationships with greater certainty than observational studies like the ones just described. One such intervention study involved 644 students between 7 and 11 years of age in 29 school classes in England. The researchers studied the effect of strongly encouraging children in half the classes to drink less “fizzy” drinks.<sup>61</sup> After one year, the percentage of overweight and obese children in the “drink less” group remained the same, but increased by 7.5 percent in the control group.

Another well-designed intervention study, this one in Denmark, compared the health effects of sugar-sweetened and diet soft drinks.<sup>62</sup> For 10 weeks, overweight adults consumed, among other foods, either 600 calories’ worth of foods sweetened with sugar or similar foods prepared with artificial sweeteners. The group that ate the sugar-sweetened foods gained an average of 3.5 pounds, while those who consumed the artificially sweetened products lost an average of 2.0 pounds.

One way that soft drinks might contribute to weight gain is by increasing dietary intakes of fructose. That fructose



### Soda Drinkers: Better Keep Exercising!

To burn off the 250 calories in a 20-ounce bottle of non-diet soda pop, a 135-pound person would have to:

- walk three miles in 45 minutes
- play vigorous basketball for 40 minutes
- bike vigorously for 22 minutes

“Because of concerns about excessive consumption of sweetened beverages in place of more nutrient-rich or lower-calorie alternatives, children should be encouraged to avoid high-calorie, nutrient-poor beverages.”

— COMMITTEE ON PREVENTION OF OBESITY  
IN CHILDREN AND YOUTH, INSTITUTE OF  
MEDICINE

comes from either high-fructose corn syrup or sugar (sugar molecules are made up of fructose and glucose). Fructose appears to affect blood levels of such hormones as insulin, leptin, and ghrelin. According to one group of researchers, because of fructose’s effects on hormones, “prolonged consumption of diets high in energy from fructose could lead to increased caloric intake and contribute to weight gain and obesity.”<sup>63</sup>

Another line of research indicates that calories consumed in the form of liquids (such as soda pop), rather than solids, are more likely to promote obesity. In one study, subjects added 450 calories a day to their diets from either soft drinks or jelly beans during two four-week periods.<sup>64</sup> When they ate jelly beans, the subjects subconsciously compensated for the added calories by consuming roughly 450 fewer calories from other foods. However, when they drank soft drinks, the subjects failed to compensate, adding 450 calories to their previous diet. Other studies support that finding;<sup>65,66,67</sup> some research does not.<sup>68</sup> The differing results may be due to the foods tested, the subjects tested, the length of the tests, or other reasons. Pending definitive research, we should recognize the likelihood that liquid calories are particularly conducive to weight gain.

The overall body of research on soft drinks and obesity indicates that soft drinks are a special problem. Thus in 2004, the committee that advised the government on *Dietary Guidelines for Americans* concluded:

In summary, although the evidence is not large and there are methodologic problems with this research, the preponderance of prospective data available suggest that added sugars (particularly in beverages) are associated with an increase in energy intake. As a result, decreasing the intake of added sugars (particularly in beverages) may help prevent weight gain and may aid in weight loss.<sup>69</sup>

As noted above, the 2005 *Dietary Guidelines for Americans* itself emphasizes this concern.

The fear that soft drinks are fueling the obesity epidemic was echoed by the Institute of Medicine’s (IOM’s) Committee on Prevention of Obesity in Children and Youth.<sup>70</sup> It acknowledged the lack of “definitive proof” that soft drinks cause obesity, but still declared: “Because of concerns about excessive consumption of sweetened beverages in place of more nutrient-rich or lower-calorie alternatives, children should be encouraged to avoid high-calorie, nutrient-poor beverages.”

## Bones and Osteoporosis

People who drink soft drinks instead of milk or other dairy products likely will have lower calcium intakes. Low calcium intake contributes to osteoporosis, a disease leading to fragile and broken bones. In 2002, the National Osteoporosis Foundation estimated that 10 million Americans had osteoporosis. Another 34 million had low bone mass and were at increased risk for the disease.<sup>71</sup> Women are more frequently affected than men. Considering the low calcium intake of today's teenage girls, osteoporosis likely will continue to be a problem.

The risk of osteoporosis depends in part on how much bone mass is built up early in life. Girls build 92 percent of their bone mass by age 18,<sup>72</sup> but if they don't consume enough calcium in their teenage years they cannot catch up later. That's why experts recommend higher calcium intakes for youths aged 9 to 18 than for adults aged 19 to 50. Teenage girls in 1994–96 were consuming only 60 percent of the recommended amount of calcium; those who drank soft drinks consumed almost one-fifth less calcium than those who didn't drink soft drinks.<sup>73</sup>

Although osteoporosis takes decades to develop, preliminary research suggests that the lower calcium intake that may result from drinking soda pop instead of milk can contribute to broken bones in children. In a study of 200 girls 3 to 15 years old, the 100 who had suffered broken bones had lower bone density than the 100 who had not.<sup>74</sup> In a Mayo Clinic study, researchers looked at rates of bone fracture in residents under the age of 35 in Rochester, Minnesota. They found a 32 percent increase between 1969–71 and 1999–2001 in distal forearm bone fractures in males and a 56 percent increase in females. Among 10- to 14-year-olds of both sexes, the increase was 63 percent. That study couldn't establish a cause-and-effect relationship, but the researchers suggested that increasing obesity rates, increased soft drink and decreased milk consumption, and suboptimal calcium consumption could be the culprits.<sup>75</sup>

Canadian researchers found that over a two-year period during adolescence—the peak period for building bone mass—girls who drank more soft drinks and other beverages with few nutrients (fruit drinks, coffee, tea) built up less bone mass.<sup>76</sup> The same association was not found in boys, perhaps because boys eat more calcium-rich cheese than do girls.

A small study by Grace Wyshak of Harvard Medical School found strong associations between consumption of carbonated beverages and bone fractures in teenage girls.<sup>77</sup> Among active girls, the risk of bone fracture

People who drink soft drinks instead of milk and other dairy products likely will have lower calcium intakes—a loss that contributes to osteoporosis and to broken bones in children.

“Nationally, there is great concern about the effects of carbonated-beverage consumption on obesity, tooth decay, osteoporosis, and other health problems.”

— GRACE WYSHAK, HARVARD MEDICAL SCHOOL

was almost five times greater in girls who consumed colas compared to girls who did not. Among all girls in this study, the risk of bone fracture in those who consumed carbonated beverages was more than three times that in girls who did not consume carbonated beverages. The author acknowledges limitations in the study (for example, failure to ascertain the amounts of soft drinks and milk consumed), but stated:

In conclusion, nationally, there is great concern about the effects of carbonated-beverage consumption on obesity, tooth decay, osteoporosis, and other health problems. Concern about the health impact of carbonated-beverage consumption, in particular, the association with bone fractures in adolescent girls, is validated by our findings. Our findings have implications both for the health of teenagers and for the health of women at later ages.

In an editorial accompanying that paper, a specialist in adolescent medicine stated that those “findings are alarming and warrant confirmation.”<sup>78</sup> He highlighted the sharp increase in soft drink consumption and the sharp drop in milk consumption.

## Tooth Decay and Erosion

Refined sugars are one of several important factors that promote tooth decay (dental caries). Regular soft drinks promote caries because they bathe the teeth of frequent consumers in sugar-water for long periods of time during the day. An analysis of data from 1971–74 found a strong association between the frequency of between-meal consumption of soda pop and caries.<sup>79</sup> (Those researchers distinguished the effects of soft drinks from sugary desserts.) A recent large study of young children in Iowa found “intake of regular soda pop was the strongest predictor of the extent of caries.”<sup>80</sup>

Tooth-decay rates in the United States have declined considerably in recent decades, thanks to such preventive factors as fluoride-containing toothpaste, fluoridated water, and tooth sealants. That may be why one study that used data from 1988–94 found an association between soda consumption and caries in people over 25, but not in younger people.<sup>81</sup> Also, as Amid Ismail, a professor of epidemiology at the University of Michigan’s School of Dentistry, points out, Americans consume so many sugary foods it simply may not be possible to tease out the effects of individual foods on teeth.<sup>82</sup>

Caries remains a problem, however, especially for low-income and minority children. As a report from the Surgeon General stated, “Despite



recent declines, dental caries is a prevalent disease, with some age and population groups particularly vulnerable.”<sup>83</sup> A large survey in California found that children (ages 6–8 and 15) of less-educated parents have 20 percent higher rates of decayed and filled teeth.<sup>84</sup> A national study found that African American and Mexican American children (6 to 18 years old) are about twice as likely to have untreated caries as their white counterparts.<sup>85</sup>

To prevent tooth decay, health experts—and Refreshments Canada (formerly the Canadian Soft Drink Association)—recommend eating sugary foods and beverages with meals and limiting between-meal snacking of sugary and starchy foods.<sup>86</sup> Unfortunately, many heavy drinkers of soft drinks ignore both of those precepts.

Besides tooth decay, dentists are concerned about erosion caused by the acids in soft drinks, including sugar-free diet drinks.<sup>87</sup> The American Dental Association sums up the matter this way:

Though there is limited epidemiological evidence assessing the association between oral health and soft drink consumption, it consistently indicates that soft drinks adversely affect dental caries and enamel erosion. Moreover, numerous in vitro and animal studies have consistently shown enamel erosion with the use of soft drinks. Given this evidence it would seem appropriate to encourage children and adolescents to limit their intake of soda.<sup>88</sup>

## Heart Disease

Heart disease is the nation’s number-one killer. Some of the most important causes are diets high in saturated and *trans* fats and cholesterol, cigarette smoking, and a sedentary lifestyle. In many adults, a diet high in sugar may also be a modest contributor to heart disease.

High-sugar diets may contribute to heart disease in people who are “insulin resistant” or have “syndrome X.” Those people, an estimated one-fourth of adults, frequently have high levels of triglycerides and low levels of HDL (“good”) cholesterol in their blood, abdominal obesity, and elevated blood pressure and blood sugar. When they eat a diet high in carbohydrates, their triglyceride and insulin levels rise. In many studies, sugar has a greater effect than other carbohydrates.<sup>89</sup> High triglyceride levels are associated with a higher risk of heart disease and diabetes.<sup>90</sup>

A study of young adults (19 to 38 years old) in Louisiana found a strong association between consumption of sweetened beverages and risk factors

Besides tooth decay, dentists are concerned about erosion caused by the acids in soft drinks, including sugar-free diet drinks.

Cola drinkers who reduced their consumption of soft drinks (to less than half their customary levels) were almost one-third less likely to experience recurrence of kidney stones.

for syndrome X.<sup>91</sup> According to the researchers, that finding was not simply due to the subjects consuming excess calories or being overweight.

It is sensible for insulin-resistant people, in particular, to consume low levels of regular soft drinks and other sugary foods, though researchers are urging that everyone reduce their intake of refined carbohydrates.<sup>92</sup> More research is needed on insulin resistance in adolescents.

### Kidney Stones

Kidney stones are one of the most painful disorders to afflict humans and one of the most common disorders of the urinary tract. According to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), a unit of the National Institutes of Health, more than 1 million cases of kidney stones were diagnosed in 1996.<sup>93</sup> NIDDK estimates that 10 percent of all Americans will have a kidney stone during their lifetime. Several times more men, frequently between the ages of 20 and 40, are affected than women. Young men are also the heaviest consumers of soft drinks. After a study suggested a link between soft drinks and kidney stones, researchers conducted an intervention trial.<sup>94</sup> That trial involved 1,009 men who had suffered kidney stones and drank at least 5<sup>1</sup>/<sub>3</sub> ounces of soda pop per day. Half the men were asked to refrain from drinking pop, while the others were not asked to do so. Over the next three years, cola drinkers who reduced their consumption (to less than half their customary levels) were almost one-third less likely to experience recurrence of stones. Among those who usually drank fruit-flavored soft drinks—which are acidified with citric acid rather than the phosphoric acid used in colas—drinking less had no effect.

Coming at the problem from another angle, researchers had subjects consume large volumes of cola drinks for one or several days. The next day, the subjects' urine contained higher levels of oxalate and lower levels of magnesium and citrate, changes that could contribute to kidney stone formation.<sup>95,96</sup> While more research needs to be done to prove the cola-stone connection, NIDDK recommends that people trying to avoid more stones should limit their consumption of cola beverages, as well as of coffee and tea.<sup>97</sup>

### Additives: Psychoactive Drug, Allergens, and More

Several additives in soft drinks raise health concerns. *Caffeine*, a mildly addictive stimulant drug, is present in most cola and “pepper” drinks,

as well as in some orange, lemon-lime, and vanilla sodas and other products. Caffeine's addictiveness, in fact, may be one reason why six of the seven most popular soft drinks contain caffeine.<sup>98</sup> Caffeine-free colas are available, but account for only about 5 percent of the volume of colas made by Coca-Cola.<sup>99</sup> On the other hand, some companies have begun marketing soft drinks, such as Red Bull, that contain several times the caffeine level of Coke or Pepsi.

Companies say they add caffeine as a flavoring. Coca-Cola says "Flavor is the only reason for using caffeine in these products."<sup>100</sup> However, most regular-cola-drinkers cannot detect caffeine's flavor when the substance is consumed in soft drinks.<sup>101</sup> That strongly suggests that companies really add caffeine primarily for its physiological effects, not for its flavor. Indeed, an official of the British soft drinks manufacturer Hero Drinks Group forthrightly states that caffeine "is added mainly for its stimulatory effects."<sup>102</sup>

In 1994–96, the average 13- to 18-year-old boy who drank soft drinks consumed about 1<sup>2</sup>/<sub>8</sub> cans per day. Those drinking Mountain Dew would have ingested 92 milligrams (mg) of caffeine from that source (55 mg caffeine/12 ounces). That is equivalent to a six-ounce cup of brewed coffee. Boys in the 90th percentile of soft drink consumption daily consume as much caffeine as is in two cups of coffee; for girls, the figure is 1<sup>1</sup>/<sub>2</sub> cups of coffee.

One problem with caffeine is that it increases the excretion of calcium in urine.<sup>103</sup> Drinking 12 ounces of caffeine-containing soft drink causes the loss of about 20 mg of calcium, or 2 percent of the recommended consumption. That loss, compounded by the relatively low calcium intake in girls who are heavy consumers of soda pop, may further increase the risk of osteoporosis.

The amounts of caffeine in soft drinks can have distinct pharmacological and behavioral effects. Caffeine can increase alertness, an effect that many people desire. However, caffeine also can cause nervousness, irritability, sleeplessness, and rapid heartbeat.<sup>104</sup> It causes children who normally do not consume much caffeine to be restless and fidgety, develop headaches, and have difficulty going to sleep.<sup>105,106</sup> Also, caffeine's addictiveness may keep people hooked on soft drinks (or other caffeine-containing beverages).<sup>107</sup> One reflection of the drug's addictiveness is that when children aged 6 to 12 stop consuming caffeine, they suffer withdrawal symptoms that impair their attention span and performance.<sup>108</sup>

Caffeine's addictiveness may be one reason why six of the seven most popular soft drinks contain caffeine.

The amounts of caffeine in one or two cans of caffeinated soft drink can affect performance and mood, increase anxiety in children, and reduce the ability to sleep.

One study showed that the caffeine equivalent of two to three cans of soft drink per day (100 mg/day) is sufficient to produce physical dependence, characterized by withdrawal symptoms of tiredness and headache if consumption is stopped. That study also found that 25 mg of caffeine is sufficient to suppress caffeine-withdrawal headache.<sup>109</sup> Another study showed that 40 mg of caffeine (roughly the amount in one can of soda) produces mood and performance effects,<sup>110</sup> while yet another demonstrated that low doses of caffeine can have cognitive and performance effects—the former manifesting at doses as low as 12.5 mg.<sup>111</sup>

The Australia New Zealand Food Authority has concluded the following:<sup>112</sup>

- The amounts of caffeine in one or two cans of caffeinated soft drink can affect performance and mood, increase anxiety in children, and reduce the ability to sleep, though “the threshold dose for possible behavioral effects in children remains unclear.”
- Typical doses of caffeine “may lead to withdrawal effects and some physical dependence in adults...Further research will be required...in children.”
- There is little evidence for adverse cardiovascular effects.

Several additives used in carbonated and noncarbonated soft drinks cause occasional allergic reactions. *Yellow 5 dye* causes asthma, hives, and a runny nose.<sup>113</sup> The red colorings *cochineal* and *carmine*, which are extracted from insects, cause rare life-threatening reactions.<sup>114</sup> Dyes can cause attention-deficit hyperactivity disorder (ADHD) in sensitive children.<sup>115,116</sup>

In diet sodas, certain *artificial sweeteners* raise concerns. Saccharin, which has been replaced by other chemicals in all but a few brands, was linked in a human study to urinary bladder cancer<sup>117</sup> and in numerous animal studies to cancers of the bladder and other organs.<sup>118</sup> Even though in 2000 the government repealed the law requiring a warning label on products containing saccharin, the Center for Science in the Public Interest (CSPI) recommends that the additive still should be avoided.<sup>119</sup> Another questionable artificial sweetener is acesulfame, which was approved in 1998 for use in soft drinks. The testing was flawed, but there were signs of increased cancer risk in animals.<sup>120</sup> Probably the safest synthetic sweetener is Splenda (sucralose), which is rapidly displacing aspartame (NutraSweet), long the major artificial sweetener. Unfortunately, Splenda is often used together with acesulfame. Aspartame, for two decades the most widely used artificial sweetener, may

cause occasional adverse reactions (including headaches<sup>121</sup>) and should be better tested in animals to provide greater assurance that it does not promote cancer.

## Aggressive Marketing of Soft Drinks

Soft drink companies are among the most aggressive marketers in the world. They have used myriad techniques, including ones that some consider unethical, to increase sales.

For starters, and most importantly, companies make sure their products are always readily accessible. Coca-Cola's stated goal is to:

make Coca-Cola the preferred drink for any occasion, whether it's a simple family supper or a formal state dinner....To build pervasiveness of our products, we're putting ice-cold Coca-Cola classic and our other brands within reach, wherever you look: at the supermarket, the video store, the soccer field, the gas station—everywhere.<sup>122</sup>

Coca-Cola sells its soft drinks in the United States at 2 million stores, at more than 450,000 restaurants, and from 1.4 million vending machines and coolers.<sup>123</sup> Industry-wide, in 2000, 3 million soft drink vending machines<sup>124</sup> dispensed about one-seventh of all soft drinks sold.<sup>125</sup>

### Through Advertising and Marketing

Soft drink advertising budgets dwarf all advertising and public service campaigns promoting the consumption of fruits, vegetables, low-fat milk, and other healthful foods. In 2000, the Coca-Cola Company, which accounts for 44 percent<sup>126</sup> of the soft drink market in the United States, spent over \$200 million on television, magazine, and other media advertising.<sup>127</sup> The entire industry spent over \$700 million.<sup>128</sup> Between 1986 and 1997, the top four soft drink companies spent \$6.8 billion on advertising.<sup>129</sup> That level of investment pays off: In 2004, Coca-Cola and its subsidiaries spent \$2.2 billion on promotions worldwide and sold \$22 billion worth of beverages.<sup>130</sup>

In addition to media advertising, companies spend hundreds of millions of dollars a year on other forms of marketing, from couponing to sponsorship of concerts to sponsorship of professional organizations. In the United States in 2003, Coca-Cola spent \$184 million on promotional activities.<sup>131</sup>



The ubiquity of soft drinks, and their relentless marketing, reflect manufacturers' stated desire "to build pervasiveness of our products."

Worldwide, in 2005, Coca-Cola expects to spend \$350 million to \$400 million more on “marketing and innovation” than it did in 2004.<sup>132</sup>

To its credit, the industry has respected one advertising limit. Companies have not gone directly after 4-year-olds by plugging pop on Saturday-morning television. But that important bit of self-restraint aside, the major companies target slightly older children aggressively and relentlessly.

In 1999, Dawn Hudson, Pepsi’s chief of marketing, told the *New York Times* that marketing to 8- to 12-year-olds was a priority. “We’re absolutely going to look at preteens,” she said.<sup>133</sup> At Toys “R” Us, you can buy a memo board with a Coca-Cola motif, a deck of Uno cards with Coke ads on the faces of the cards and “Coca-Cola” on the backs, or a Coca-Cola checkers or chess set (the pieces are Coke bottles or characters from Coca-Cola ads).<sup>134</sup> Soft drink companies are paying to have their products shown in Hollywood movies, according to the advocacy group Commercial Alert.<sup>135</sup> Coca-Cola, the top brand to use such product placements, has been featured on the teen-targeted *Young Americans*, which the *New York Daily News* called “a slick, thinly disguised commercial” for Coke, and *American Idol*.<sup>136</sup> Not surprisingly, Pepsi was featured in the WB show *Pepsi Smash*, and it played a big part in ABC’s reality show *The Runner*. Mountain Dew was showcased in the CBS reality shows *Survivor* and *Survivor II*.



Major soft-drink companies put their logos everywhere—and one company has even turned its beverage containers into toys.

### Through Schools

Companies love to cultivate brand loyalty (and sell product) in the trusted environment of public schools. Pepsi has advertised on *Channel One News*, a daily program seen by 8 million students in 12,000 junior high, middle, and high schools.<sup>137</sup> Moreover, 25 percent of elementary schools, 62 percent of middle schools, and 92 percent of high schools sell soft drinks to students, using vending machines or school stores.<sup>138</sup> Schools get a cut of the profits. A 2004 survey conducted by CSPI found that of vended beverages, 70 percent were sugary drinks such as soda pop, juice drinks, iced tea, and sports drinks.<sup>139</sup> Only 14 percent of the sodas were diet.

Marketing contracts that give one company a school-wide monopoly provide extra benefits to local bottlers and to schools. Exclusive contracts

typically result in heavier advertising and more vending machines. Companies have paid dozens of school districts for such exclusive marketing agreements. For instance, Coca-Cola has a 10-year exclusive contract with Colorado Springs that is worth between \$8 million and \$11 million.<sup>140</sup> Even little East Stroudsburg, Pennsylvania, signed a 10-year, \$736,000 contract with Pepsi.<sup>141</sup> Dr Pepper paid the Grapevine Colleyville, Texas, School District \$3.45 million for a 10-year contract; it includes rooftop advertising to reach passengers in planes landing at the nearby Dallas-Fort Worth Airport.<sup>142</sup> To strengthen its reputation, Coca-Cola has built strong links with the Boys & Girls Clubs of America. The company has raised tens of millions of dollars for the clubs in recent years (but does not have exclusive marketing rights in the clubs).<sup>143</sup>

Not surprisingly, the American Beverage Association defends the marketing of soft drinks in schools, saying:

Beverage companies have helped narrow the education funding gap by providing grants, scholarships and employee volunteer programs to local schools. School partnerships with beverage companies also generate revenue from the sale of a wide variety of beverages that help schools pay for arts and theater programs, foreign language classes, computers and other technology, sports and physical education equipment....Each year, schools across America earn tens of millions of dollars from the sale of beverages at school. There are no strings attached to the money.<sup>144</sup>

## Through Tie-ins

Soft drink companies frequently link their brands to popular youth-oriented movies and music groups. Thus, in 2001, Coca-Cola was the exclusive global marketing partner for Time-Life-Warner's movie, *Harry Potter and the Sorcerer's Stone*, and was reported to be spending \$150 million on marketing related to that movie.<sup>145</sup> In 2005, Pepsi bought the rights to Yoda, the *Star Wars* creature, to hawk Diet Pepsi.<sup>146</sup> Coca-Cola and Pepsi-Cola have also paid pop music stars such as Britney Spears and Christina Aguilera to promote their products.

Companies also hire star athletes as pitchmen (and pitchwomen). In 2003, Coca-Cola hired Cleveland Cavaliers basketball phenom LeBron James for a reported \$14 million to advertise Sprite and Powerade over the next six years. Another pitchman didn't work out so well.



Coke and Pepsi have long used sports and entertainment stars to encourage consumption of their soft drinks.

The latest trend is to fortify soft drinks with nutrients, but nutritionists question the wisdom of adding nutrients to processed foods.

Coke dropped Los Angeles Lakers star Kobe Bryant after he was accused of sexually assaulting a woman.<sup>147</sup>

### Through Targeted New Products

Soft drink companies increasingly have been creating new products to appeal to different segments of the population. Low-calorie diet sodas have been aimed at women and caffeine-free products at parents. Some higher-caffeine products are aimed at teenaged boys. Pepsi Blue, Vanilla Coke, and Pepsi's Code Red are marketed to youths, minorities, or people tired of colas.<sup>148</sup> In 2004, companies tried a new gambit by offering drinks with 50 percent less sugar (thanks to artificial sweeteners). Coca-Cola's C2 and Pepsi's Edge were targeted at consumers trying to cut their intake of calories and carbohydrates; both flopped.<sup>149</sup>

The latest trend is to fortify soft drinks with nutrients. Cadbury Schweppes has introduced 7 UP PLUS, which is fortified with calcium, vitamin C, and a tablespoon of juice. It does not contain caffeine and has only 10 calories per can. That certainly overcomes many of the problems with typical soft drinks, but nutritionists still question the wisdom of adding nutrients to processed foods. Joanne Lupton, a nutrition professor at Texas A&M University, told the *Wall Street Journal*, "The whole concept of putting good nutrients into less-than-nutritious foods is not a good idea."<sup>150</sup> Whether such drinks will be consumed by people who previously drank diet soda, regular soda, or other beverages is not known.

### Through Conscience, Cost, and Craft

To win allies and quiet potential critics, companies sometimes open their purse strings. In 2003, Coca-Cola gave \$1 million to the American Academy of Pediatric Dentistry, a small professional association.<sup>151</sup> Academy president David Curtis defended his group against criticism, stating, "Scientific evidence is certainly not clear on the exact role that soft drinks play in terms of children's oral disease." Before the gift, the group candidly noted the link between soft drinks and tooth decay.

Also in 2003, the Coca-Cola Company reaped good publicity when it announced that it would not advertise its soft drinks directly to children under 12.<sup>152</sup> However, that turned out to be more smoke than substance. A company spokeswoman acknowledged that the "new" policy had actually been in place for 50 years—and, further, that it would not affect the sale of Coke products in schools. Coca-Cola continues to use



celebrities and other marketing tactics attractive to children under 12 to promote its products.

One of the most important factors fueling soft drink sales is their relatively low cost. (See **table 6**.) Supermarket soft drink brands are particularly cheap, often as low as 28 cents per quart, but even Coke and Pepsi may be available for about 33 cents per quart when on special.<sup>153</sup> Milk costs two to three times as much, about 75 to 95 cents per quart. Orange juice costs closer to \$1 or more per quart.

With sales down since 1998, the soft drink industry is working extra hard to maximize sales. A recent president of Coca-Cola bemoaned the fact that his company's products accounted for only 1 billion of the 47 billion servings of beverages that people worldwide consume daily.<sup>154</sup> Leaving no stone unturned to increase sales, Coca-Cola has gone so far as to encourage table-service restaurants not to serve water unless asked.

A Coca-Cola marketing executive explained: "You kill your beverage sale opportunity when you quench your customer's thirst with free water. Offering water upon request only increases sales of revenue-generating beverages."<sup>155</sup>

## Citizens Fight Back

By 2000, the massive increases in soft drink consumption and in obesity began fueling a backlash among parents, school officials, and activists. People began hearing the message that was summarized succinctly by Robert P. Schwartz, a pediatrician at Wake Forest University School of Medicine, in an editorial in *The Journal of Pediatrics*: "We should not

**Table 6**  
**Low soft-drink prices promote consumption**

Beverage	Cost	Cost per quart
Cola, supermarket brand	\$0.59/2 liters	\$0.28
Coca-Cola	\$0.69/2 liters	\$0.33
	\$2.50/6½ liters	\$0.79
	\$2.67/12 12-oz. cans	\$0.59
Pepsi-Cola	\$2.50/12 12-oz. cans	\$0.56
	\$0.79/2 liters	\$0.37
Sierra Mist	\$0.89/2 liters	\$0.42
Cranberry Juice Cocktail	\$1.99/64 oz.	\$1.00
Capri Sun Juice	\$2/10 6¾ oz. pouches	\$0.95
Bottled water (supermarket brand)	\$0.89/gallon	\$0.22
Bottled spring water (supermarket brand)	\$0.89/gallon	\$0.22
Seltzer water, club soda, supermarket brand	\$0.89/2 liters	\$0.42
Dannon water	\$5.99/24 16.9-oz. bottles	\$0.47
Milk	\$2.99/gallon	\$0.75
	\$0.95/quart	\$0.95
Orange juice, frozen, supermarket brand	\$1.49/12-oz. can	\$0.99
Tropicana Orange Juice	\$1.88/64 oz.	\$0.94
Florida's Natural Orange Juice	\$2.50/64 oz.	\$1.25

**Source:** Prices at Washington, D.C., area stores, late 2004–early 2005; many prices are specials.

## THE LABELING OF SUGARS AND SOFT DRINKS

One limitation of the nutrition labels on soft drinks is that the amount of sugars is not put in any context. Other nutrients are expressed as a percentage of daily need or daily limit—that is, the Daily Value. It would be useful if the same were done with added sugars.

USDA has recommended that, depending on their calorie intake, people consume no more than 6 to 10 percent of their calories from added sugars. For example, people who consume 2,000 calories per day should limit themselves to 10 teaspoons (40 grams) of added sugars.<sup>i</sup> That's about what's in the average soft drink: A 12-ounce Coke or Pepsi has 40 grams of sugar, while Mountain Dew has 46 grams and Sunkist Orange Soda has 52 grams.

In 1999, CSPI petitioned the U.S. Food and Drug Administration (FDA) to set a Daily Value for added sugars at 40 grams, but the FDA postponed any action pending advice from the Institute of Medicine or other body that it considers more authoritative than USDA. Three years later, an IOM subcommittee recognized that diets high in added sugars are low in vitamins and minerals. It advised that people get 25 percent or less of their calories in the form of added sugars and that they cut back on beverages and other foods high in added sugars.<sup>ii</sup> That proportion is far higher than what USDA or others have advised. The World Health Organization and many foreign governments have recommended that people limit added sugars to 10 percent or less of their calories.

Shortly after the IOM issued its report, its president clarified that the 25 percent figure was “not meant to convey a desirable or even acceptable standard intake....It does not address the issue that added sugar intakes at 25% or even well below it, may well have significant implications for caloric balance and weight control.”<sup>iii</sup> In 2003, a different committee of the IOM stated that the FDA should make it an “urgent consideration” to “place this important source of calories (sugars or added sugars) in the context of the total diet,” whether that be through the use of a “% DV” or other means.<sup>iv</sup> The FDA has done nothing.

With sweetened beverages providing a whopping 9 percent of all calories—and higher percentages for many teenagers and other individuals—nutrition labeling does not provide sufficiently clear and emphatic advice to discourage overconsumption. In addition to information about added sugars in the Nutrition Facts panel, soda labels should remind consumers of the links between soda and obesity and dental problems, and should encourage people to drink more-healthy beverages.

auction our children’s health to the highest bidder.”<sup>156</sup> From coast to coast, parents, health professionals, and others have been campaigning against soft drink sales in schools. As a result, California, Los Angeles, San Francisco, New York City, Philadelphia, Boston, Seattle, Tennessee, Arizona, and other jurisdictions have banned the sale of soft drinks in some or all schools (and, in New York and elsewhere, school officials have begun improving the nutritional quality of school meals as well). Though school officials worry that such bans would deprive them of valuable income, some school districts did not experience losses.<sup>157</sup> Another stimulus in this regard is that trial lawyers have raised the possibility that school officials could be held liable for undermining students’ health by tempting them to buy soft drinks in school hallways.

In 2004, health advocates got support from the American Academy of Pediatrics.<sup>158</sup> It issued a policy statement that urged pediatricians to “work to eliminate [sugar-] sweetened drinks in schools.” It also urged that “consumption or advertising of [sugar-]sweetened soft drinks within the classroom” be eliminated and other measures be taken to discourage consumption by school children. That endorsement reinforced a 2002 statement on soft drinks issued by the American Dental Association.

## Recommendations for Action

Soft drinks are popular, in part, because people like their taste. But powerful advertising, universal availability, low price, and the use of a mildly addictive ingredient (caffeine) are other factors that have made soft drinks a routine snack and a standard component of meals instead of the occasional treat they were considered several decades ago. Moreover, many of today’s younger parents grew up with soft drinks, see it as normal to drink pop throughout the day, and so make little effort to restrict their children’s consumption.

The bottom line is health. Soft drinks provide enormous amounts of refined sugars and calories to a nation that already does not meet national dietary goals and is experiencing an epidemic of obesity. The replacement of milk by soft drinks in teenage girls’ diets may increase rates of osteoporosis. Soft drinks may also contribute to dental problems, kidney

### Improving School Foods

For a wealth of resources for improving foods in your child’s school, city, or state, visit [www.cspinet.org/nutritionpolicy](http://www.cspinet.org/nutritionpolicy).



### What to Drink Instead of Soft Drinks...

- Water from the tap, bottle, or fountain
- Seltzer water and unsalted club soda
- Spritzer (half-seltzer, half-orange juice)
- Orange, grapefruit, and other juices
- Low-fat or fat-free milk

stones, and heart disease. Additives in some of the drinks may cause insomnia, behavioral problems, allergic reactions, and cancer.

Based on its past record, the soft drink industry will do everything possible to persuade even more consumers to drink even more soda pop even more often. Parents and health officials need to recognize soft drinks for what they are—*liquid candy*—and do everything they can to return those beverages to their former role as an occasional treat. As Walter Willett, chairman of the nutrition department at the Harvard School of Public Health and overseer of the Nurses' Health Study, said, "The message is: Anyone who cares about their health or the health of their family would not consume these beverages."<sup>159</sup>

The Center for Science in the Public Interest offers the following suggestions for reducing the consumption of soft drinks:

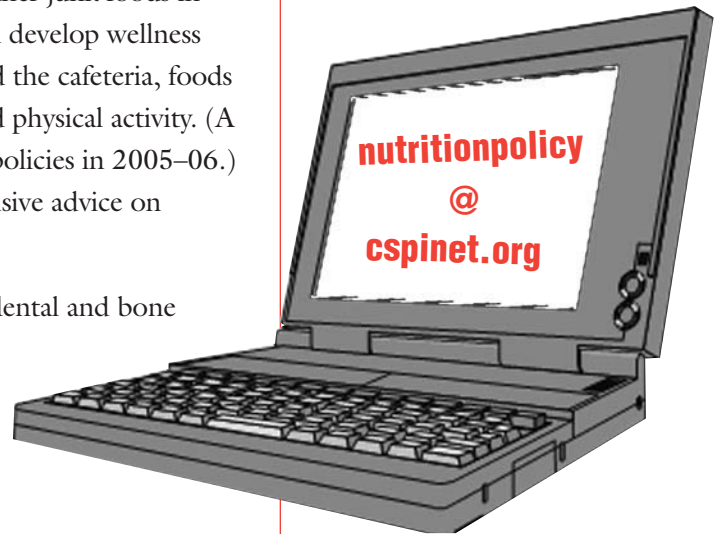
- Individuals and families should consider how much soda pop they are drinking and reduce consumption accordingly. Parents should stock their homes with healthful foods and beverages that family members enjoy and, for the most part, not keep soft drinks—especially non-diet drinks—in the refrigerator.
- Physicians, nurses, dentists, and nutritionists should routinely ask their patients how much soda pop (and other low-nutrition foods) they are consuming and advise them, when appropriate, to consume less.
- National and local governments should require chain restaurants to declare the calorie content of soft drinks and all other items on menu boards. (On printed menus, where there is more room, saturated and *trans* fat and sodium should also be listed.) Since 2003, bills to that effect have been introduced in both chambers of Congress and legislatures in California, Maine, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Texas, and other states.<sup>160</sup> In 2004, an Institute of Medicine committee on childhood obesity recognized the importance of having restaurants provide nutrition information on menus or at the point of sale.<sup>161</sup> Vending machines, too, should be required to disclose the calorie content of each item they offer.
- The Food and Drug Administration should set a Daily Value (daily limit) for refined sugars and require the number of grams of those sugars and the percentage of that Daily Value to be included on Nutrition Facts labels. Labels on non-diet soft drinks should state that

frequent consumption of those drinks promotes obesity, diabetes, and tooth decay and may displace more nutritious foods from the diet, thereby promoting osteoporosis and other health problems.

- Local, state, and federal governments should be as aggressive in providing water fountains in schools, government buildings, parks, and other public spaces as the industry is in placing vending machines.
- School systems and other organizations catering to children should stop selling or advertising soft drinks, candy, and other junk foods in hallways, shops, and cafeterias. They should instead develop wellness policies that would cover foods sold in hallways and the cafeteria, foods provided at classroom parties, food advertising, and physical activity. (A 2004 federal law requires schools to develop such policies in 2005–06.) CSPI's School Foods Tool Kit provides comprehensive advice on improving the foods sold in schools.<sup>162</sup>
- Organizations concerned about children's health, dental and bone health, heart disease, and cancer should collaborate on campaigns to reduce soft drink consumption.
- State and local governments should consider levying small taxes on soft drinks, as California, New York, Arkansas, Chicago, and most Canadian provinces currently do. Arkansas, for instance, raises \$40 million per year from such a tax.<sup>163</sup> However, unlike current junk-food taxes, the revenues from which go into the general treasury, revenues from new taxes should be earmarked for promoting health and fitness. If all states taxed soft drinks at Arkansas's rate (2 cents per 12-ounce can), they could raise \$3 billion annually. Those revenues could fund mass-media campaigns to improve diets and increase physical activity, build exercise facilities (bike paths, swimming pools, etc.), and support physical-education programs in schools.
- Federal agencies should sponsor more scientific research to further explore the effects of soft drink (and refined-sugars) consumption on nutrient intake, obesity, dental caries and erosion, osteoporosis, kidney stones, and heart disease.

## Take Action!

Contact CSPI for help in getting sodas out of schools.



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