

# Current Comments

## Should We Kick the Caffeine Habit?

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When I was a boy growing up in New York, a weekly event was the comics section of the *New York Sunday News*. I looked forward to the adventures of *Dick Tracy*, *Orphan Annie*, and *Andy Gump*. But I also enjoyed the machinations of *Mr. Coffee Nerves*. The villain of this comic strip advertisement was a diabolic dandy with a long mustache and black suit. His life was dedicated to making people miserable. Eventually good would prevail over evil because the victim of *Mr. Coffee Nerves* discovered the blessings of *Postum*, a cereal-based hot drink. I still drink *Postum* a few times a week.

*Mr. Coffee Nerves* notwithstanding, millions of people throughout the world still habitually consume an alkaloid derived from plants that thrive in Africa and Latin America. This drug quickens the flow of thought and enhances the association of ideas. It staves off fatigue. It has marked but ambiguous effects on the cardiovascular system. It is habit-forming. Many users dread facing the day without it.

The drug isn't some sinister substance that's corrupting the population of our nation. It's caffeine, which is found mainly in coffee and tea and many soft drinks. It's also found in *maté*, the national beverage of many South American countries. That drink is made with the dried leaves of the *maté* shrub.

The average daily consumption of caffeine in the US is about 200 milligrams per person, including children.<sup>1</sup> About 100 mg of caffeine is enough to

induce significant biological effects in most people. This dose is about what you get in a cup of coffee. Twenty to 30% of us in the US take 500-600 mg a day; 10% may consume more than 1,000 mg a day.<sup>2</sup> And the per capita consumption of coffee in Scandinavia is even higher. The average Nordic citizen consumes from 14 to 27 pounds of coffee a year. So do people in the Netherlands, Belgium, and Switzerland. In contrast, the average American consumes 12.43 pounds.<sup>3</sup>

Other sources of caffeine are non-prescription headache, allergy, or cold medicines. They can contain from 15 to 30 mg of caffeine per tablet.<sup>4</sup>

We usually think of caffeine as an adult's drug. But it is important to remember that caffeine is also consumed by children, mostly in the form of soft drinks. In a paper in the *Journal of the American Dietetic Association*, Mary Louise Bunker and Margaret McWilliams reported that a can of some soft drinks contains about 30-60 mg of caffeine. The authors warn that when very young children drink a can of *Coca-Cola*, *Pepsi*, *Dr. Pepper*, or *Mountain Dew*, the "caffeine content is comparable to an adult drinking four cups of instant coffee."<sup>5</sup>

Caffeine's enormous popularity is undoubtedly due to the stimulation it provides. But different people react differently to caffeine. Among the effects that have been reported are frequent urination, jitteriness, light-headedness, irregular heartbeat and breathing, upset

stomach, diarrhea, and heartburn.<sup>2</sup> Caffeine consumption is also associated with tinnitus, a chronic ringing or hissing noise in the ears.<sup>6</sup> Other reported problems have been anxiety or depression. It is known from studies on animals that caffeine changes the activity of certain neurotransmitters that influence our moods. Disturbed sleep is another common effect.<sup>2</sup>

John F. Greden of the University of Michigan Medical Center lists such problems as symptoms of a syndrome called "caffeinism." He defines caffeinism as "the ingestion and consequent pharmacological actions of high doses of caffeine." He says the syndrome is "infrequently recognized" by physicians; thus its incidence is not well measured.<sup>2</sup>

One reason for this is that many caffeine users tend to use other drugs, especially nicotine,<sup>7</sup> alcohol, and tranquilizers. It's difficult for researchers to separate the effects of the drugs. Another thing that makes it difficult to quantify caffeinism is that many people develop a tolerance to caffeine. People who were once stimulated by a single cup of coffee may find that this is not enough. They may have to increase their consumption to experience caffeine's stimulant effect.<sup>2</sup> Caffeine does not accumulate in the body. It has a metabolic half-life of about three hours.<sup>4</sup>

Many caffeine users are probably unaware of one significant aspect of caffeinism. The substance is mildly physiologically addictive. The most prevalent withdrawal symptom is a headache that can't be relieved with plain aspirin or acetaminophen. More caffeine will relieve the pain, though. Usually the withdrawal headache occurs 18 to 24 hours after the last dose of caffeine.<sup>2</sup>

Greden suggests that many people who think they get "tension headaches" may be suffering from caffeine withdrawal. He notes that such symptoms often occur on weekends. People who take caffeine in the form of coffee to

help them work often stop taking it on Saturday and Sunday. Greden lists these other symptoms of caffeine withdrawal: drowsiness or lethargy, nosebleeds, irritability, nervousness, nausea, and mild depression.<sup>2</sup>

In a telephone interview, Greden said there is no absolutely sure way to identify a person habituated to caffeine. But if a person consumes from 500-600 mg per day and shows other symptoms of caffeinism, it's a good bet that the user has become physiologically dependent. Greden said that withdrawal symptoms may be avoided or lessened if the caffeine user tries to withdraw gradually. He added that some users don't experience withdrawal headaches or other symptoms.<sup>8</sup>

Since about a fourth of the US population consumes 500-600 mg of caffeine per day, it would be useful to know more about the pharmacological actions of caffeine. It would also be useful to know what kinds of people consume caffeine in large amounts. Greden told us, "There is no classic psychological profile." But he said caffeine users tend to be older, less active in religion, and heavier users of nicotine, alcohol, and tranquilizers than people who use less or no caffeine.<sup>8</sup>

If the pharmacological effects of caffeine are uncertain, so is the question of whether it poses health hazards. People who drink a lot of coffee worry, for example, that caffeine consumption can contribute to cardiovascular disease. A recent review of the literature by epidemiologist Frederick A. MacCornack of the American Health Foundation, New York, states that there is no evidence that caffeine consumption plays a significant role in cardiovascular disease in general and heart attacks in particular.<sup>9</sup> MacCornack points out that some epidemiological studies implicating caffeine do not take into account the known risk of cardiovascular disease from cigarettes or alcohol. He adds that some researchers mistakenly use the "cup of coffee" as the measure

of caffeine intake. This can be inaccurate, because different types of coffee or brewing methods yield different amounts of caffeine.

In 1978 the *New England Journal of Medicine* published a report of a double-blind study by David Robertson and colleagues at Vanderbilt University School of Medicine.<sup>10</sup> The authors suggested that caffeine could induce hypertension in those prone to it. Robertson's team had nine subjects between the ages of 21-30 abstain from caffeine for three weeks. Then they drank two or three cups of coffee.

The researchers noted a 14% increase in diastolic blood pressure. They theorized that if comparable blood pressure increases occurred in regular coffee drinkers on the borderline of hypertension, caffeine could make them hypertensive. They also noted a 51% increase in plasma renin. Renin is a hormone produced by the kidneys in response to lowered blood pressure. It activates a vasoconstrictor called angiotensin, which increases blood pressure. Robertson's team wrote that this increase "is of obvious clinical importance if similar alterations occur in coffee-drinking hypertensive subjects."<sup>10</sup>

The researchers called for more studies of chronic caffeine use and the relationship between caffeine and hypertension. They noted that in the past caffeine had been said to both raise and lower blood pressure. MacCornack notes that caffeine acts in different ways on different parts of the cardiovascular system. The effects are often antagonistic.<sup>9</sup>

I suppose that with so many other culprits in the carcinogenesis game, caffeine is not a surprising candidate. But apparently there is no direct evidence that caffeine causes cancer in humans. It does cause mutations in certain bacteria, fungi, and algae. Some researchers claim it is slightly mutagenic in the fruit fly; others say it isn't. According to John Timson, a medical geneticist at the University of Man-

chester, caffeine is also mutagenic in human cells in culture, but probably doesn't cause cancer in humans.<sup>11</sup>

However, John P. Minton and colleagues at Ohio State University recently linked fibrocystic breast disease to caffeine consumption.<sup>12</sup> Minton told 20 women with this benign disease to abstain from caffeine. He reported that in 13 of them all symptoms disappeared. Minton says this does not mean caffeine is a carcinogen.<sup>13</sup> But he notes that women with fibrocystic breast disease have four times the normal risk of breast cancer.

Minton's results have not yet been replicated. He told us, however, that he has received about 500 letters from women with fibrocystic breast disease who read about his experiment and gave up caffeine. According to Minton, "The vast majority indicated decreased pain and size of lesions." He said he plans to send out questionnaires to confirm these findings.<sup>14</sup>

Since the thalidomide tragedy, many chemical substances are suspected of being teratogenic, i.e., causing birth defects. Caffeine, after all, is distributed to all parts of the body where water is found. It goes to the reproductive organs and through the blood of the fetus.

It has not yet been proven beyond doubt that caffeine, when consumed by pregnant women, can cause birth defects. However, Robert Reinhold wrote in the *New York Times*' "Science Times" section, "The Food and Drug Administration (FDA) is expected to release soon the results of a lengthy caffeine study of its own, done on rats, and it is reliably understood that the findings will strongly confirm the suspect hazards."<sup>15</sup>

Reinhold says the FDA probably won't rush to require a warning label on caffeine drinks. He quotes FDA Commissioner Jere E. Goyan as saying, "If we were to move against caffeine, and then 6 to 12 months later the studies were refuted, we would lose

credibility."<sup>15</sup> The FDA has already been criticized for requiring, on the basis of what some call incomplete evidence, warning labels for products containing saccharin. The *Times* story says the FDA's first action will probably be to issue an "advance notice of proposed rule-making," which simply means to raise the issue and invite comment.

One consumer group believes there is enough evidence to suggest that pregnant women shouldn't consume caffeine. The Washington, DC based Center for Science in the Public Interest (CSPI) wrote to 12,500 obstetricians and gynecologists, and 1,500 midwives, asking them to tell pregnant women to abstain from caffeine. It has also asked the FDA to require warning labels for coffee and tea.<sup>16</sup>

CSPI director Michael Jacobson points to some evidence for caffeine's teratogenic effects.<sup>17</sup> One study by Paul E. Palm and colleagues suggested that caffeine consumption by rats was associated with "some apparent delay in development...."<sup>18</sup> A French study concluded that caffeine "presents a slight and irregular teratogen effect in mice." But it induces ectrodactylia (missing digits) in rats and rabbits.<sup>19</sup> I. Borlée and colleagues studied the coffee consumption of women whose babies were malformed, and a control group. Their results indicate "that high consumption (more than eight cups daily) is associated with increasing frequency of congenital malformations." The Borlée group also called for longitudinal studies to confirm this conclusion.<sup>20</sup>

In a telephone conversation, Jacobson said the evidence that caffeine harms the human fetus is not conclusive. But he believes pregnant women should play it safe: "Even without human studies proving teratogenicity, we'd recommend that pregnant women avoid caffeine because doctors advise pregnant women not to take drugs." Jacobson said a warning label would re-

mind the public of the often forgotten fact that caffeine is a drug.<sup>17</sup>

Those who worry about the health effects of caffeine, but don't want to give it up, can reduce their consumption. Estimates of the amount of caffeine in different types of beverages vary. The most recent figures come from Bunker and McWilliams.<sup>5</sup> They report that instant or freeze-dried coffees, or teas brewed for only a few minutes, have less caffeine in them than coffee prepared in percolators. Instant or freeze-dried coffee averaged 66 mg of caffeine per cup, black bag teas brewed for one minute averaged 28 mg, 44 mg for three minutes, and 47 mg for five minutes of brewing. But coffee made in percolators can contain as much as 150 mg per cup.<sup>5</sup> (I have never understood why so much tea is wasted in the average tea bag. I use one tea bag for three cups. But this would never satisfy a tea or coffee addict.)

The Consumers Union (CU) recently tested 39 brands of instant coffee and concluded that none tasted or smelled like brewed coffee.<sup>1</sup> CU tested only three decaffeinated coffees. Since the decaffeinated brands don't taste much worse than other forms of instant coffees, there is no reason to avoid them if you can do without the kick of caffeine. *New York Times* food critic Mimi Sheraton sampled about 20 brands of decaffeinated coffee. She rated *Brim* and *Savarin* as the best of the national brands. She also reports, "I found no decaffeinated coffee that surpassed or even equalled a really fine undecaffeinated blend."<sup>21</sup>

Coffee is decaffeinated by removing the caffeine from the beans before roasting. In the US this is done with methylenechloride, a solvent suspected of being carcinogenic. A spokesman for the FDA's Division of Food and Color Additives said that the FDA allows a maximum solvent residue of 10 parts per million in roasted decaffeinated beans. CU found no trace of the solvent in the

brands it tested. This is probably because the substance evaporates rapidly.<sup>1</sup>

Not all coffees are decaffeinated with solvents, however. Coffex Ltd., Switzerland, has developed a pure water process which decaffeinate beans. But it still produces some decaffeinated coffee with solvents, because that method is cheaper.<sup>21</sup> Hag AG, Bremen, Federal Republic of Germany, developed a decaffeination process in which frozen carbon dioxide is employed.<sup>22</sup> Hag AG markets coffee in its own country, France, Switzerland, Austria, and the Netherlands. US sales in 1978 amounted to less than \$50,000. General Foods, which bought the company in

September 1979, may well try to increase the US market.<sup>23</sup>

I've had some close friends who were in the grip of *Mr. Coffee Nerves*. They were also heavy smokers. Why some people need this kind of stimulation to keep them going is not certain. For most people, I think it is clear that, like so much else in life, moderation is the safest course. But then not everyone wants to live safely.

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#### REFERENCES

1. Instant coffees. *Consumer Reports* 44:569-72, 1979.
2. Greden J F. Coffee, tea and you. *The Sciences* 19(1):6-11, January 1979.
3. *Coffee: the world cup*. London: International Coffee Organization, 1979. 24 p.
4. Graham D M. Caffeine—its identity, dietary sources, intake, and biological effects. *Nutrition Reviews* 36:97-102, 1978.
5. Bunker M L & McWilliams M. Caffeine contents of common beverages. *J. Amer. Diet. Ass.* 74:28-32, 1979.
6. Garfield E. Tinnitus, anyone? *Current Contents* (30):5-8, 23 July 1979.
7. -----, Nicotine addiction is a major medical problem: why so much government inertia? *Current Contents* (31):5-14, 30 July 1979.
8. Greden J F. Telephone communication. 20 November 1979.
9. MacCormack F A. The effects of coffee drinking on the cardiovascular system: experimental and epidemiological research. *Prev. Med.* 6:104-19, 1977.
10. Robertson D, Frollich J C, Caln R K, Watson J T, Hollifield J W, Shand D G & Oates J A. Effects of caffeine on plasma renin activity, catecholamines, and blood pressure. *N. Eng. J. Med.* 208:181-6, 1978.
11. Timson J. How harmful is your daily caffeine? *New Scientist* 78:736-7, 1978.
12. Minton J P, Foecking M S, Webster J T & Matthews R H. Caffeine, cyclic nucleotides, and breast disease. *Surgery* 86:105-9, 1979.
13. Benign breast disease tied to coffee, tea, cocoa, cola. *Medical World News* 20(6):11-2, 19 March 1979.
14. Minton J P. Telephone communication. 19 November 1979.
15. Reinhold R. Caffeine quandary illustrates FDA's plight. *NY Times* 8 January 1980, p. C1, C2.
16. Associated Press. Consumer group urges warning on use of caffeine in pregnancy. *NY Times* 18 November 1979, p. 32.
17. Jacobson M. Telephone communication. 19 November 1979.
18. Palm P E, Arnold E P, Rachwall P C, Leyczek J C, Teague K W & Kengler C J. Evaluation of the teratogenic potential of fresh-brewed coffee and caffeine in the rat. *Tox. Appl. Pharm.* 44:1-16, 1978.
19. Groupe d'Etude des Risques Tératogènes. Tératogénèse expérimentale: Etude de la caféine chez la souris. (Experimental teratogenesis: study of caffeine in the mouse.) *Thérapie* 24:575-80, 1969.
20. Borée I, Lechat M F, Bouckert A & Misson C. Le café: facteur de risque pendant la grossesse? (Coffee: risk factor during pregnancy?) *Louvain Med.* 97:279-84, 1978.
21. Sheraton M. Decaffeinated coffee: surprises for the skeptic. *NY Times* 7 February 1979, p. C1, C6.
22. Svez M & Desrosier N W. *Coffee technology*. Westport, Connecticut: AVI Publishing Company, Inc., 1979. 716 p.
23. Quinn J P. General Foods moves into Bremen. *Tea & Coffee Trade J.* 151(11):40, November 1979.