

Carbonated Cola Drinks Drop Bone Density in Women

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BOSTON, Oct. 6 -- Quaffing Coke, Pepsi, and their carbonated cola cousins, including decaf and diet versions, is associated with lower bone mineral density in older women, researchers reported.

The findings from the Framingham Osteoporosis Study did not extend to men or to non-cola carbonated beverages, and the reasons for bone loss remain uncertain, according to a report in the October issue of the *American Journal of Clinical Nutrition*.

Several studies have examined the association between carbonated beverages and fractures in children and adolescent girls, but few have studied adults, said Katherine Tucker, Ph.D., of Tufts University here, and colleagues.

Because bone mineral density is strongly linked with fracture risk, and because cola is a popular beverage, these findings are of considerable public health importance, Dr. Tucker and colleagues wrote. Although occasional use of carbonate cola beverages is unlikely to be harmful, she said, "women who are concerned about osteoporosis may want to avoid the regular use of cola beverages."

In the Framingham study, which included 1,413 women (ages 29 to 83) and 1,125 men (ages 35 to 86), bone mineral density was measured by dual-energy x-ray absorptiometry at the spine and three hip sites.

Both men and women tended to be overweight, former smokers, and to consume alcohol moderately. Mean calcium intake for men and women was lower than the current recommendations. Of the women, 80% were postmenopausal, and 29% of these used estrogen.

Mean intake of carbonated beverages was six servings a week (one glass, bottle, or can) for the men and five servings for the women. Cola was the most common choice at almost five servings for men and four for women. Women were equally likely to consume caffeinated and non-caffeinated cola, but were more likely to drink diet cola (2.7 diet compared with 0.9 non-diet servings a week), although intakes were variable. Non-cola soft drinks were either sugared or diet products.

Non-cola carbonated-beverage intake did not decrease BMD in either men or women, the researchers reported.

However, cola intake had a significant effect on BMD. Cola drinks were associated with significantly lower ($P < 0.001-0.05$) bone mineral density at each hip site, but not the spine, in women but not in men, the researchers reported.

The mean BMD for women with daily cola intake was 3.7% lower at the femoral neck and 5.4% lower at Ward's area than the BMDs for those who consumed less than one cola beverage a month.

Similar results were seen for diet cola and, although weaker, for decaffeinated cola, approaching significance ($P < 0.1$) at total hip and femoral neck. Compared with decaf cola, total caffeinated cola was more strongly associated with hip BMD ($P < 0.01-0.001$) and Ward's area ($P < 0.05$).

Additional analysis of cola subgroups for the women showed that the trends were not unique to the sugared, caffeinated colas, but were evident for all subgroups tested, with the exception of sugared decaf soda, women's least popular drink favored by fewer than 16%.

Compared with the recommended daily intake of 1,200 mg, women's calcium intake (1,000 mg/d) was lower, and although total phosphorus intake was not significantly higher in daily cola consumers than in non-consumers, the cola-drinkers' calcium-to-phosphorus ratios were lower, a possible significant finding, according to the researchers.

Reviewing the possible causes for these associations, Dr. Tucker turned first to calcium intake and the possible displacement of milk and other beneficial foods by the sodas. Although cola consumers drank less fruit juice, adjustment for total juice intake (or total fruit and vegetable intake) did not significantly change the results, she said.

The consistency of bone density findings across cola types, including calcium intake, suggests that the results are not due to elimination of milk or other healthy beverages in the diet, the researchers said. Nevertheless, they added, total calcium intake was lower among women who consumed the most cola drinks and may affect bone density.

The caffeine content of the drinks may also contribute to lower BMD, the researchers said. The results were consistently stronger for caffeinated cola versus the decaf version. However, the caffeine factor remained in play. Although adjustment for caffeine from other sources attenuated the association with decaf drinks, it did not entirely eliminate caffeine. The remaining significance, the investigators said, may be due to yet unexplained actions of phosphoric acid.

Although adjustment for overall daily calcium-to-phosphoric acid, did not significantly change the results, it is less clear how regular use of a beverage containing a dose of phosphoric acid with no calcium and no other basic forming or neutralizing components, may affect BMD over long-term exposure, the researchers said.

Phosphoric acid in the gut may form a complex with dietary calcium to block absorption. Although high phosphorus and low calcium may lead to changes that cause bone resorption, the amount of phosphoric acid in cola may be insufficient to cause these changes, they said.

It remains unclear whether regular exposure to phosphoric acid without exposure to calcium or other beneficial nutrients causes bone loss over time. More research on the potential mechanisms by which phosphoric acid may affect bone is needed, the investigators said.

Commenting on the lack of association between cola drinks and BMD in men, the researchers suggested several possibilities. Girls' and women's smaller bones would make them more sensitive to nutritional insult, whereas the higher levels of physical activity in boys and men might be protective. Hormonal interactions may also contribute to these differing results by sex, but here, too, additional research is needed, they said.

Summing up, Dr. Tucker's team first noted that further studies are needed to confirm these findings.

A greater intake of cola was not associated with a significantly lower intake of milk, the researchers said. As for caffeine, it can take some, but not all, of the blame. Results were consistently stronger for intake of caffeinated cola. However, low BMD remained even after adjustment for caffeine intake, and some associations with decaffeinated cola remained.

Action Points

Explain to women who are concerned about osteoporosis that this study suggests they may want to avoid the regular use of carbonated cola drinks.

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Tucker, KL, et al "Colas, but not other carbonated beverages, are associated with low bone mineral density in older women: The Framingham Osteoporosis Study" *Am J Clinical Nutrition* 2006; 84: 936-942