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The Potential Health Benefit of Coffee: Does a Spoonful of Sugar Make It All Go Away?

Coffee is one of the most widely consumed beverages, and there is longstanding interest in understanding its health effects. According to a 2022 estimate, Americans drink 517 million cups of coffee per day, and 66% of Americans surveyed reported drinking coffee within the past day (1). Much of the data to date on coffee's health effects rely on observational studies, and these—including 2 earlier studies published by *Annals* in 2017 by Gunter and colleagues (2) and Park and colleagues (3)—suggest a U-shaped relationship between coffee consumption and all-cause mortality and other health outcomes; those consuming moderate amounts of coffee daily (including decaffeinated coffee) seem to have the lowest risk and derive the greatest potential benefit (2, 3).

Coffee contains several bioactive substances beyond caffeine that make beneficial health effects plausible (4). Moreover, how coffee is processed (for example, filtered vs. unfiltered, roasting process, and whether it is boiled) may also play a role (4, 5). Coffee is believed to contribute to the body's antioxidant effects through both caffeine and chlorogenic acids and may also inhibit platelet aggregation and reduce risk for thromboembolism. There is also increasing interest in understanding whether coffee intake has a protective association with dementia (6). On the other hand, cafestol and other compounds resulting from unfiltered and boiled coffee may lead to elevated plasma lipids (4, 5). Caffeine can also lead to transient short-term elevations in blood pressure that do not seem to persist with longer-term moderate consumption (4, 5). Thus, coffee's effects are complex and may explain its apparent U-shaped association with mortality outcomes.

In their article, Liu and colleagues (7) revisit the question of coffee's health effects with a new twist: focusing on whether adding sugar to coffee negates potential health benefits. This is not a trivial question given the popularity of specialty coffees and coffees with added sugar and calorie-laden dairy products—and compelling evidence that other sugar-sweetened beverages can lead to adverse metabolic effects (8). Liu and colleagues analyzed coffee consumption data collected between 2009 and 2012 from 171 616 participants in the UK Biobank study, a large prospective cohort of adults aged 37 to 73 years from 22 study centers in the United Kingdom (7). Consistent with prior work, they found a U-shaped association between regular consumption of caffeinated or decaffeinated coffee and the outcomes of all-cause, cancer-related, and cardiovascular mortality, with up to a 30% mortality reduction. Moreover, this U-shaped association was noted regardless of whether coffee was consumed unsweetened or sweetened with sugar. Among consumers of unsweetened coffee, those who had approximately 3 cups per day had the lowest risk for all-cause mortality relative to non–coffee consumers; among consumers of sugar-sweetened coffee, those

having approximately 2 cups a day had the lowest risk. Reductions in cancer and cardiovascular mortality were also noted with consumption of sugar-sweetened and unsweetened coffee and regardless of whether it was instant, ground, or decaffeinated. Importantly, there were no clear signals of potential adverse effects on mortality compared with non–coffee consumers regardless of the number of cups of unsweetened or sugar-sweetened coffee consumed per day across the range studied.

Nonetheless, before we all rush out for our cups of "caramel macchiato," the benefits of coffee are far from settled science. The strongest evidence for benefit comes from observational cohort studies, which are subject to confounding. In many ways, Liu and colleagues' study tries to address this issue better than some others. In addition to accounting for the usual clinical, sociodemographic, and behavioral factors, their study tried to better adjust for diet and its components and for socioeconomic status through both educational attainment and a social deprivation index based on area of residence. Liu and colleagues also explored the confounding effects of both air and noise pollution and conducted a myriad of sensitivity analyses that demonstrate consistency in their findings. Nonetheless, the decision whether to consume coffee (and whether to add sugar) is not a random event (9) and is influenced by difficult-to-measure factors, including occupation and work demands and hours, socioeconomic and emotional stressors, the availability of leisure time, and intolerance to coffee from uncaptured health or clinical reasons, to name just a few. Mendelian randomization studies, which are less affected by confounding, have not consistently demonstrated an association in either direction between a genetic score associated with coffee intake and mortality or cardiovascular or cancer outcomes (4). Yet, it is important to recognize the limitations of such studies. As a proxy for coffee consumption, current genetic markers are relatively weak instruments leading to limited power to detect effects. Thus, as with most underpowered studies, null findings from Mendelian randomization studies do not rule out true health effects.

Unfortunately, Liu and colleagues' study does not quite get at what we really want to know. Is drinking coffee laden with sugar and calories still potentially beneficial, or at least not harmful? The coffee consumption data used in their study reflected consumption from approximately 10 years ago in a country where tea is a competing beverage. The average dose of added sugar per cup of sweetened coffee was only a little over a teaspoon, or about 4 grams. This is a far cry from the 15 grams of sugar in an 8-ounce cup of caramel macchiato at a popular U.S. coffee chain (10). Nonetheless, Liu and colleagues' data are reassuring in demonstrating that most study participants who drank coffee added no or only small amounts

of sugar and this pattern of intake was not harmful from a mortality risk perspective and was potentially beneficial.

As with most epidemiologic studies, drinkers of sugar-sweetened coffee were compared with non–coffee-consuming control participants. In reality, many consumers of sweetened coffee may drink coffee in lieu of another sweetened beverage. Thus, the true impact of the consumption of sugar-sweetened coffee is not easily knowable and is potentially greater than that presented in studies like Liu and colleagues' depending on the counterfactual.

Liu and colleagues' study also could not shed clear light on the more complicated question of whether artificially sweetened coffee consumption is associated with health outcomes. Results from their analyses were less conclusive in this regard, with wider CIs, and for some categories of coffee intake and outcomes, risk estimates exceeded 1. This inconsistency is unsurprising because those who reported drinking artificially sweetened coffee may represent a more diverse group of people with less stable patterns of coffee consumption over time.

Given the current available evidence on coffee's potential health effects, what should we tell our patients who drink coffee and add sugar to it? Although we cannot definitively conclude that drinking coffee reduces mortality risk, the totality of the evidence does not suggest a need for most coffee drinkers–particularly those who drink it with no or modest amounts of sugar–to eliminate coffee. So drink up–but it would be prudent to avoid too many caramel macchiatos while more evidence brews.

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Note: Dr. Wee discloses that she drinks coffee with cream and sugar regularly and enjoys it.

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