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Caffeine Consumption and Cardiovascular Risks: Little Cause for Concern

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Caffeine consumption is virtually ubiquitous in our society. It is naturally found in coffee, tea, chocolate, and cola drinks. Furthermore, caffeine is often added to beverages, foods, pain relievers, and other products. In the United States, coffee accounts for ≈70% of the caffeine consumed. A report in this issue of JAHA by Dixit and colleagues describes the relations between the reported intake of caffeinated products and the occurrence of arrhythmias assessed by 24-hour Holter monitoring in the Cardiovascular Health Study. The investigation included >1300 adults and all participants were >65 years of age at baseline. The authors report no association for atrial or ventricular arrhythmia prevalence and reported intake of caffeinated products. The Dixit article provides an opportunity to briefly review the pharmacology of caffeine related to the cardiovascular system and to share recent information and insights from clinical studies and population reports concerning caffeine intake and cardiovascular disease (CVD) outcomes, and arrhythmias.

Cardiovascular Risk Factors: Blood Pressure and Lipids

In a mechanistic study published in the late 1970s, it was reported that 250 mg of caffeine, administered orally in a clinical research unit to adults not regularly ingesting caffeine products, raised plasma renin 57%, plasma norepinephrine 75%, plasma normetanephrine 207%, and blood pressure 14/10 mm Hg. A single dose of caffeine was given, the amount typically present in 12 ounces of filtered coffee. Maximal plasma caffeine levels were observed 1 hour after consumption, and habituation was not investigated. Other pharmacologic research has corroborated these findings, shown that caffeine has diuretic effects, and demonstrated that the highest blood caffeine concentrations are typically observed in the afternoon.

Clinical studies have reported the chronic effects of caffeine products on blood pressure and results have generally been null. It is believed that genetics, smoking, and other aspects of the diet may modify effects. A meta-analysis by Zhang in 2011 that included >170 000 adults and >32 000 new cases of hypertension reported no association between caffeine intake and the development of hypertension. An ambulatory blood pressure study that investigated 24-hour urinary caffeine and caffeine metabolites levels in >800 adults reported that each doubling of caffeine excretion was associated with ≈0.6 mm Hg lower blood pressure. The caffeine effects were significant even after statistical adjustment for blood pressure medication use.

Research has suggested that both plasma total cholesterol and low-density lipoprotein cholesterol may increase if the coffee is boiled during the brewing process. A meta-analysis based on 12 randomized controlled trials of coffee consumed daily for 45 days showed that caffeine intake led to statistically significant increases for total serum cholesterol (mean increase 8.1 mg/dL), low-density lipoprotein cholesterol (mean increase 5.4 mg/dL), and triglycerides (mean increase 12.6 mg/dL). The greater increases in lipid levels were observed for boiled coffee compared to filtered coffee, and decaffeinated coffee had little effect on blood lipid levels.

Atherosclerotic CVD Outcomes

A meta-analysis that included data from 36 studies, >1 000 000 participants, and >36 000 CVD cases demonstrated a nonlinear relationship between chronic coffee consumption and CVD risk. Compared with the lowest category of coffee intake (median, 0 cups per day), the relative risk of CVD was 0.89 for a median of 1.5 cups per day.
Another study examined the experience of 50 patients known to have ventricular arrhythmias. The participants received 200 mg of caffeine or placebo in a crossover trial prior to exercise testing within 30 minutes and there was no greater risk of ventricular arrhythmias after the caffeine exposure.

Many studies examining caffeine intake have focused on the number of “cups of coffee” regularly consumed. The epidemiology of coffee consumption itself has changed significantly over the last 2 decades, with the advent of coffee shop franchise expansion over the entire United States in the 1990s and worldwide in the 2000s. In 2015, of the 100 million coffee drinkers in the United States, 30 million had a preference for “speciality beverages”—lattes, cappuccinos, and mochas. In addition, energy drinks sprang into being. For example, Red Bull was first produced in 1987 and sold more than 5.6 billion cans in 2014. Caffeine consumption in isolation appears to be benign, but there is a growing body of evidence that substances such as taurine and guarana in some caffeinated beverages may be unhealthy. There are multiple case reports in the literature regarding arrhythmias and/or death following excessive energy drink consumption prior to exercise. According to the Substance Abuse and Mental Health Services Administration, there were >20,000 emergency room visits related to energy drinks in 2011. Many specialized caffeinated beverages have a large number of calories and that may be a health hazard for the development of hyperglycemia and diabetes mellitus. A restaurant double espresso (2 ounces, 150 mg caffeine, 0 calories) habit may not be problematic, but how healthy is a Venti Peppermint Mocha (20 ounces, 415 mg caffeine, 440 calories) or a Monster Energy (16 ounces, 160 mg caffeine, 300 calories)?

Modern technology provides the opportunity to design studies to collect immense amounts of observational data related to arrhythmias. We no longer rely on a 24 to 48-hour snapshot of a person’s life using traditional Holter monitors. We have the capacity to easily implant loop recorders that are smaller than a penlight battery. The procedure is performed with very little risk to the patient, and the device captures and broadcasts wireless data for 3 years or more, 24 hours a day, and 7 days a week. Smart phone apps are also available that allow individuals to provide other information instantaneously to a study site or coordinator. Individuals who are at high risk to develop a cardiac arrhythmia could have a loop recorder implanted, the participant could transmit beverage consumption information in real time, and the two data sources could be linked and analyzed. These types of research possibilities are opening new opportunities to investigate the occurrence of arrhythmias.
In summary, recently published studies, including prospective cohorts, clinical investigations, and meta-analyses, generally show coffee consumption is safe for the heart. Concerning CVD risk factors, there is little evidence that chronic coffee intake consumption raises blood pressure. Boiled coffee brewing may raise atherogenic lipid levels, and other brewing methods do not appear to have this effect. Finally, there is little risk for atrial or ventricular arrhythmias at most of the levels of caffeine consumption in our society. Future research in this area is especially of interest concerning newer caffeinated beverages with greater amounts of caffeine per serving and with a large number of calories. Implantable and wearable devices have become available to identify cardiac arrhythmias, and this type of technology will provide new opportunities for research, diagnosis, and cardiovascular care.

Disclosures
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References

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