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Coffee and blood pressure: exciting news!

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ABSTRACT

A growing number of epidemiological studies have reported the beneficial effects of habitual coffee consumption on incident cardiovascular disease (CVD), and mortality. However, the effects of coffee on arterial hypertension are still objects of active discussion mainly because of the debated effects of caffeine on blood pressure and cardiovascular system. In particular, the negative impact of caffeine would involve the whole cardiovascular system and could be responsible for an excess in the relative risk of new onset of hypertension and a worsening of blood pressure control. Recent evidence has been published excluding a significant effect of coffee consumption on hypertension development and blood pressure control in treated and untreated hypertensive supporting a protective role for the antioxidant components of coffee that may counteract the claimed negative effect of caffeine. The presence and amount of caffeine and cardio-protective chemical constituents of coffee is largely dependent on the type, production, and method of preparation and this can partially explain the divergent opinions on the effects of coffee intake on blood pressure and cardiovascular system. In addition, some genetic aspect of caffeine metabolism can contribute to the heterogeneity of published evidence while the most recent cardiovascular guidelines largely endorse coffee consumption in hypertension and CV disease. The purpose of this short review is to briefly summarise some of the recent information available in the literature on coffee and blood pressure.

KEY POINTS

According to the considerable amount of observational evidence we can suggest that:

- While acute coffee administration in non-habitual users may induce a blood pressure rise, habitual coffee consumption in medium-high dosages (from 3 to 5 cups/day), has neutral or even beneficial impact on blood pressure values and the new onset of hypertension.
- The same intake significantly reduces the incidence of cardiovascular disease, as well as all-cause mortality.
- The consumption of coffee is compatible with a correct and balanced lifestyle and should therefore not be discouraged in subjects with hypertension and cardiovascular diseases.

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Coffee is probably one of the most popular beverages in the world where it is consumed in different ways. The effects of coffee on cardiovascular system and arterial hypertension have been largely debated over the last decades. Recent evidence has made it possible to dispel most of the clinical doubts on whether to advise and to what extent to allow the consumption of this drink, particularly in patients with cardiovascular diseases.

The composition of coffee is much more complex than is commonly believed and depends on several factors, such as the type, production, and method of preparation. On average, over 1000 chemical constituents are present in coffee, and many of them are

biologically active. Among the most common substances, the main role is that of caffeine variously associated with diterpenes, melanoidins, the alkaloid trigonelline and polyphenols such as chlorogenic acid and lignans, that possess antioxidant and anti-inflammatory effects that can counteract the negative effects of caffeine [1]. Caffeine can also be synthesised pharmacologically and added to foods or non-alcoholic or energy drinks or commercial preparations to reduce fatigue and increase psychic reactivity. The side effects of caffeine usually occur following the intake of high dosages and include anxiety, tachycardia, restlessness, mood changes, insomnia, psychomotor agitation, changes in the flow of thought and

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Table 1. Summary of studies investigating the effects of coffee and caffeine on blood pressure and prevalence of hypertension.

Author	Substance	Dose	Population	Outcome
Nurminen et al. Eur J Clin Nutr, 1999	Caffeine	200–250 mg/ single dose	Normotensive	SBP/DBP: –3–14/–4–13 mmHg
Jee et al. [9], Hypertension, 1999	Coffee	Various doses	Metanalysis	SBP/DBP: –2.4/1.2 mmHg
Klag et al. Arch Int Med 2022 [10]	Coffee	Various doses	Habitual drinkers vs. non drinkers	New onset HTN: 28.8% vs. 18.8%
Lane et al. Psychosom Med 2002 [11]	Caffeine	500 mg vs. placebo	Global population	Mean BP: –3–4 mmHg
Steffen et al. J Hypertens, 2012	Coffee	Various doses	Metanalysis (mix)	No excess in prevalence HTN
Xie et al. J Hum Hypertens 2018	Coffee	Various doses	Metanalysis (mix)	2% reduction of HTN/cup /day
Zhang et al. Am J Clin Nutr 2011	Coffee	≥ 4 cups/day	Global population	No excess in prevalence HTN
Winkelmayer et al. JAMA 2011	Coffee	1–6 cups/day	Women (NHS)	No excess in prevalence HTN
Guessous M et al. Hypertension 2015	Caffeine	Various doses	Global population	Potential protective effects of caffeine on BP

speech. Toxic effects appear for dosages of 1.2 g or higher (over 20 cups), while the dose deemed lethal is believed to be over 10 g (75–100 cups of coffee consumed in a short time) [2]. Coffee has a variable caffeine content depending on how it is prepared. Espresso coffee contains about 60 mg of caffeine per cup, whereas in soluble coffee caffeine content can vary between 30 and 90 mg, ‘American’ coffee generally provides between 180 and 300 mg of caffeine per cup, while decaffeinated coffee only 3 mg. The differences in the content of caffeine can be responsible for most of uncertainties about the effects of coffee intake in patients with or at risk of cardiovascular disease. The purpose of this short review is to summarise some of the reliable and recent information available in the literature on this issue.

Discussion

Effects of caffeine/coffee on blood pressure: negative evidence

Over 40 years ago, a seminal study reported an increase in blood pressure and sympathetic nervous system activation after the administration of 250 mg of oral caffeine in not habitual coffee drinkers [3]. These findings have been confirmed by some additional studies (Table 1) which mainly tested the effects of the single administration of unusually high doses of caffeine (200–250 mg in a single administration) in an heterogeneous population of patients with different blood pressure values and levels of habitual coffee consumption.

Effects of caffeine/coffee on blood pressure: favourable evidence

As an alternative to the pressure effects of high doses of caffeine described above, some recent meta-analyses have shown that coffee has a neutral or even

protective effect in patients with systemic arterial hypertension (Table 1). Different, sometimes opposite, effects were found between naïve subjects and habitual coffee consumers: in non-consumers, the intake of coffee can acutely cause a minimal increase in blood pressure while exerting an insignificant action on habitual drinkers. Tolerance occurs within a week though may be incomplete in some individuals [4]. The inverse relationship between coffee consumption and the risk of hypertension could be attributable to some biological substances with antihypertensive action (vitamin E, niacin, potassium and magnesium) and antioxidant compounds, such as polyphenols, which also have vasodilator and antihypertensive properties [5]. Interestingly the effects of caffeine on blood pressure could be mediated by the interaction of smoking habit on caffeine metabolism. Guessous and co-workers [6] have reported that the activity of CYP1A2 enzyme involved in caffeine metabolism is correlated to blood pressure control with a lower risk of hypertension in response to caffeine in subjects with elevated CYP1A2 activity as well as in subjects with low CYP1A2 activity associated with smoking habit. These data support a role for caffeine metabolisms in the blood pressure control and can contribute to explain the variability in blood pressure response observed in the population.

Coffee and cardiovascular diseases: What evidence

Many observational cohort studies have analysed the relationship between coffee consumption and the incidence of cardiovascular events, reporting results that consistently suggest that an incremental consumption of up to 5 cups of filtered coffee per day is not associated with an increase in cardiovascular risk when compared with lack of consumption [7]. Indeed, coffee consumption was correlated with a reduction in the risk of major cardiovascular events with a greater benefit in subjects consuming between 3 and 5 cups of coffee per day [7].

Regarding the relationship between coffee consumption and arrhythmias related to hypertension, numerous studies have found that coffee consumption is inversely associated with the onset of atrial fibrillation and tachyarrhythmias in general, especially supraventricular ones [2].

Coffee and cardiovascular/all-cause mortality

Numerous studies and meta-analyses have found a reduction in all-cause mortality in coffee consumers: in particular, the EPIC study (European Prospective Investigation Into Cancer and Nutrition), that followed over 500,000 European adults for 16 years, found that regular coffee drinkers had a 7% to 12% reduction in the risk of cardiovascular and all-cause mortality compared to non-drinkers [8]. In another large prospective cohort study of over 200,000 health-care workers followed for 25 years, an inverse relationship between coffee consumption and all-cause mortality was reported [9]. Overall, the intake of 3 to 5 cups of coffee a day was associated with the lowest CV risk and longer survival, and this was recently confirmed by three large cohort studies including over 1 million subjects followed for at least 10 years [10–12]. In the first study (n.382.535) [10], a coffee intake of 2–3 cups/day was significantly associated with the lowest risk for developing CVD (Hazard ratio, HR = 0.91, 95% CI 0.88–0.94), Coronary artery disease (HR = 0.90), heart failure (HR = 0.85) and all-cause mortality (HR = 0.86). In the second study (n.502.543) [11], coffee intake of 2–3 cups/day showed an improved survival (HR = 0.92, 95% CI 0.86–0.99, $p = 0.03$) among patients with previous CV diseases or arrhythmias (particularly atrial fibrillation). The third study (population n.382.535) [11] confirmed that drinking between 1 and 5 cups of coffee per day were associated with a reduced risk of arrhythmia, CVD, CHD, heart failure and stroke. The greatest reduction in risk for CVD was seen with drinking 2–3 cups/day of ground coffee (HR = 0.83, 95% CI 0.79–0.87) with a mortality benefit including decaffeinated, leading to the conclusion that non-caffeine compounds within coffee are likely to be important factors associated with greater survival among coffee drinkers.

Conclusion

The consumption of coffee is compatible with a correct and balanced lifestyle and should therefore not be discouraged in subjects with hypertension and cardiovascular diseases.

This attitude corresponds to the position of the most recent consensus documents in terms of cardiovascular prevention beyond the control of lipid, carbohydrate and salt intake [13].

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