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The influence of phenolic compounds from coffee and tea on postprandial cardiovascular stress: a mini-review

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Both postprandial hypotension and hypertension are associated with arteriosclerosis and hypertension. We aimed to review the effects of coffee and tea on postprandial hemodynamic, in light of the pharmacokinetic of phenolic compounds. Phenolic compounds of coffee and teas improve flow-mediated dilation, hypotension or hypertension after meal. *O*-methylation, microbial metabolism and food matrix effects could account for some contrasting results after meal. In the postprandial reviewed studies, the absence of relationship between cardiovascular and oxidative stress do not support the hypothesis that phenolic compounds improve the cardiovascular changes by increasing the bioavailability of nitric oxide. On the other hand, phenolic compounds and their metabolites could affect sympathetic nervous system, angiotensin I-converting enzyme and postprandial insulin. In conclusion, the beneficial effects of phenolic compounds from coffee and tea on postprandial hemodynamic could be more likely caused by pharmacological rather than to antioxidant effects.

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Introduction

The repeated consumption of High-Fat Meals (HFM), High Carbohydrate Meals (HCM) or mixed high fat and high carbohydrate meals (HFHCM) generate atherosclerosis, isolated systolic hypertension, autonomic and endothelial dysfunctions [1]. Despite older individuals have the lowest baseline flow-mediated dilation (FMD) and the greatest reduction in FMD postprandially [2••], they are more likely than nonelderly to experience postprandial hypotension [3]. It has been suggested that caffeine-containing beverages could provide protection against the risk of heart disease mortality among elderly participants, caused by inhibition of postprandial hypotension by caffeine [3]. Coffee and teas are the most frequently consumed caffeinated beverages and controversy exists about their impact on the cardiovascular system [4–6]. Coffee acutely increases blood pressure in hypertensive subjects [4], whereas chronic consumption decreases the risk of cardiovascular diseases [5]. Teas have no effects after acute intake, whereas chronic consumption reduces systolic (SBP) and diastolic (DBP) blood pressure [6]. Although the suggested mechanism of blood pressure improvement by coffee and teas involve the phenolic compounds [7], the latter are extensively metabolized [8].

We aimed to discuss the effects on postprandial cardiovascular stress of coffee, teas and their extracts, in light of the pharmacokinetic of phenolic compounds.

Phenolic compounds

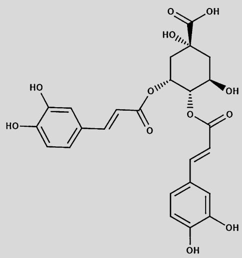
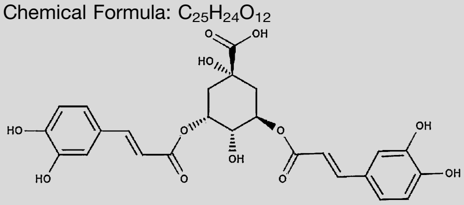
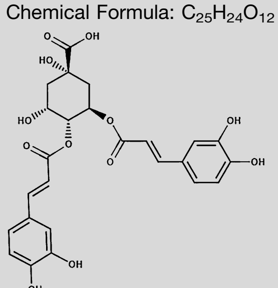
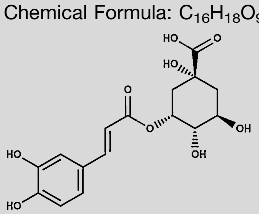
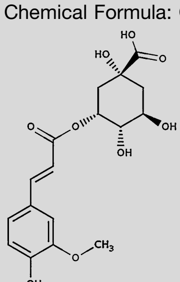
Within phenolic compounds, phenolic acids and flavanols are the key components of coffee and tea, respectively [8–21] (Table 1). These are the two most important contributors to total phenol intake (hydroxycinnamic acids 27–53% and flavanols 28–48%) in Europe [22••]. Tea in non-Mediterranean regions (34%) and coffee in all European regions (58–75%) are the most important dietary sources of flavonoids and phenolic acids, respectively [22••].

A cup (200 mL) of coffee contains an average amount of 160 mg chlorogenic acids (CGA) [8], mainly caffeoylquinic, feruloylquinic, and dicaffeoylquinic acids (Table 1).

After coffee consumption, CGA and their metabolites have been detected in human plasma and C_{max} values were found for caffeic acid, a primary metabolite of caffeoylquinic acid and dicaffeoylquinic acids especially in conjugated forms (Table 1). In this regard, Monteiro *et al.* [10] reported that the caffeic acid identified in plasma might originate from hydrolysis of CGA. In addition, CGA and conjugates forms are excreted in the urine (~56% of the ingested dose) [8,10].

Table 1

Pharmacokinetic of phenolic acids and flavanols in coffee and teas

Compounds	Beverage Type	Content mg/100 mL Mean ± SD	Pharmacokinetic Detected compound	Cmax *nmol/L*	Tmax *h*	Ref.
Phenolic acids (Hydroxycinnamic acids)						
3,4-Dicaffeoylquinic acid Chemical Formula: $C_{25}H_{24}O_{12}$ 	Coffee A coffee R coffee D coffee	2.66 ± 0.00 3.53 ± 0.00 5.96 ± 0.00 7.55 ± 9.75	3,4-Dicaffeoylquinic acid	0.92 ± 0.3	2.2 ± 1.2	[9–11]
3,5-Dicaffeoylquinic acid Chemical Formula: $C_{25}H_{24}O_{12}$ 	Coffee A coffee R coffee D coffee	1.55 ± 0.00 2.65 ± 0.00 4.42 ± 0.00 6.34 ± 8.89	3,5-Dicaffeoylquinic acid	1.2 ± 0.95	2.3 ± 1.2	[9,11]
4,5-Dicaffeoylquinic acid Chemical Formula: $C_{25}H_{24}O_{12}$ 	Coffee A coffee R coffee D coffee	2.05 ± 0.00 1.54 ± 0.00 3.09 ± 0.00 8.34 ± 11.2	4,5-Dicaffeoylquinic acid	1.1 ± 0.36	2.3 ± 1.2	[9,11]
3-Caffeoylquinic acid (3-CQA) Chemical Formula: $C_{16}H_{18}O_9$ 	Coffee R coffee D coffee BTI GTI	51.80 ± 16.7 32.26 ± 0.0 57.91 ± 49.6 0.24 ± 0.11 0.33 ± 0.00	3-CQA 3-CQA-lactone-sulfate	1 ± 0.75 27 ± 3	1.7 ± 0.9 0.6 ± 0.1	[9–13]
3-Feruloylquinic acid Chemical Formula: $C_{17}H_{20}O_9$ 	Coffee D coffee	4.17 ± 0.00 2.74 ± 0.00	3-Feruloylquinic acid	16 ± 2	0.7 ± 0.1	[9]