



# Acute effect of coffee consumption on arterial stiffness, evaluated using an oscillometric method

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## KEYWORDS

Vascular stiffness;  
Aorta;  
Caffeine;  
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**Abstract** *Introduction:* Previous studies show contradictory results related to the vascular effects of coffee; they suggest that caffeine increases arterial stiffness and negatively impacts vascular health, the aim of this study is to evaluate the acute coffee effects on the vascular stiffness.

*Methods and materials:* We carried out a controlled, blind, cohort study in healthy subjects. The acute effect of coffee (caffeinated vs. decaffeinated) was evaluated on arterial stiffness parameters, using a oscillometric method known as Arteriograph<sup>®</sup> (TensioMed-Budapest-Hungary, Ltd.). Each subject received 14 gr. of caffeinated excelso-coffee (caffeine-151.2 mg) and decaffeinated excelso-coffee (caffeine-3.92 mg), two weeks apart in a random order. The parameters were obtained under stable baseline conditions before drinking the coffee, 30 and 60 min later.

*Results:* Thirty-two subjects were included, with an age of  $46.2 \pm 10.4$  years, sixteen men. Consumption of caffeinated-coffee at 30 and 60 min increased statistically significant ( $p < 0.05$ ) brachial-systolic-blood-pressure in 3.9 mmHg and 3.8 mmHg, brachial-diastolic-blood-pressure in 4.1 mmHg and 3.2 mmHg, mean-arterial-pressure in 4.0 mmHg and 3.3 mmHg, central-systolic-blood-pressure in 5.8 mmHg and 7.6 mmHg, brachial-AIX 9.9% and 12.3%, aortic-AIX 5.1% and 6.3%, decreased heart-rate by 4 beats/min and 5 beats/min respectively, and it not demonstrated that had an impact on the pulse wave velocity ( $p = 0.861$ ). Decaffeinated-coffee increased the braquial-AIX (7.1–10.5%) and aortic-AIX (3.55–5.3%) and decreased the heart-rate (3–4 beats/min).

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**Conclusions:** This study suggests for the first time that drinking caffeinated coffee slightly increases peripheral arterial stiffness at the expense of increased vascular tone in distal arteries without changes in central stiffness. Further studies are needed to clarify whether these effects induced by coffee have an impact on the population health.

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## Introduction

Cardiovascular disease continues to be the main cause of morbidity and mortality in the Western world.<sup>1</sup> It is well known that a healthy and appropriate diet is the defining key for adequate human health, and the fundamental pillar for the prevention and treatment of cardiovascular diseases. Epidemiological and experimental studies in the last 50 years have implicated dietary factors in the etiology and prevention of important chronic diseases such as arteriosclerosis.<sup>2</sup>

Coffee is one of the most consumed beverages in the world. Among coffee's components, the most recognized is caffeine, the active substance in many foods and beverages consumed around the world.<sup>3</sup> Previous clinical studies have generated a significant controversy regarding the consumption of coffee and its cardiovascular effects.<sup>4–7</sup> The divergence in clinical results is due to a high number of selection biases, and the presence or not of multiple risk factors which interact in the development of cardiovascular disease in humans. The results of controlled clinical studies in large populations have recently shown the benefits of coffee for cardiovascular health.<sup>7–9</sup>

Recently, the Scientific Report of the 2015 Dietary Guidelines Advisory Committee (DGAC), as the official organ of the Food and Drug Administration in the United States,<sup>10</sup> described that the consumption of coffee within a moderate range (3–5 cups/day, or up to 400 mg/day of caffeine), is not associated with a greater risk of chronic diseases, such as cardiovascular disease, cancer and premature death in healthy adults. Consistent observation tests show that the moderate consumption of coffee is associated with a reduction in the risk of type II diabetes and cardiovascular disease, in healthy adults.<sup>11</sup> Thus, the moderate consumption of coffee could be incorporated into a healthy lifestyle. The evidence suggests a significant inverse relationship between the consumption of 1–4 cups of coffee/day and total mortality, especially mortality due to cardiovascular disease.<sup>12–14</sup> Previous studies by our group regarding the role of caffeine and its effect on *in vitro* animal<sup>15</sup> and human<sup>16–18</sup> arterial tissues, show beneficial vascular effects.

The study of vascular stiffness has generated great interest in the last two decades, especially the measurement of pulse wave velocity (PWV), measured in meters/sec, and the arterial augmentation indices, both brachial and aortic. The stiffening of the central arteries has important hemodynamic consequences which include: an increase in pulse pressure amplitude, decreased shear stress, and an increase in the transmission of the pulsatile flow within the

microcirculation.<sup>19</sup> These effects have adverse consequences, and could, in part, explain why arterial stiffness is a determinant of the cardiovascular system performance and a predictor of cardiovascular risk.<sup>20,21</sup>

Thus, arterial stiffness has been identified for several years as an independent cardiovascular risk factor.<sup>22–24</sup> A high PWV has been shown to be associated with an increased risk of coronary disease, cerebrovascular accidents, and compound cardiovascular events.<sup>25,26</sup>

The vascular response in the presence of caffeine has been controversial. An acute vasopressor effect of caffeine has been described, mainly in non-habitual consumers. Current evidence supports the hypothesis that caffeine affects the cardiovascular system, at least acutely, not just through an elevation in peripheral blood pressure, but also through an increase in arterial stiffness.<sup>27</sup>

The current study intends to evaluate and quantify the *in vivo* effect of coffee on vascular mechanics, evaluated through vascular stiffness parameters using a non-invasive method, the Arteriograph® (TensioMed Budapest-Hungary, Ltd.), an available technology which uses an oscillometric method to detect brachial wave signals to evaluate vascular stiffness parameters, in a selected healthy population.

## Materials and methods

This study was carried out in the Vascular Function Research Laboratory at the Fundación Cardioinfantil-Instituto de Cardiología, in Bogotá, Colombia. A controlled, blind, prospective cohort study was performed to evaluate the vascular effect of coffee, through measurement of vascular stiffness parameters in healthy adult individuals of both sexes, they were the self-controls using decaffeinated coffee. It was approved by the institutional Clinical Research and Research Ethics committees.

## Inclusion criteria

Healthy individuals over the age of 30 and under the age of 60, who signed the informed consent.

## Exclusion criteria

Cardiovascular disease conditions, such as heart failure, ischemic cardiopathy, arterial hypertension, renal insufficiency, diabetes mellitus. Conditions in which coffee consumption is contraindicated, such as: migraine, hyperthyroidism, cardiac tachyarrhythmias, anxiety states, symptomatic acute gastritis, diarrhea, and fibrocystic

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