

EDITORIAL

Effects of Dark Chocolate on
Cardiovascular Risk

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ABSTRACT

Cocoa is rich in polyphenols, a subgroup of dietary flavonoids, which seems to be able to reduce cardiovascular risk. Since dark chocolate is popular in Europe and the United States, and it is a potent source of polyphenols, there is increasing interest on its potential effects on cardiovascular risk. Evidence suggests that dark chocolate has some beneficial effects on cardiovascular risk factors, particularly on atherogenic dyslipidemia. Beneficial effects include the reduction of elevated blood pressure in hypertensive subjects, the increase in vasodilatation with improved endothelial function, as well as the inhibition of platelet activation and function. In addition, dark chocolate seems to reduce C-reactive protein concentrations and to modulate atherogenic dyslipidemia, reducing plasma total-cholesterol, LDL-cholesterol and triglyceride levels, with a concomitant increase in HDL-cholesterol concentrations. Yet, further studies are needed before recommending habitual dark chocolate consumption for the reduction of cardiovascular risk.

KEY WORDS: *dark chocolate;*
atherosclerosis; dyslipidemia;
cardiovascular risk

INTRODUCTION

Dark chocolate is a potent source of flavonoids, which have been proposed as a key protective dietary component able to reduce cardiovascular risk.¹ These agents are polyphenolic compounds ubiquitous in fruits and vegetables, and appear in higher concentrations in the form of flavanols in cocoa, with beneficial antioxidant effects.^{2,3} In addition, flavonoids are known to suppress inflammation, by inhibiting the cyclooxygenase-2, an enzyme that up-regulates during inflammation, as well as some types of tumor formation.⁴ Recent evidence also suggests that some flavanols may inhibit atherogenesis, by the interaction with beta-platelet derived growth factor.⁵

Further beneficial effects include the reduction of elevated blood pressure in hypertensive subjects,^{6,7} the increase in vasodilatation with improved endothelial function,^{8,9} as well as the inhibition of platelet activation and function.¹⁰ In addition, dark chocolate seems to reduce C-reactive protein concentrations¹¹ and to modulate atherogenic dyslipidemia, reducing plasma total-cholesterol, low-density lipoprotein (LDL)-cholesterol and triglyceride levels,^{11,12} with a concomitant increase in high-density lipoprotein (HDL)-cholesterol concentrations.^{11,12} This represents a very important point, since atherogenic dyslipidemia is strongly associated with cardiovascular risk.¹³

ABBREVIATIONS

HDL = high density lipoproteins
LDL = low density lipoproteins

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It is difficult to determine which compounds present in the dark chocolate affect plasma lipids, and particularly HDL-cholesterol levels;¹⁴ future studies should identify the HDL-increasing compound in cocoa. The modifications on LDL-cholesterol are of high interest as well, but definitive conclusions are difficult to make so far. The most reasonable explanation is that oxidative modifications of LDL play a key role in the initial stages of atherogenesis and dark chocolate is able to reduce LDL oxidative susceptibility, increasing total antioxidant capacity.

In fact, the most important link between lipid metabolism and inflammation is based on the formation of foam cells (first step of plaque generation) from altered, oxidized LDL.¹⁵ Yet, LDL are very heterogeneous particles, which comprise multiple distinct subclasses that differ in size, density, physicochemical composition, metabolic and oxidative behavior, as well as atherogenicity, with at least 4 major subspecies: large LDL-I, medium LDL-II, small LDL-III, and very small LDL-IV (Figure 1).¹⁶ Increasing evidence suggests that the “quality” of LDL has a direct influence on cardiovascular risk, with smaller, more dense LDL particles being more susceptible to oxidation and greatly atherogenic.^{17,18}

Oxidative stress plays a crucial role in the atherogenic process.¹⁹ The increase in reactive oxygen species leads to the formation of oxidized (ox) LDL particles. Strong evidence support the hypothesis that oxLDL are highly immunogenic and more atherogenic compared to the normal LDL molecules. Reactive oxygen species are generated through several metabolic pathways. These cascades act as modifiers in fatty acids, lipoproteins and amino acids, resulting thus in the formation of atherogenic particles such as oxLDL.²⁰

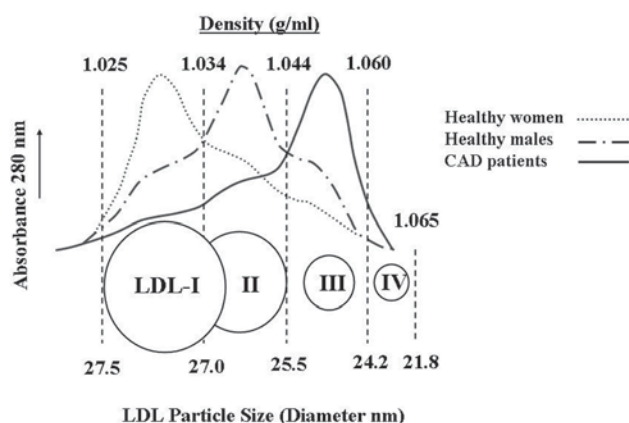


FIGURE 1. LDL subclass distribution according to size and density (as modified from ref. 16). CAD: coronary artery disease.

CONCLUSIONS

Cocoa is rich in polyphenols, a subgroup of dietary flavonoids, which seem to be able to reduce cardiovascular risk. Since dark chocolate is popular in Europe and the United States, and it is a potent source of polyphenols, there is increasing interest on its potential effects on cardiovascular risk. Evidence suggests that dark chocolate has some beneficial effects on cardiovascular risk factors, particularly on atherogenic dyslipidemia. Yet, further studies are needed before recommending habitual dark chocolate consumption for the reduction of cardiovascular risk.

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