Effects of black spent coffee extracts on blood platelet function

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Keywords: spent coffee ground, polyphenols, platelets

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Introduction

Coffee is one of the most popular beverages today, consumed all over the world. In the Balkan region, traditional black coffee is consumed more frequently than other types of coffee. It is served mainly at homes and pubs, so called ''kafana'' and is often referred to as Turkish or Greek coffee. This type of coffee refers to a specific method of preparing coffee and it is typical in the Middle East, the Caucasus, North Africa, the Balkan countries and various locations within Eastern Europe.

A huge amount of solid residue, a spent coffee ground (SCG), is obtained as a waste product during preparation of coffee beverage. Although considered as a waste and an ecological threat, SCG obtained from a different types of coffee is an excellent source of bioactive components (mainly polyphenols) with outstanding anti-oxidative activity (Yen et al., 2005; Bravo et al., 2012; Cruz et al., 2012; Zuorro et al., 2012; Ranic et al., 2014), and potential to be used as a raw material in production of fortified food or nutriceuticals.

Antiplatelet action of dietary polyphenols represents an important part of their pleiotropic action, and underlying mechanisms of their shown beneficial effects on cardiovascular health (CVH) (Konic-Ristic et al., 2015). Accordingly, a reduction in platelet aggregation was accepted by EFSA as a beneficial effect of food and dietary constituents, in the context of maintaining CVH enabling claims related to foods or substances affecting disturbed platelet function (EFSA Panel, 2011). Thus, platelets are considered an emerging target for the prophylactic effects of food bioactives in CVH with promising scientific evidence of their efficacy.

Objectives

We herein hypothesized that black coffee SCG may exert potent anti-thrombotic activity. To test this hypothesis and to confirm the efficient optimization towards the extraction of biologically active components, we examined *in vitro* the effects of polyphenol-rich extracts of black coffee SCG on platelets activation and their aggregation with monocytes and neutrophiles by using flow cytometry.

Materials and methods

The Response surface method was employed to optimize the microwave assisted extraction of phenolic compounds from black coffee SCG and to determine the optimum extraction characteristics by employing the central composite design (CCD). The antiplatelet activity of defatted black SCG extracts was measured by using flow cytometry, in blood obtained from healthy human donors. The effects of investigated extract (25, 50 and 100 μg GAE/ml) on platelet activation (P-selectin and GPIIbIIIa expression) and platelet aggregation with monocytes and

neutrophils were assessed in samples activated by adenosine diphosphate as platelet agonist, and compared to DMSO treated control.

Main findings

The obtained results indicated that espresso SCG extracts induce dose dependant inhibition of platelet activation, shown bythe decrease both in P-selectin and GPIIbIIIa expression (up to 15 %) and their aggregation with monocytes (up to 22.4 %) and neutrophiles (up to 24.3%).

Conclusion and recommendations

The sustainability of the coffee processing system can be substantially improved through the use of by-products based on the bioactivity-guided optimization of the extraction process**.** Shown antiplatelet effects of polyphenols present in black coffee SCG extract optimised by the response surface methodology indicate favorable profile of bioactive compounds toward platelet function and thereby rationalize their use as functional ingredients aiming to promote CVH.

References

1. Bravo J, Juániz I, Monente C, Caemmerer B, Kroh LW, De Peña MP, et al. Evaluation of Spent Coffee Obtained from the Most Common Coffeemakers as a Source of Hydrophilic Bioactive Compounds. Journal of Agricultural and Food Chemistry. 2012; 60(51):12565-73.
2. Cruz R, Cardoso MM, Fernandes L, Oliveira M, Mendes E, Baptista P, et al. Espresso coffee residues: a valuable source of unextracted compounds. J Agric Food Chem. 2012; 60(32):7777-84.
3. EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA). Guidance on the scienticfic requirements for health claims related to antioxidants, oxidative damage and cardiovascular health. EFSA Journal. 2011; 9(12):2474.
4. Konic Ristic A, Kroon PA, Glibetic M. Modulation of platelet function with dietary polyphenols. A promising strategy in the prevention of cardiovascular disease. Agro FOOD Indusrty Hi Tech. 2015; 26(2):15-8.
5. Ranic M, Nikolic M, Pavlovic M, Buntic A, Siler-Marinkovic S, Dimitrijevic-Brankovic S. Optimization of microwave-assisted extraction of natural antioxidants from spent espresso coffee grounds by response surface methodology. Journal of Cleaner Production. 2014; 80:69-79.
6. Yen WJ, Wang BS, Chang LW, Duh PD. Antioxidant properties of roasted coffee residues. J Agric Food Chem. 2005;5 3(7):2658-63.
7. Zuorro A, Lavecchia R. Spent coffee grounds as a valuable source of phenolic compounds and bioenergy. Journal of Cleaner Production. 2012; 34(0):49-56.

Acknowledgment

This work was supported by the Project III41030 and TR31035 financed by the Serbian Ministry of Education, Science and Technological Development.