Can coffee silverskin have similar beneficial effects on type II diabetes prevention as coffee?

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Introduction

Coffee is one of the most appreciated beverages worldwide. Over the last years, its consumption has been increasing, in part due to its claimed health benefits, which include prevention of type II diabetes [1,2]. Nonetheless, as a consequence of this consumption increase, more and more by-products are generated throughout the coffee chain, posing serious risks for the environment [1,3]. Coffee silverskin (the thin layer that detaches from the coffee bean during roasting) represents the major by-product of coffee roasting industries. It is rich in bioactive compounds similar to those present in the coffee bean, such as chlorogenic acids (CGA) and caffeine, linked to the coffee potential health benefits on type II diabetes [1–3]. Thus, this preliminary study aimed to ascertain the potential of silverskin in that context, having in view its valorization. For that, a silverskin extract was compared to a green and a roasted coffee extracts regarding their caffeine content, their CGA profile, and the effect on intestinal glucose uptake using human intestinal epithelial (Caco-2) cells.

Material and Methods

Green coffee, roasted coffee, and silverskin were kindly supplied by a Portuguese coffee roasting industry. Extracts of the different samples were prepared using a green method (ultrasonication with water), filtered, and freeze-dried (-80 °C, 0.015 mbar). The obtained powder extracts were chemically characterized by RP-HPLC-DAD, using a Tracer-Excel ODSA column (5 µm; 250 x 4 mm) and a gradient solvent system: A) 0.2% acetic acid in water and B) methanol. Caffeine and CGA were monitored at 274 and 320 nm, respectively [3]. To evaluate the effect on glucose uptake, Caco-2 cells were firstly incubated (37 °C, 24h) with extracts at different concentrations (0.01, 0.1, and 1 mg/mL). After this period, glucose uptake was measured by incubating the cells (37 °C, 6 min) with 10 nM ^{3}H-deoxy-D-glucose (^{3}H-DG) [4]. Moreover, the effect of the major identified compounds was assessed using individual and combined standards in the similar concentrations to those of the extracts.

Results and Discussion

As expected, the green coffee extract was the richest in CGA (~250 mg/g), followed by roasted coffee (~80 mg/g) and silverskin (8 mg/g) extracts. 5-Caffeoylquinic acid (5-CQA) was the major CGA in the three extracts, but other CGA (3-CQA, 4-CQA and 4- and 5-feruloylquinic acids) were also identified. Caffeine was present in significantly higher amounts in the roasted coffee extract (~60 mg/g), approximately double amounts than those found for silverskin.

Regarding the effect on ^{3}H-DG uptake, all extracts exhibited a higher and significant inhibition (p<0.05) when tested at 1 mg/mL. Moreover, at 1mg/mL, green coffee was the most potent inhibitor (~37% of reduction), followed by silverskin (~28%) and roasted coffee (~19%). To better understand the compounds involved and the possible interactions between them, the effects of the major compounds identified (caffeine and 5-CQA, individually and combined) were also analysed at the concentrations present in each extract. Individually, none of them were able to inhibit ^{3}H-DG uptake, but when combined, similar and significant inhibitions (~12%, p<0.05) were found, suggesting synergetic effects between both compounds.

Conclusion

These results show that although the silverskin extract was not as rich as green and roasted coffee extracts regarding caffeine and CGA contents, it was able to reduce ^{3}H-DG uptake significant and effectively. Furthermore, the effects observed when the compounds were combined suggest that the proportions in which they are present in the extracts can influence the results. Moreover, it seems that other compounds besides caffeine and 5-CQA also contribute to ^{3}H-DG uptake reduction. Overall, these preliminary results evidence that, besides coffee, silverskin also presents a high potential to be used on the context of type II diabetes prevention.

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