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Bioactive compounds of spent coffee grounds and their potential use as functional food

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Hot brewed coffee is the most popular hot beverage in the world, and its health properties have been published in the literature(1). Conversely, over the past decade, cold-brewed coffee has gained popularity, but its eventual nutritional properties are unclear. Both hot and cold brewed coffee produces over 6 million tons of spent coffee grounds (SCG) yearly disposed in landfills(1). Interestingly, studies have shown that SCG can improve several metabolic parameters via changes in the gut microbiome in obese and diabetic rats(2), and reduce energy consumption in overweight humans(3). However, studies investigating the nutritional properties of SCG are lacking in the literature. Hence, in this study, we aimed to identify, quantify and compare two main bioactive compounds in hot- and cold-brewed coffee as a beverage, as well as in the SCG. Samples from hot and cold coffee beverages and SCG were obtained from a local coffee shop (n = 3 per group). The coffee beans were composed of *Coffea arabica* from Papa New Guinea, Brazil, Ethiopia, and Colombia (in order from highest to lowest proportion). All samples were analysed by high-performance liquid chromatography and mass spectrometry (HPLC-MS). The analyses focused on two main bioactive compounds; trigonelline and chlorogenic acid (CGA). Statistical analyses were performed using an unpaired *t*-test with Welch's correction and two-way ANOVA with Tukey's post-hoc test ($p<0.05$). When compared to hot-brewed coffee beverages, cold-brewed coffee beverages have shown lower ($p<0.05$) levels of trigonelline (17.26 mg/g + 1.305 vs. 8.46 mg/g + 0.74, respectively) and CGA (9.82 mg/g + 0.93 vs. 5.31 mg/g + 0.48, respectively). In SCG obtained from hot-brewed coffee, a higher concentration of CGA was found (0.12 mg/g + 0.006), when compared to SCG obtained from cold-brewed coffee (0.10 mg/g + 0.03). However, trigonelline in cold-brewed SCG was found in higher ($p<0.05$) concentration, when compared to hot-brewed SCG (0.11 mg/g + 0.03 vs. 0.09 mg/g + 0.017, respectively). Moreover, hot-brewed coffee beverages showed higher ($p<0.05$) concentrations of trigonelline and CGA, when compared to hot-brewed SCG. Similarly, cold-brewed coffee beverages showed higher ($p<0.05$) concentrations of both bioactive compounds, when compared to cold-brewed SCG. Our results indicated that hot brewed coffee beverage contains high concentrations of bioactive compounds (CGA and trigonelline), which possibly explain its health properties. Although SCG obtained from hot and cold-brewed coffee showed lower concentrations of both bioactive compounds than coffee beverages, our results shed light on the possible health benefits of SCG consumption. In a world seeking more sustainable solutions, further studies investigating the potential use of SCG as a functional food are required.

Keywords: sustainability; coffee; mechanism; gut health

Ethics Declaration

Yes

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