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Quantification of caffeine in different plant matrices and by different techniques

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The consumption of plant-based beverages is an ancient practice, associated with both cultural aspects and the physiological effects of their bioactive constituents. In Brazil, coffee, yerba mate, and green tea are among the most popular beverages, with caffeine being the main compound of interest. This xanthine alkaloid exerts a stimulating effect on the central nervous system by inhibiting adenosine receptors, resulting in increased alertness and reduced fatigue. In addition to its pharmacological effect, quantifying caffeine in different matrices is important for quality control, product standardization, and comparative evaluation of the efficiency of extraction methods. This study aimed to determine the caffeine levels in coffee beans (*Coffea arabica*), yerba mate leaves (*Ilex paraguariensis*), and green tea (*Camellia sinensis*), as well as to compare different extraction processes. Initially, aqueous extracts were obtained by infusion (10 min) using 5 g of plant drug. They were then subjected to high-performance liquid chromatography (HPLC) analysis using a calibration curve with a caffeine standard ($R^2 = 0.99$). The average concentrations obtained were 76.7, 18.5, and 14.1 µg/mL in coffee, yerba mate, and green tea, respectively. Based on these results, coffee was selected for comparative evaluation of extraction methods, employing infusion, decoction, and pressurization. Starting from 8.8 g of plant drug and each extraction lasting 2 min, the aqueous extract was obtained. The concentrations obtained were similar: 26.5, 26.7, and 25.5 µg/mL, respectively. This suggests that the methods present equivalent efficiencies for caffeine extraction. It is concluded that coffee stands out as the matrix with the highest caffeine content among those analyzed and that, regardless of the method employed, the extraction of the alkaloid presents consistent results. These findings reinforce the importance of choosing the plant matrix for caffeine intake and demonstrate the viability of simple methods, such as infusion, for efficiently obtaining the compound.

Keywords: *Coffea arabica, Ilex paraguariensis, Camellia sinensis, HPLC-DAD, Caffeine*