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Short communication

Decoding Matcha: a deep dive into its phenolic and flavonoid secrets

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Introduction

Matcha tea is a powdered form of green tea obtained from the leaves of *Camellia sinensis* (Theaceae). In recent years, its consumption has increased due to its high antioxidant potential and associated health benefits. Matcha is particularly rich in polyphenolic compounds, including catechins, flavonoids, phenolic acids, rutin and quercetin, which contribute to its strong antioxidant activity (Sayuti et al., 2021). Compared to conventional green tea products, matcha contains higher concentrations of these bioactive compounds as a result of the shade-growing cultivation process, which promotes the accumulation of antioxidant constituents in the leaves (Farooq and Sehgal, 2018). These compounds are capable of scavenging reactive oxygen species (ROS) and reducing oxidative stress, thereby contributing to the prevention of oxidative stress-related disorders (Jakubczyk et al., 2020).

Therefore, the aim of this study was to evaluate the antioxidant potential of Matcha tea by determining its total phenolic and flavonoid content.

Materials and methods

Plant material

Commercial Matcha tea powder (*Camellia sinensis* L.) was purchased from DM drogerie market (Skopje, Macedonia) and stored in a sealed container at room temperature, protected from light and moisture until analysis.

Standards and instruments

The chemicals and standards used in the experiment included: gallic acid (GA), quercetin, Folin–Ciocalteu phenol reagent, aluminum chloride (AlCl3), sodium acetate (CH3COONa), and sodium carbonate (Na2CO3), (Sigma-Aldrich Chemical Co. (France). Absorbance measurements for all assays were performed using a UV-VIS spectrophotometer Varian Cary 50 (Agilent Technologies).

Herbal extracts preparations

The herbal extract was prepared from 0.5g of dried and powdered Matcha tea material using 10 mL of 70% methanol (v/v). The extraction was performed in an ultrasonic bath (50/60 Hz, 720 W) for 15 minutes. The extract was filtered and adjusted to 10 mL, giving a stock solution of 50 mg/mL.

The stock solution was further diluted obtaining a working solution of 0.5 mg/mL, which was used for analyses.

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Total phenolic content (TPC)

TPC was determined using the Folin-Ciocalteu method and spectrophotometric measurement of absorbance at 760 nm. The reaction was performed using Folin-Ciocalteu reagent and sodium carbonate, followed by incubation of the mixture for 30 minutes in the dark. The results were expressed as mg of gallic acid equivalents per gram of dry plant material (mg GAE/g), (Singleton et al., 1999).

Total flavonoid content (TFC)

TFC was determined using aluminum chloride and sodium acetate with incubation for 30 minutes at room temperature. Absorbance was measured at 415 nm, and results were expressed as mg quercetin equivalents per gram (mg QE/g), (Chang et al., 2002).

Results and discussions

Based on the measured absorbance values and calibration curves constructed using gallic acid and quercetin standards, the total phenolic content (TPC) and total flavonoid content (TFC) of Matcha tea were determined, respectively. The calibration curve for TPC ($y = 0.0066x + 0.0286$) showed high linearity with R^2 of 0.9938, resulting in a total phenolic content of 271.71 mg GAE/g. Similarly, the calibration curve for TFC ($y = 0.0075x + 0.0026$) yielded an R^2 value of 0.9979, while the total flavonoid content was calculated as 7.15 mg QE/g.

The obtained TPC value confirms that Matcha tea is a rich source of phenolic compounds with pronounced antioxidant potential. Similar findings have been reported in previous studies, where the antioxidant activity of Matcha tea was mainly associated with catechins and other polyphenolic constituents (Jakubczyk et al., 2020).

The lower TFC value compared to TPC suggests that, besides flavonoids, other phenolic compounds also contribute significantly to the antioxidant profile of Matcha tea. Considering that matcha tea contains approximately 169-273 mg GAE/g of total phenolics, consumption of one cup prepared from 1-2 g of powder may provide approximately 169–546 mg of phenolic compounds, including catechins, rutin and quercetin, supporting its potential role as a valuable dietary source of natural antioxidants (Kochman et al., 2021).

Conslusion

The obtained results confirm that Matcha tea is a rich source of phenolic compounds with significant antioxidant potential. The high total phenolic content and the presence of bioactive compounds such as catechins, rutin and quercetin contribute substantially to its antioxidant activity. Regular consumption of Matcha tea may therefore contribute to the maintenance of general health status and help protect against oxidative stress-related conditions.

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