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Short communication

Antioxidative effect of Matcha extract on human peripheral blood lymphocytes under oxidative stress conditions

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Introduction

Oxidative stress, caused by excessive production of reactive oxygen species (ROS), contributes to cellular damage and the development of numerous pathological conditions. Lymphocytes are particularly sensitive to oxidative stress, as excessive ROS production can impair their viability, function and immune response. Hydrogen peroxide (H_2O_2) is widely used as an *in vitro* model for inducing oxidative stress due to its ability to generate reactive oxygen species and promote cellular damage. Natural products rich in polyphenols have attracted considerable attention due to their antioxidant properties. Matcha green tea (*Camellia sinensis*) is characterized by a high content of catechins, flavonoids, polyphenols, rutin and vitamin C, compounds associated with strong antioxidant activity (Jakubczyk et al., 2020). Although the antioxidant potential of matcha has been extensively documented, limited data are available regarding its protective effects on human peripheral blood lymphocytes.

Therefore, the aim of this study was to evaluate the protective effect of matcha extract on human peripheral blood lymphocytes exposed to hydrogen peroxide (H_2O_2)-induced oxidative stress.

Materials and Methods

Matcha extract was prepared by ultrasonic-assisted extraction of dried and powdered plant material using 50% ethanol. Following solvent evaporation, the dry extract was resuspended and diluted to final concentrations of 50, 100 and 200 µg/mL. Peripheral blood mononuclear cells (PBMCs) were isolated by Ficoll density-gradient centrifugation and cultured in RPMI-1640 medium supplemented with fetal bovine serum and antibiotics. Cells were divided into control groups and treated with H_2O_2, matcha extract alone and combination of matcha extract and H_2O_2.

The MTT assay was used to assess the viability of lymphocytes in each experimental group. The 96-well plates were incubated at 37 °C for three hours

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after 20 µL of MTT solution (5 mg/mL) was applied to each well at the prearranged time point. After incubation, the formazan crystals were dissolved in 150 µL of DMSO, and the supernatant was carefully discarded. A VICTOR microplate reader (Perkin Elmer, USA) was used to measure the absorbance at 570 nm.

Results and Discussion

Matcha extract showed a strong protective impact on lymphocyte viability at every studied concentration. The extract alone provided 94% protection at 50 µg/mL and 100% protection at concentrations of 100 and 200 µg/mL. In combination with H_2O_2, matcha maintained high protective activity, showing 89% protection at 50 µg/mL and complete protection (100%) at both 100 and 200 µg/mL.

A concentration-dependent increase in protective activity was observed. While the lowest tested concentration (50 µg/mL) provided substantial protection, maximal protection was achieved at 100 and 200 µg/mL, suggesting that higher concentrations of matcha extract exert stronger cytoprotective effects. Interestingly, the extract maintained a high level of protection even under oxidative stress conditions induced by H_2O_2, indicating that its antioxidant constituents remained effective in neutralizing ROS and preventing cellular damage.

The observed cytoprotective effect may be associated with the synergistic action of catechins such as epigallocatechin gallate (EGCG), epigallocatechin (EGC) and epicatechin gallate (ECG), flavonoids and vitamin C present in matcha. These compounds are known to scavenge free radicals, reduce lipid peroxidation, neutralize reactive oxygen species and support endogenous antioxidant defense systems (Jakubczyk et al., 2020).

Previous studies have shown that green tea polyphenols can protect lymphocytes and other cell types against oxidative damage through free-radical scavenging activity and modulation of cellular antioxidant defense systems (Kager et al., 2010; Lin et al., 2013). The present findings are in agreement with previous studies demonstrating that green tea polyphenols improve cellular resistance to oxidative injury and preserve lymphocyte viability under conditions of oxidative stress. Matcha has been reported to possess exceptionally high antioxidant potential due to its elevated concentrations of polyphenols and flavonoids, which may explain the strong cytoprotective effect observed in the present study (Jakubczyk et al., 2020).

Conclusion

Human peripheral blood lymphocytes subjected to oxidative stress showed notable antioxidative and cytoprotective benefits from matcha extract. The findings from our study support the growing evidence that matcha represents a valuable source of bioactive compounds capable of protecting immune cells against oxidative damage. Further studies investigating additional biomarkers of oxidative stress and the underlying molecular mechanisms are warranted to confirm its therapeutic potential and possible applications in disease prevention and immune protection.

References

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