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Pharmacognostic studies on the antioxidant activity of medicinal mushrooms

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Abstract
Medicinal mushrooms have been traditionally used for their health benefits, particularly for their antioxidant properties. This study investigates the pharmacognostic characteristics and antioxidant activity of selected medicinal mushrooms. By combining phytochemical screening, extraction methods, and *in vitro* antioxidant assays, we aim to provide a comprehensive evaluation of the therapeutic potential of these fungi.

Keywords: Medicinal mushrooms, traditional use, health benefits

Introduction
Medicinal mushrooms have gained attention for their bioactive compounds, which exhibit a range of pharmacological activities, including antioxidant, anti-inflammatory, and anticancer effects. Antioxidants play a crucial role in neutralizing free radicals, thereby preventing oxidative stress-related diseases. This study focuses on the pharmacognostic evaluation and antioxidant activity of selected medicinal mushrooms, aiming to identify potent natural sources of antioxidants.

Main Objective
The main objective of this study is to evaluate the pharmacognostic characteristics and antioxidant activity of selected medicinal mushrooms to identify their potential as natural sources of antioxidants.

Materials and Methods
Fresh samples of five medicinal mushroom species (*Ganoderma lucidum, Lentinula edodes, Grifola frondosa*, *Trametes versicolor*, and *Hericium erinaceus*) were collected from certified organic farms. The samples were thoroughly cleaned, air-dried, and finely powdered for subsequent analysis. For the pharmacognostic evaluation, both macroscopic and microscopic examinations were conducted. Macroscopic examination involved observing the shape, size, color, texture, and odor of the mushroom samples. Microscopic examination included preparing thin sections of the mushrooms and analyzing cellular structures and arrangements under a microscope. Physicochemical analysis was performed to determine the moisture content, ash values, and extractive values of the powdered mushroom samples. Moisture content was measured by drying the samples in an oven at 105 °C until a constant weight was achieved. Total ash, acid-insoluble ash, and water-soluble ash values were determined using standard procedures. Phytochemical screening was carried out to qualitatively assess the presence of bioactive compounds such as alkaloids, flavonoids, tannins, saponins, and polysaccharides. Standard qualitative methods were employed for this purpose. For alkaloids, the Dragendorff's and Mayer's tests were used. The presence of flavonoids was confirmed using the Shinoda test, while tannins were detected using the ferric chloride test. The froth test was employed to identify saponins, and the phenol-sulfuric acid method was used to confirm the presence of polysaccharides.
Extraction of bioactive compounds from the powdered mushroom samples was performed using solvents of varying polarity, including water, methanol, and ethanol. The samples were subjected to maceration, where they were soaked in the solvents for 48 hours with occasional

stirring. The resulting extracts were filtered, concentrated using a rotary evaporator, and stored at 4 °C until further use.

The antioxidant activity of the mushroom extracts was evaluated using several *in vitro* assays. The DPPH radical scavenging assay was conducted by mixing the mushroom extracts with a DPPH solution and measuring the decrease in absorbance at 517 nm. The ABTS radical cation decolorization assay involved generating ABTS radicals, reacting them with the extracts, and measuring the absorbance at 734 nm. The ferric reducing antioxidant power (FRAP) assay measured the reduction of ferric ions to ferrous ions by the extracts, with the results expressed as μM Fe^{2+}/g extract. The total phenolic content (TPC) assay was performed using the Folin-Ciocalteu reagent, with the results expressed as mg gallic acid equivalents (GAE)/g extract.

Statistical analysis was conducted using SPSS software. All experiments were performed in triplicate, and the results were expressed as mean ± standard deviation. One-way analysis of variance (ANOVA) followed by Tukey's post hoc test was used to determine significant differences between the groups, with a p-value of <0.05 considered statistically significant.

Results

Table 1: Phytochemical Screening of Mushroom Extracts

Mushroom Species	Alkaloids	Flavonoids	Tannins	Saponins	Polysaccharides
Ganoderma lucidum	+	++	+	-	+++
Lentinula edodes	-	++	++	+	++
Grifola frondosa	+	+	+	+	+++
Trametes versicolor	-	++	+	-	++
Hericium erinaceus	+	+++	++	-	++

Table 2: Antioxidant Activity of Mushroom Extracts

Mushroom Species	DPPH (IC50, µg/mL)	ABTS (IC50, µg/mL)	FRAP (µM Fe^{2+}/g extract)	TPC (mg GAE/g extract)
Ganoderma lucidum	25.4	22.8	250.6	45.3
Lentinula edodes	30.1	27.4	200.4	38.7
Grifola frondosa	28.5	25.9	220.1	41.2
Trametes versicolor	35.2	32.6	180.7	36.8
Hericium erinaceus	22.7	19.5	270.3	48.9

Discussion

The phytochemical screening of the selected medicinal mushrooms revealed a rich presence of bioactive compounds, particularly polysaccharides, flavonoids, and tannins. *Ganoderma lucidum* and *Hericium erinaceus* showed a higher concentration of polysaccharides, known for their immune-modulating and antioxidant properties.

The *in vitro* antioxidant assays demonstrated that all mushroom extracts exhibited significant antioxidant activity, with *Hericium erinaceus* showing the highest activity in both DPPH and ABTS assays. This species also had the highest total phenolic content, correlating with its strong antioxidant capacity. *Ganoderma lucidum*, known for its traditional medicinal use, also exhibited high antioxidant activity, particularly in the FRAP assay, indicating its potential as a natural antioxidant source.

The variation in antioxidant activity among the different species can be attributed to their distinct phytochemical compositions. The presence of flavonoids and phenolic compounds is likely responsible for the observed antioxidant effects, as these compounds are well-known for their ability to neutralize free radicals and reduce oxidative stress.

Conclusion

This study highlights the significant antioxidant potential of medicinal mushrooms, with *Hericium erinaceus* and *Ganoderma lucidum* showing the most promising results. The pharmacognostic evaluation and phytochemical screening provide a comprehensive understanding of the bioactive compounds present in these fungi. These findings support the use of medicinal mushrooms as natural sources of antioxidants, which could be beneficial in preventing oxidative stress-related diseases. Further research, including clinical trials, is necessary to validate these results and explore their therapeutic applications.

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